HOW GOOD CHANGE HAPPENS:
THE POLITICAL ECONOMY OF CHILD NUTRITION

A Thesis
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By

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Food Security Researcher, Feinstein International Center, Friedman School of Nutrition Science and Policy, Tufts University, Medford, MA. January 2009–Present. Working on research design, data collection, and data analysis for a livelihoods and food security-focused household survey in the Tigray Region of Ethiopia. Also supported background research and editing for a study on community-based targeting in complex emergencies, commissioned by the World Food Program.

Food Security and Nutrition Consultant, Action Against Hunger/Action contre la Faim (Various locations). September–October 2011; October–November 2009. Studied the effects of rural-urban linkages on child nutrition and household food security in Guinea (2011). Analyzed the spatial pattern and causes of undernutrition in Madhya Pradesh and Rajasthan, India, and mapped major national and international nutrition-related stakeholders in the country (2009).

Teaching Assistant in Development Economics, Fletcher School, Tufts University, Medford, MA. September 2009–May 2011. Assisted in course on graduate-level Development Economics taught by Professor Steven Block.

Food Security Researcher, Action Against Hunger-UK, London (UK), Malawi, India. July 2006–September 2008. Analyst within the *Hunger Watch* research and advocacy department of Action Against Hunger-UK. In 2007-8, worked on a study pertaining to agricultural development, public health, and social protection responses to seasonal hunger and undernutrition, focusing particularly on livelihoods of rural households in Malawi and India.

Food Security Researcher, Action contre la Faim-Ethiopia/France. July 2005–July 2006. Designed and conducted field research pertaining to 1) the impact of social protection and agricultural development programs on food insecurity in various regions of Ethiopia; and 2) the impact of United States and European foreign assistance approaches on hunger alleviation in Ethiopia.

Bio-economic Researcher, Univ. of California-Davis, USA. January–July 2005. Conducted research evaluating the economic performance and carbon sequestration potential of various California agricultural systems. Created land-use system models to simulate economic cost/benefit and carbon flows from systems.

Public Health Monitoring and Evaluation Officer, United Nations Children's Fund (UNICEF), India. May–September 2004. Assisted with the implementation, monitoring, and evaluation of the *Sisu Samrakshak* project, an initiative utilizing information technology to disseminate public health information to under-served rural communities in northern Andhra Pradesh state.

PUBLICATIONS

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Stephen Devereux, Bapu Vaitla, and Samuel Hauenstein-Swan. 2008. *Seasons of Hunger: Fighting Cycles of Quiet Starvation Among the World's Rural Poor*. London: Pluto Press.

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Abstract

Although the political obstacles to child stunting reduction are formidable, some countries have indeed made important strides towards stunting reduction. In this study, I conduct a cross-country econometric analysis of the determinants of stunting reduction, and also look at reform experiences in Northeast Brazil and at the federal and state levels in India.

The econometric analysis shows that income per capita and educational attainment are the most powerful determinants of stunting reduction, but find few other strong policy or political correlates; the results suggest that multiple pathways to stunting reduction exist, and few generalities apply across contexts. In Brazil, macroeconomic stabilization efforts and redistributive policies together drove stunting reduction, despite a lack of focus on child nutrition as such. In India, an elite/poor activist alliance, committed political leadership, and judicial activism helped bring about federal food and nutrition policy reforms. In the states of Kerala and Tamil Nadu within India, powerful class-based movements have permanently elevated the issue of access to basic health and nutrition services to political prominence.

The overall message of the study is that improvements in a wide range of policy and political variables are likely necessary for poor countries to reach developed-world nutrition levels, but the determinants of marginal improvement at any given level are not consistent across political units. Though direct nutrition interventions (or food and health policies closely linked to nutrition) are not always politically

feasible, other stunting reduction pathways may be available. Political opportunities vary by time and place, but skillful statecraft and a synergy of interests between the executive, judiciary, and civil society may provide enough political strength to overcome resistance to pro-poor, undernutrition-reducing public action.

For

Amy Margolies

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Lisa Inks

Becca Furst-Nichols

Rabeh Ghadban

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Bapu Vaitla

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Preface

Child undernutrition is one of the most serious public health problems in the world. Nearly five million preschool children die preventable deaths every year from causes linked to undernutrition. Of the millions more who survive episodes of hunger, many suffer irreparable damage to their cognitive and physical development. The undernourished children of today become the less productive workforce of tomorrow, compromising the future of entire societies.

This study starts from the proposition that the main obstacle to reducing chronic child undernutrition – and particularly the height-for-age deficit known as stunting, an important overall marker of public health [1] – is neither an insufficiency of resources nor a lack of policy ideas. Rather, the paramount challenge is that formidable political constraints prevent societies from mobilizing their resources to implement pro-poor policies known to be effective in addressing stunting and its causes.

These constraints stem from one simple fact: children at risk of stunting do not have political voice. Their families, usually poor rural households making a living as small farmers or landless workers, rarely exercise meaningful power in the political arena, even in democratic countries. The potential force of their numbers is outweighed by severe poverty, a historical legacy of political

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[1] Stunting is one type of chronic undernutrition; there are other important types, including deficiencies of various micronutrients. However, in this study the terms "chronic undernutrition" and "stunting" are used interchangeably.

disenfranchisement, and the difficulties of collective action in dispersed rural societies.

Compounding the problem is the political invisibility of chronic undernutrition, even to policymakers who are concerned with the welfare of the poor. This invisibility is not difficult to understand. The consequences of chronic undernutrition do not always manifest themselves in viscerally distressing physical symptoms, and so the media and public are less driven to outrage than they may be by famine or disease epidemics. In communities where the prevalence of undernutrition is very high, the most common consequences of developmental stunting – small stature, frequent illness, weak school performance – may appear normal, or at least causally unrelated to poor nutrition, even to families themselves.

Even if policymakers perceive the problem, there is little political incentive to act urgently to combat stunting. The slow burn of chronic undernutrition plays out over periods of time longer than election cycles, and so there are few rewards for committed political action, and little cost to inaction. There are also clear dangers to staking political capital on the fight against chronic undernutrition; as we will see in case studies of Brazil of India, while political rhetoric around addressing hunger and undernutrition is common, substantive action is rare. Success in reducing stunting rates is thought to depend on effectively implementing a large and complex set of interventions spanning the fields of rural development, social protection, public health, and education. Unforeseen issues – for example, economic crises, changes in foreign assistance levels, or implementation struggles at the local level – can stymie the most genuine political efforts. The lack of easy "silver bullet" technical solutions to chronic undernutrition discourages policymakers from taking the risk of proposing bold policy reforms.

There are two dominant strands of political science thinking, interest-based and ideas-based theory, that allow us to explain the failure of many developing world countries to reduce stunting prevalence. Interest-based explanations assume that policymakers are self-interested and seek to maximize their power. The implication is that reductions in stunting can only come about if poor rural populations possess the political power necessary to exert pressure on policymakers in electoral and other political bargaining forums, and thereby alter policymaker calculations of self-interest. In most countries, they do not have this power. Ideational explanations, meanwhile, argue that personal values or party ideologies can compel policymakers to prioritize child nutrition even when the immediate costs of such action exceed the benefits to person or party. If undernutrition is politically invisible, however, such values and beliefs will not be activated.

Yet, despite these political obstacles, some countries have indeed dramatically reduced child stunting in recent decades, or initiated sweeping food and nutrition policy reforms that have great potential to catalyze reduction. Analyzing how they have accomplished this – and the implications of these success stories for the many countries still struggling with high rates of stunting – is the central objective of this research. Over the past few years, international attention to the immense public health cost of chronic undernutrition has greatly increased, exemplified by efforts like the United Nations' Scaling Up Nutrition (SUN) and Renewed Efforts Against Child Hunger (REACH) initiatives and the US-based 1,000 Days partnership. Expanding the body of political economy evidence about how good change happens will help governments to make the most of the current window of opportunity.

The structure of the study is as follows. Part I, comprised of Chapters 1, 2, 3, and 4, is concerned with preliminaries. Chapter 1 provides an overview of the phenomenon of child stunting, including its consequences on child development, the current spatial distribution of stunting across the world, and the historical trend of stunting over the last 25 years, globally and in individual countries. The chapter identifies "top performers", the countries that have been most successful in reducing stunting. Chapters 2 and 3 then review the two branches of the literature most relevant to understanding how stunting is reduced: the largely household-level econometric analysis of the determinants of stunting and work on the political economy of pro-poor policy reform, with focus on the particular policies most relevant to stunting reduction. Chapter 4 details the methodology for the study as a whole. The chapter begins by presenting a conceptual framework of stunting's causation. This framework is used at the beginning of Chapter 5 to develop a system of equations that together comprise a formal model of the determinants of child stunting; in Chapter 4, a simple overview of the modeling approach is described. The chapter then reviews the process-tracing methodology used for the Brazil and India narratives in Parts III and IV.

Part II – Chapters 5 and 6 – then analyzes the cross-national policy and political determinants of stunting, using data from 144 countries. Chapter 5 presents the underlying model, tracing the links from stunting outcomes to household-level variables to underlying policies and then finally to the ultimate political economy determinants of these policies. Following a description of the data and estimation strategy, Chapter 6 estimates various reduced-form specifications of the model and discusses the results. While some policy variables and other factors are found to have a significant and strong impact on stunting (notably education and environmental health policy, dependency ratio, environmental disease threats, and income), many others do not – including all the political variables tested. If the model construction and specification approach is considered valid, then the implication of this finding is that there are diverse policy and political pathways to stunting reduction; only a few factors seem to have a powerful impact across countries. The complex etiology of chronic undernutrition may, however, offer a multitude of context-specific solutions for rapid reduction.

Parts III and IV present histories of stunting reduction that reinforce this message. Chapters 7 through 9 (Part III) analyze in detail the extraordinary experience of the Northeast Region of Brazil. Between 1975 and 2006, the prevalence of stunting among children under age five in this region fell from 52% to 5.9%. The depth and speed of this decline is equaled by few countries or sub-national regions anywhere in the world, and the accomplishment is even more impressive when considering that the child population in Northeast Brazil is larger than that of all but a few developing countries. In addition to this singular performance in reducing stunting, several other historical circumstances make Northeast Brazil a crucial case for studying the political economy of child nutrition. First, Brazil in this time period underwent radical political change, transitioning from military dictatorship in the mid-1980s to highly flawed democracy in the late 1980s and early 1990s to what most observers today regard as a rule-based, mature democratic system. The ability of the poor to express their "interests" and thus to influence the interests of policymakers changed greatly over this period. Second, Brazil's leaders over this time period were, at least on the surface (a caveat discussed further in the chapters), of differing ideological dispositions, from the rightist military government to the centrist Fernando Henrique Cardoso to the leftist Luiz Inácio "Lula" da Silva. Thus the Brazil case study offers an opportunity to observe variation in both interests and ideas over the time period of stunting reduction. I make the argument that the success story was not due to a deliberate focus on undernutrition (or even hunger or public health) but rather the result of a narrow focus by President Cardoso on inflation control and by President Lula on inequality-reducing redistributive programs. Both men were skillful statesmen, taking advantage of political opportunities and minimizing political risks to implement pro-poor policies that might have elicited serious resistance.

Chapters 10 through 12 (Part IV) then turn to India, a country in which an alarming 48% of all children under the age of five were stunted in 2005-06. Given that India contains nearly one-third of the world's stunted children, the magnitude of the problem is immense. However, there are several food, nutrition, and health policy reform experiences within India that have achieved substantive stunting reduction, or hold great promise for doing so. I concentrate specifically on federal-level overhauls of the country's two largest maternal and child health and food subsidy programs, as well as state-level health and nutrition policy reforms in Kerala and Tamil Nadu. Part IV examines three puzzles that pertain to undernutrition in India. First, why has the country's stunting prevalence remained persistently high even during the recent period of extremely rapid economic growth? Second, what explains the considerable cross-state variation in stunting prevalence? Third, given India's long history of policy failure around nutrition, what political factors explain the reform successes mentioned above? Again, the roles of ideas and interests take center stage in this analysis. I argue that the geographical and sectoral exclusion of the poor from growth, social and intrahousehold inequality, and the neglect of social policies that could have addressed India's nutritional crisis are largely to blame for continuing undernutrition. However, the pressure applied in the last decade by alliances between activist elites and the representatives of the rural poor, committed leadership at the highest levels of the Indian state, and judicial activism have all been responsible for producing the most profound food policy reforms in the history of the independent state. In Kerala and Tamil Nadu, meanwhile, a long history of mass mobilization around caste discrimination eventually led to the creation of powerful political organizations calling for class-based rights, and especially for the delivery of basic health services from the state. The right of poor rural households to access to health and food entitlements has become strongly embedded in the political dialogue, to an extent where these issues determine the electoral fortunes of political parties.

The conclusion summarizes the results of all the chapters, and suggests the implications of the study's findings for research and policymaking. The most powerful generalizable message of the research is this: improvements in a wide range of policy and political variables will be necessary for poor countries to reach developed-world nutrition levels, but the determinants of marginal improvement at any given level are not consistent across political units. Direct interventions to reduce chronic child undernutrition are complicated by the very serious collective action problems faced by all non-communicable disease control efforts – perhaps to an extent where in some circumstances such problems simply cannot be overcome. Nutritional improvement thus will often depend on policymakers accurately 1) identifying politically tenable and empirically strong causal paths from non-(exclusively) nutritional policies to nutritional impact *in a given time and place*, which may range from macroeconomic stabilization to increasing maternal education to progressive social security reform; and 2) anticipating and pre-empting resistance (especially that of a clientelistic or bureaucratic nature) to such policy paths through strategies like providing attractive short-term incentives for opponents to compromise or allying with politically powerful civil society advocates. Advocates, for their part, may present moral arguments to mobilize public sentiment, but must also be focused on the electoral incentives for policymakers to take action against undernutrition.

In sum, rapid stunting reduction in the many countries still struggling with undernutrition rates may depend less on straightforward confrontation of the many political obstacles detailed at the beginning of this preface than finding ways “around” them. Policymakers and advocates should embrace the impressively complex causality of undernutrition as an opportunity: more causes also imply more potential solutions.

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List of Abbreviations

APL	Above Poverty Line
AWC	Anganwadi Center
AWW	Anganwadi Worker
BJP	Bharatiya Janata Party
BMI	Body Mass Index
BPL	Below Poverty Line
BPNI	Breastfeeding Promotion Network of India
CPI	Communist Party of India (Kerala)
DALYs	Disability-Adjusted Life Years
DHS	Demographic and Health Surveys
DMK	Dravida Munnetra Kazhagam party (Tamil Nadu)
DWCD	Department of Women and Child Development
ENDEF	Estudo Nacional da Despesa Familiar (National Study of Family Expenditure)
FUNRURAL	Contribuição Previdenciária sobre a Comercialização Rural (Rural Commercial Social Security Fund)
ICDS	Integrated Child Development Services
IDA	International Development Agency
IGBE	Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
INAMPS	Instituto Nacional de Assistência Médica da Previdência Social (National Institute of Social Security Medical Assistance)
MCV	Measles-Containing Vaccination
MDGs	Millennium Development Goals
MICS	Multiple Indicator Cluster Surveys
MRGS	Multi-center Growth Reference Study
MPI	Multidimensional Poverty Index
NAC	National Advisory Council
NCHS	National Center for Health Statistics
NFHS	National Family Health Survey
NFSB	National Food Security Bill
NRA	Nominal Rate of Assistance
NRC	Nutritional Rehabilitation Center
NREGA	National Rural Employment Guarantee Act
NREGS	National Rural Employment Guarantee Scheme
NSS	National Sample Survey
PDS	Public Distribution System
PNAD	Pesquisa Nacional por Amostra de Domicílios (National Household Sample Survey)
PNDS	Pesquisa Nacional sobre Demografia e Saúde (National Demographic and Health Survey)

PNSMIPF	Pesquisa Nacional sobre Saúde Materno–Infantil e Planejamento Familiar (National Survey of Maternal/Child Health and Family Planning)
PNSN	Pesquisa Nacional sobre Saúde e Nutrição (National Health and Nutrition Survey)
PSDB	Partido da Social Democracia Brasiliera *(*Brazilian Social Democratic Party)
PT	Partido dos Trabalhadores (Workers' Party)
PUCL	People's Union for Civil Liberties
RRA	Relative Rate of Assistance
RtFC	Right to Food Campaign
RUTFs	Ready-to-Use Therapeutic Foods
SAM	Severe Acute Malnutrition
SD	Standard Deviation
SNP	Supplemental Nutrition Program
SUDENE	Superintendência do Desenvolvimento do Nordeste (Superintendency for the Development of the Northeast)
TNIP	Tamil Nadu Integrated Nutrition Project
USAID	United States Agency for International Development
U5MR	Under-5 Mortality Rate
UPA	United Progressive Alliance
WHO	World Health Organization

Part I. Preliminaries

The first four chapters deal with preliminary issues. Chapter 1 provides an overview of the phenomenon of child stunting. The first section of the chapter, "Types of Child Undernutrition", justifies the selection of stunting as the particular outcome of interest in this study. The second section, "The Consequences of Stunting", is an argument for why reducing stunting is one of the most critical public health challenges facing the world today. The final section, "Spatial Distribution and Historical Trends", uses the most recent household-level survey data available to estimate the prevalence of stunted children, globally and within most countries of the developing world. The global trend over the 1980 to 2007 time period is also presented. The section concludes by listing the countries in the world that have most significantly reduced stunting in the last several decades.

The second and third chapters summarize the literature on the determinants of child stunting. Chapter 2, "Correlates of Child Nutritional Status", examines recent quantitative analyses of the determinants of stunting, at household, sub-national, and national levels. Chapter 3, "The Political Determinants of Pro-Poor Policy Action", then examines literature on the political economy of poverty reduction, with a focus on policies to reduce food insecurity and undernutrition. The main theoretical positions in the literature – a focus on interests (of the executive, the bureaucracy, and societal pressure groups) versus a focus on ideas, values, and beliefs – are reviewed, along with studies that emphasize historically contingent influences on policy action, such as macroeconomic constraints, the perception of crisis, and the particularities of a given country's historical experience.

Chapter 4, "Methodology", then outlines the approach of this study. Building on work by UNICEF, the chapter first develops a more detailed conceptual framework of the determinants of child undernutrition to be utilized throughout this work. Model specification and estimation procedures for the cross-country regression analysis of Part III are discussed in brief in the second section of the chapter, with the details left for Chapter 5. Chapter 4 then goes on to detail the process-tracing approach utilized in the country narratives of Part III and Part IV, listing various hypotheses and the causal steps implied by each hypothesis.

Chapter 1. Child Stunting in the World

A. Types of Undernutrition

The anthropometric measures of *stunting* (height-for-age), *wasting* (weight-for-height), and *underweight* (weight-for-age) are the most common indicators of child undernutrition. An undernourished child is identified by comparing his or her growth to a reference curve representing the genetic potential of a healthy child growing under optimal environmental conditions. The currently used reference growth curve is derived from the six-country Multi-center Growth Reference Study (MGRS) undertaken by the World Health Organization (WHO) between 1997 and 2003.[2] One of the key findings of the MGRS is that growth curves across the six countries are very similar, suggesting that a single global growth standard is appropriate. The human species, across societies, appears to have a broadly similar growth potential given equivalent environmental conditions and childcare practices (WHO 2006a; WHO 2006b).[3,4]

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[2] The children were selected from healthy, affluent populations in Brazil, Ghana, India, Norway, Oman, and the United States. The MGRS included both a cross-sectional component of children between 18-71 months and a longitudinal component that tracked growth of children from birth to 24 months. Inclusion criteria – i.e., the "optimal environmental conditions" referred to in the paragraph above – were: lack of health or environmental constraints to growth; mothers willing to follow MGRS feeding recommendations; no maternal smoking; single term birth; and absence of significant maternal morbidity. The new growth standards replace the National Center for Health Statistics/World Health Organization (NCHS/WHO) growth reference curves in use since the 1970s. These older reference curves were derived from a single United States population of European descent [bottlefed and hence not typical of most other babies in the world].

[3] For example, only 3% of the variability in length was due to variation across country sites, while 70% was due to variation across individuals.

Stunting is calculated using a child's height-for-age. A child that falls more than two standard deviations (SDs), or z-scores, below the median height-for-age value in the reference population is categorized as stunted. Children that fall more than three SDs below the median are categorized as severely stunted.[5] Because height attainment is the result of a long-term growth process, stunting is considered to be a marker of inadequate food intake and/or illness over a prolonged period of time. As with the other anthropometric measures, stunting in a sample population is expressed either in terms of prevalence (the percentage of children stunted in the sample) or mean Z-score (the mean SD value across the sample).

Wasting is calculated using a child's weight-for-height. It is a measure of acute undernutrition: children who undergo sudden and severe declines in food intake, absorption or retention will lose weight quickly, although their height may not be affected unless the severe nutrient shortage persists.[6] Wasting is thus the result of short-term deprivation, and can have a different etiology than stunting (Black, Brown, and Becker 1984; Victora 1992). This is not to say that stunting and wasting do not share some common causes. Most of the world's severely wasted

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[4] In the MGRS as well as throughout this study, the population of interest is children under the age of five. Due to difficulties of measurement and standardization, growth standards for older children are not commonly employed, although there has been recent progress towards creating such curves (de Onis and others 2007).

[5] A child that falls between 0 to 2 SDs below the median is categorized as "mildly stunted". The "total" stunting rates reported throughout this study include only "moderately stunted" (<-2 to ≥ -3 SD) and severely stunted (<-3 SD) children.

[6] A persistent severe nutrient shortage may, however, result in death of the child; thus, if mortality increases, a high wasting prevalence may not be reflected in an elevated stunting rate. It is also worth noting that, since wasting is a measure of weight-for-height, a stunted child (i.e., one that has a low height value) will need to have a lower weight than a non-stunted child of the same age to also be classified as wasted.

children in fact live in countries not afflicted by conflict or climatic shocks – the factors most strongly associated with short-term crises – and which also have very large stunted populations, suggesting that structural factors like income poverty and gender inequality underlie both types of undernutrition (Gross and Webb 2006).[7] Despite this geographical and causal overlap, however, the stunting-wasting contrast is nevertheless a useful means of categorizing the time frame over which the measured undernourishment has occurred.

Because weight measurements in developing countries are relatively easier to perform than height measurements, underweight (a child's weight-for-age) has until recently been the most widely used anthropometric measure (Blössner, de Onis, and Uauy 2006). Due to the relatively greater availability of underweight data – one 2004 study found that 97% of countries monitor underweight using growth charts, but only 41% do so for stunting (de Onis and others 2004) – the United Nations Millennium Development Goal target to halve child undernutrition between 1990 and 2015 is expressed in terms of underweight prevalence. However, the underweight measure faces a serious disadvantage in comparison to stunting and wasting: it cannot distinguish whether weight loss occurred steadily over time due to chronic deprivation or drastically in the recent past due to an acute shock. This ambiguity limits the ability of policymakers and program officers to respond effectively to undernutrition.

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[7] According to Gross and Webb (2006), about two-thirds of the world's wasted children live in India, and 78% live in India, Pakistan, and Bangladesh.

Micronutrient deficiencies, assessed through a variety of non-anthropometric means, are another serious and widespread type of child undernutrition. Of particular concern are Vitamin A and zinc deficiencies, which together account for 10.9% of global deaths – over 1.1 million in 2004 – and 8.9% of disability-adjusted life years (DALYs) among children under age five (Black and others 2008).[8] Iron and iodine deficiencies are also prominent problems in many developing countries. The disease and mortality burden of anemia on children, however, is minor relative to other types of undernutrition, and iodine deficiency has been greatly reduced in recent years due to a global public-private partnership to universalize the iodization of salt (Lopez and others 2006).[9]

Of the various measures available, this study focuses on stunting as the outcome of interest, for several reasons. First, the ambiguities involved in analyzing the causation of underweight status are difficult to surmount. Second, because wasting is often the result of acute shocks, interpreting wasting outcomes and their causes depends on the availability of very detailed data around the time of the shock and its immediate aftermath. The main sources of reliable representative national- and province-level nutritional data are demographic and health surveys

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[8] Black and others (2008, 251-2) provide a succinct definition of DALYs: "DALYs combine years of life lost due to premature death and years of life lived with disabilities (YLD) into one indicator allowing assessment of the total loss of health from different causes. One DALY can be regarded as roughly 1 lost year of so-called healthy life." See Lopez and others (2006) for a fuller discussion on how DALYs are calculated.

[9] Although the prevalences of iron deficiency and iodine deficiency among children are low, those who do have severe forms of these conditions experience serious consequences, including permanent loss of cognitive function and impaired motor development (Stoltzfus, Mullany and Black 2004; Glinoer and Delange 2000; Bleichrodt and Born 1994). In addition, anemia in pregnancy is estimated to cause 115,000 maternal deaths and 3.4 million DALYs a year (Stoltzfus, Mullany and Black 2004).

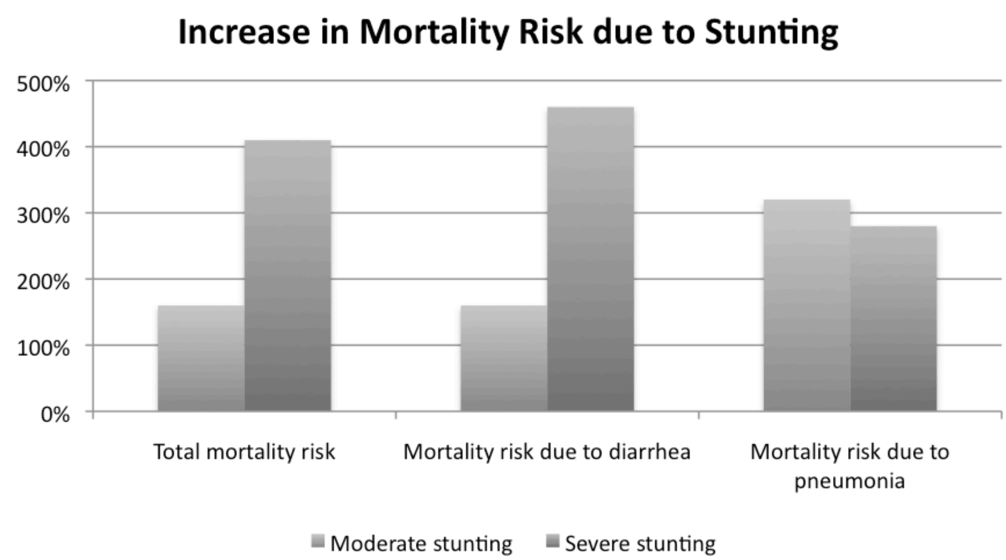
(DHS) and multiple indicator cluster surveys (MICS), neither of which necessarily collect their data at the time that such shocks occur. Permanent surveillance systems can be a good data source for analyzing the dynamics and etiology of wasting, but few reliable country surveillance systems currently exist. Third, the choice to focus on anthropometrically measured growth outcomes rather than micronutrient deficiencies is a choice made by the researcher to narrow the scope of analysis, as stunting and micronutrient deficiencies can have disparate, though sometimes overlapping, etiologies. Finally, and most importantly, stunting is one of the best indicators available of the overall welfare of a population; it can be seen as a summary measure of the extent to which the human potential of society is being protected. The next section argues this point by way of describing the severe consequences of stunting.

B. The Consequences of Stunting

Stunting has a singularly devastating impact on global child health. Black and others (2008) estimate that around 1.5 million children under the age of five die annually as a result of stunting and its sequelae, a figure that represents about 14.5% of all child mortality. The total disease burden of stunting amounts to nearly 55 thousand DALYs, or 12.5% of the global total for children under age five (Black and others 2008). A review of data from eight low-income countries – Ghana, Guinea-Bissau, Senegal, the Philippines, Nepal, India, Pakistan, and Bangladesh – suggests that moderate stunting increases risk of death by a factor of 1.6 (95% CI: 1.3-2.2) and severe stunting increases risk by a factor of 4.1 (2.6-6.4) (Adair and others 1993; WHO/CHD Immunisation-Linked Vitamin A

Supplementation Study Group 1998; Arifeen and others 2001; Cebu Study Team 1991; Garenne and others 1987; West and others 1997; West and others 1991; Andersen 1997). Increased susceptibility to dangerous childhood illnesses is the most important pathway through which this elevated risk occurs. Data from these same studies indicates that moderate stunting increases risk of death due to diarrhea by a factor of 1.6 (1.3-2.2) and severe stunting by a factor of 4.6 (2.7-8.1). Severe stunting also increases the risk of death due to pneumonia by a factor of 3.2 (1.6-6.7) and death due to measles by a factor of 2.8 (1.4-5.8) (Figure 1).

Figure 1. Increased mortality risk due to stunting. Source: Black and others (2008).



In addition, the consequences of early child undernutrition unfold over a lifetime, affecting physical and cognitive development. Long-term cohort studies from India and Brazil suggest that a 1 cm greater birth-length is associated with a 0.7-2.1 cm increase in adult height (Sachdev and others 2005; Haeffner and others 2002; Gigante and others 2009). Another study from Guatemala suggests that poor early postnatal nutrition and intrauterine conditions have similar effects (Li and others 2003). Five long-term cohort studies reviewed by Victora and others (2008) – in Guatemala, the Philippines, and South Africa as well as the India and Brazil studies mentioned above – report an average association of 3.24 cm of adult height per height-for-age Z-score at two years of age (female 95% CI: 3.13-3.31; male 2.92-3.5) (Victora and others 2003; Martorell and others 2005; Grajeda and others 2005; Sachdev and others 2005; Bhargava and others 2004; Richter, Norris and De Wet 2004; Victora and others 2008). In other words, a moderately stunted two-year old can expect to be at least 6.48 cm shorter at adulthood compared to a child who falls at the median, and a severely stunted two-year old at least 9.72 cm shorter. Body mass index at adulthood is also reduced by about 0.4 kg/m^2 (female 0.06-0.63; male 0.13-0.84) for each Z-score at age two.

In theory, this early childhood growth failure can be reversed by catch-up growth later in childhood, especially if the growth period is extended ("maturational delay"). However, Martorell, Khan, and Schroeder (1994) find that maturational delay in most poor countries is usually shorter than two years, thus diminishing the potential for catch-up growth unless socio-economic conditions improve during the developmental stages (Martorell, Khan, and Schroeder 1994; Proos and others 1993). If the undernourished child is a girl, the stunted growth can also have intergenerational effects. The five cohort studies show that a decrease of one height-for-age Z-score at age two is associated with a 78.5 g (95% CI: 43-98 g) decrease in the birthweight of the first offspring. The first child born to women who were moderately stunted at age two can thus be expected to be at least 157g lighter at birth than the child of a mother who attained median height at age two.

Early childhood stunting also has negative effects on educational attainment and cognitive ability. The cohort studies cited above showed that a child moderately stunted at age two is likely to complete one full year less of school than a median height child (per Z-score: female 95% CI: 0.32-0.51; male 0.03-0.56). In a Guatemala study, educational attainment improved by 1.2 years among women who were given food supplementation during early childhood (Maluccio and others 2006). Another study in Zimbabwe shows that a year of higher schooling is associated with 3.4 cm greater height at three years of age (Alderman and Hoddinott 2006). The cohort data from Brazil and South Africa shows a significant association between early childhood stunting and poorer cognitive ability and school performance in later years, a conclusion confirmed by a review of longitudinal studies from the Philippines, Jamaica, Peru, and Indonesia (Grantham-McGregor and others 2007).

Diminished physical and cognitive development will hurt a child's chances to escape poverty during adulthood. Data from Brazil, China, and Finland indicates that shorter height is correlated with lower income, possibly due to poorer health and reduced work capacity (Thomas and Strauss 1997; Chen and Zhou 2007; Barker and others 2005). Interventions to improve nutrition in early childhood show an effect on increased work capacity and higher incomes later in life. In a Guatemalan study, adults exposed to nutritional interventions before age two have on average 46% higher wages (Hoddinott and others 2008). Earlier studies in

Jamaica, Kenya, and Colombia show a correlation between nutritional status and work productivity (Heywood, Latham and Cook 1974; Brooks, Latham and Crompton 1979; Spurr, Barac-Neito and Maskud 1977; Spurr, Maksud and Barac-Neito 1977), although there is reason for concern about endogeneity issues biasing parameter estimates in these econometric models (Strauss 1993). In the cohort studies mentioned above, one Z-score at two years old among boys was correlated with positive adult outcomes – specifically, an increase of household assets in India and an 8% increase in income in Brazil (Victora and others 2003) (Sachdev and others 2005). These studies control for socioeconomic factors, including education. If the impact of poor childhood undernutrition on educational performance is added, the effect on adult incomes is even more pronounced.

Finally, undernutrition also has consequences on society-wide economic growth. Although accurate measurements of GDP lost to stunting are difficult to make given existing data, Bredenkamp and Akin (2006) estimate that around 2-3 percent of GDP in "low-income agricultural Asian countries" is lost each year due to all types of undernutrition.

C. Spatial Distribution and Historical Trends

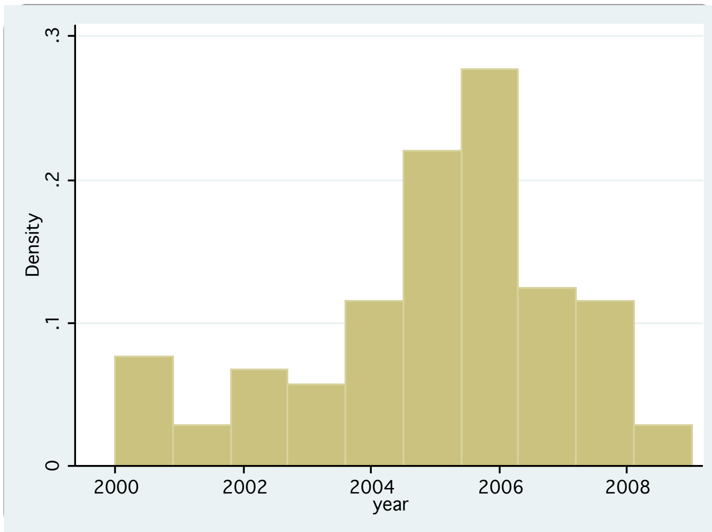
1. The Global Outlook

Estimates of global stunting are necessarily imprecise, given the incomplete coverage and infrequent nature of nationally representative nutritional surveys. However, for the 2000-2009 period, the WHO's Database on Child Growth and

Malnutrition currently contains national-level child stunting data from 116 developing countries (WHO 2011). This group of countries represents approximately 94% of the population under age five in the developing world (and 86% of the under-five population in the world as a whole).[10] Although the fact that these surveys were conducted over a ten year period (Figure 2) – three-quarters of which are from between 2004 and 2008 – reduces the reliability of estimates, aggregating the survey data is one way of presenting a global picture for the past decade.

[10] Last update used was 15 January 2011. The countries with data for 2000-2009 are Afghanistan, Albania, Algeria, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Belize, Benin, Bolivia, Bosnia-Herzegovina, Botswana, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo-Brazzaville, Cote d'Ivoire, The Democratic People's Republic of Korea (North Korea), Democratic Republic of the Congo, Djibouti, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyzstan, Laos, Lebanon, Lesotho, Liberia, Libya, Macedonia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mexico, Moldova, Mongolia, Montenegro Morocco, Mozambique, Myanmar, Namibia, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Peru, Philippines, Romania, Rwanda, Sao Tome and Principe, Saudi Arabia, Senegal, Serbia, Sierra Leone, Solomon Islands, Somalia, Sri Lanka, Sudan, Suriname, Swaziland, Syria, Tajikistan, Tanzania, Thailand, Timor-Leste, Togo, Trinidad and Tobago, Tunisia, Turkey, Tuvalu, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, West Bank and Gaza, Yemen, Zambia, and Zimbabwe. Only four developing countries with under-five populations over two million do not have nationally representative data for the post-2000 period: Angola, Iran, Malaysia, and South Africa.

Figure 2. Nationally representative nutritional surveys, 2000-2009, by year. Source: World Health Organization.

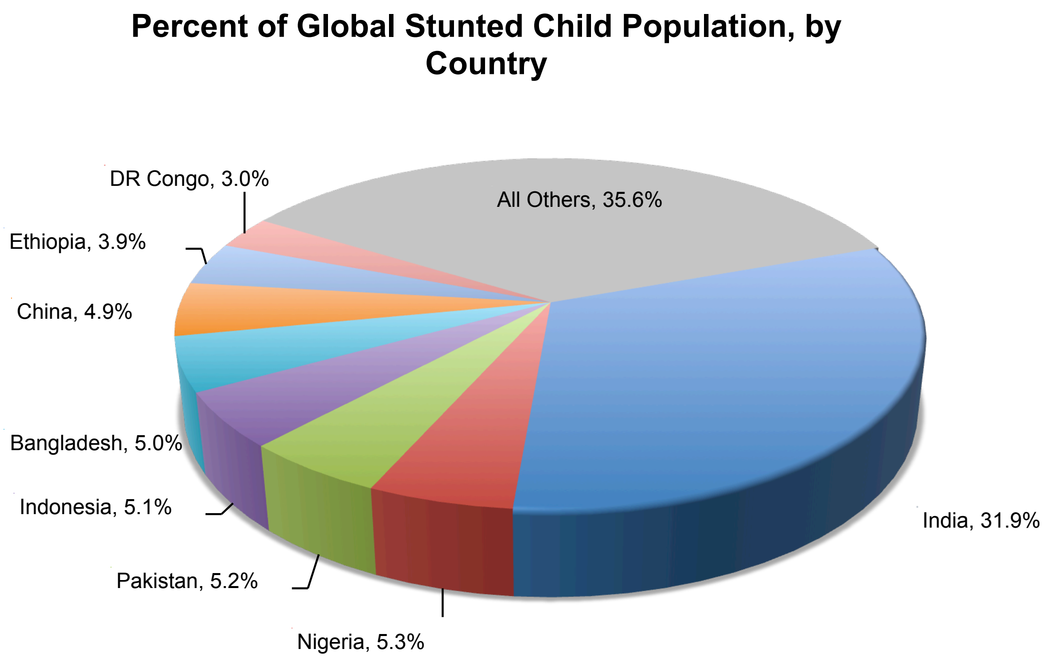


year	Freq.	Percent	Cum.
2000	8	6.90	6.90
2001	3	2.59	9.48
2002	7	6.03	15.52
2003	6	5.17	20.69
2004	12	10.34	31.03
2005	23	19.83	50.86
2006	29	25.00	75.86
2007	13	11.21	87.07
2008	12	10.34	97.41
2009	3	2.59	100.00
Total	116	100.00	

The surveys suggest that about 179 million children under age five in this group of countries are stunted, equating to a prevalence of about 34.2% in the decade between 2000-2009. Most of these children are found in South Asia and Sub-Saharan Africa. India alone has about 32% of the global total of stunted children, and just eight countries contain nearly two-thirds (

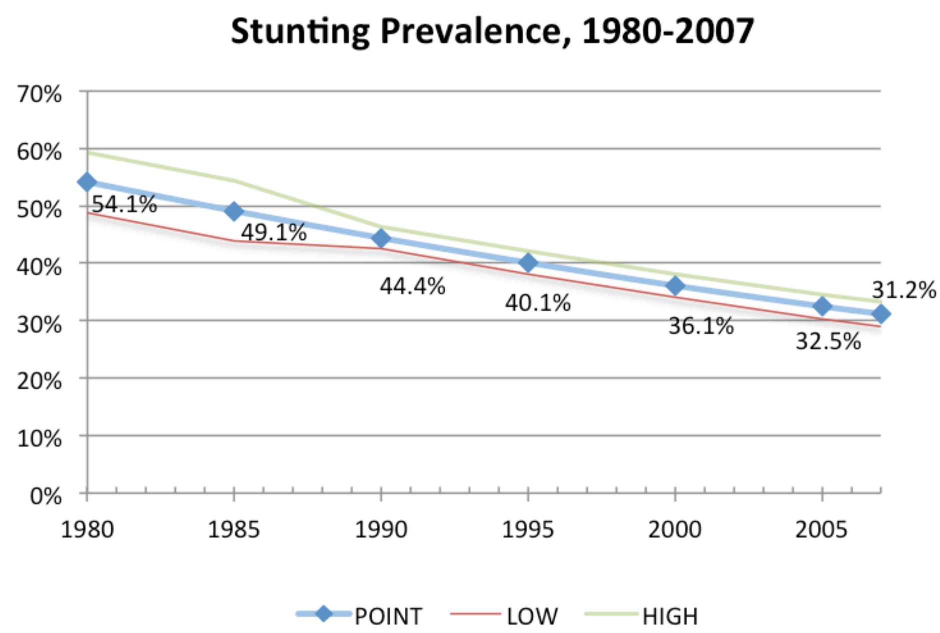
Figure 3).

Figure 3. Percent of global stunted population, by country. Source: World Health Organization (2011).



Given the paucity of reliable child stunting data, accurate assessment of historical trends is difficult. The United Nations Sub-Committee of Nutrition's Fifth Report on the World Nutrition Situation reports a 1980 global stunting prevalence in developing countries of 48.6%, using the original NCHS/WHO growth reference (UN ACC/SCN 2005). Using Yang and de Onis' (2008) method for converting the NCHS data into estimates under the new WHO Child Growth Standards, this translates to about a 54.1% "true" prevalence (95% CI: 48.8 – 59.3). Once again bearing in mind that the prevalence estimates are based on highly incomplete data, Figure 4 below illustrates the time trend calculated by UN ACC/SCN (2011) and Black and others (2008) between 1980-2005.

Figure 4. Global stunting prevalence, 1980-2007. Source: UN ACC/SCN 2011, Black and others 2008. Statistical significance at 95% CI for UN/SCN observations: 1980a, 1985ab, 1990bc, 1995d, 2000e, 2005ef, 2007f. Observations that share a common letter are not statistically significantly different.

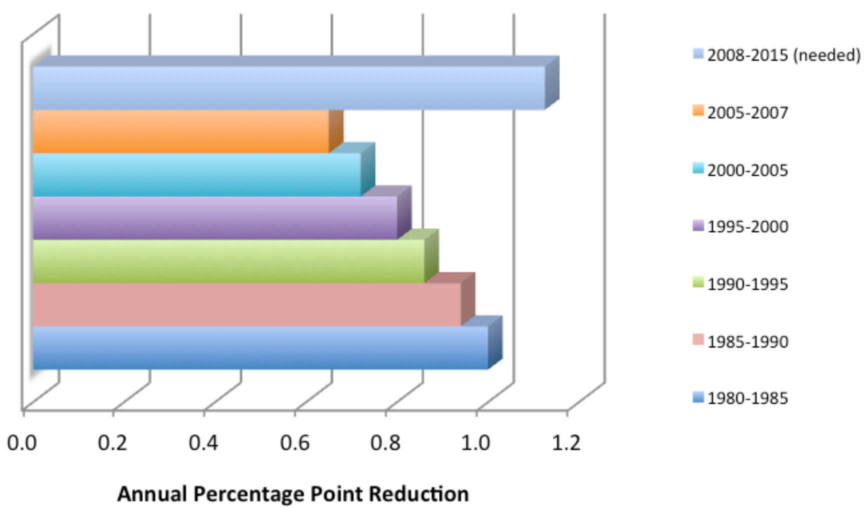


Note that the point estimates for 2005 and 2007 are several percentage points lower than the 34.2% prevalence noted earlier using surveys from 2000-2009. The methodology used to construct the 2005 and 2007 estimates, detailed in UN ACC/SCN (2011), relies on econometric extrapolation instead of a simple weighted average of the latest prevalences available. In the following sections, the UN ACC/SCN calculated prevalence of 31.2% for the year 2007 is used as indicative of the present situation.

The data summarized above indicates a 22.9 percentage point drop in child stunting in developing countries, or about 0.85 percentage points a year over the 27-year time period. This equates to a 42.3% total drop.

For many countries, the change in child undernutrition rates is below the aspirations of the Millennium Development Goals. There is no MDG target specific to child stunting, but there is a general child nutrition target: to halve the proportion of children under the age of five who are underweight between 1990 and 2015. If this same objective were to be applied to stunting, the target prevalence for 2015 would be about 22.2%. This suggests a necessary fall of 28.9% from the 2007 estimate, or a total of 9 percentage points (1.13 percentage points a year) for the 2008 to 2015 period. As Figure 5 shows, this global rate of reduction would have to exceed recent historical precedent, and would furthermore need to reverse the pattern of decelerating stunting reduction since 1980. In addition, most of the available nutritional data was gathered before the recent food price and financial crises, which may have slowed or reversed stunting reduction. If this is the case, the rate of reduction between 2008-2015 will need to be even greater to achieve the halving target.

Figure 5. Annual rate of stunting reduction observed 1980-2007 and required 2008-2015. Source: Author's calculations from World Health Organization database.



It should be noted that meeting the MDG target depends critically on exceptional performance by India. Without rapid decline in undernutrition throughout India, the pace of stunting reduction needed in the rest of the world to meet the global target is practically impossible. Table 1 below shows some potential stunting reduction scenarios in India between 2005 (the latest year for which India stunting prevalence is available) and 2015, and their implications for attaining the global target prevalence of 22.2%. The message of the table is that slow progress in India will necessitate unattainable rates of stunting reduction in the rest of the world to meet the global target. On the other hand, acceleration of stunting reduction in India will greatly lessen the required pace in other countries.

Table 1. Needed rates of global progress to meet 2015 target given different scenarios of stunting reduction in India. Source: Author's calculations, based on data from WHO Database on Child Growth and Malnutrition.

India % 2005-2015 stunting reduction scenario (from 47.9% prevalence in 2005)	India 2015 stunting prevalence under scenario	World % reduction 2005-2015 needed to meet global 22% target under given scenario (excluding India)	World 2015 stunting prevalence needed to meet target under given scenario (excluding India)
10%	43.1%	38.8%	16.5%
15%	40.7%	36.7%	17.1%
20%	38.3%	34.7%	17.7%
25%	35.9%	32.6%	18.4%
30%	33.5%	30.5%	19.0%
35%	31.1%	28.4%	19.6%
40%	28.7%	26.4%	20.2%
45%	26.3%	24.3%	20.9%
50%	24.0%	22.2%	21.5%

2. Individual Country Stunting Trends

Appendix A shows stunting prevalences by year of survey for all countries in the database, and Appendix B provides time trend information for the 129 countries with more than one observation in the database. Only countries with stunting prevalence estimates calculated with reference to the new WHO Child Growth Standards for the 0 to 5 years old age group are included. For countries with more than two surveys, the rates of change between the earliest and latest surveys are calculated, in both percent and percentage point terms.

The tables below present the top performers in reducing stunting, on the basis of three different rates of progress that would be needed to meet global targets between 2008-2015: 1) at least 28.9% total decline in stunting; 2) at least a 9 total percentage point decline in stunting; and 3) at least a 1.13 annual percentage point decline in stunting. Countries with stunting prevalence point estimates that are not statistically significantly different are excluded. One country sub-region, Northeast Brazil, is also included, for reasons explained below. The final table below summarizes by categorizing countries according to how many of these criteria they meet.

Table 2. Top performers, total percent decline in stunting. Only countries with a ≥28.9% total decline are included (23 in all). Northeast Brazil, the focus of Part III, is also included. Source: Author's calculations from World Health Organization data.

Country	Earliest survey	Latest survey	Period (yrs)	Initial prevalence (%)	Latest prevalence (%)	Total percent decline
Northeast Brazil	*1975*	*2006*	*31*	*51.3*	*5.9*	*88.5%*
Tunisia	1973	2006	33	41.8	9.0	78.5%
Jamaica	1978	2007	29	16.6	3.7	77.7%
China	1992	2005	13	37.6	11.7	68.9%
Jordan	1990	2009	19	20.5	8.3	59.5%
Colombia	1965	2004	39	38.1	16.2	57.5%
Saudi Arabia	1994	2004	10	21.4	9.3	56.5%
El Salvador	1975	2002	27	56.2	24.6	56.2%
Mauritania	1988	2008	20	40.2	24.2	55.8%
Vietnam	1983	2008	25	64.1	30.5	52.4%
Dominican Rep.	1991	2007	16	21.2	10.1	52.4%
Brazil	1996	2006	10	13.5	7.1	47.4%
Mexico	1988	2006	18	28.7	15.5	46.0%
Bolivia	1981	2008	27	48.6	27.1	44.2%
Senegal	1992	2005	13	33.7	20.1	40.4%
Bangladesh	1982	2007	16	71.1	45.0	36.7%
Nicaragua	1993	2003	10	29.6	18.8	36.5%
Turkey	1993	2003	10	24.1	15.6	35.3%
Morocco	1987	2003	16	34.5	23.1	33.0%
Cambodia	1996	2008	12	58.6	39.5	32.6%
Togo	1976	2008	32	39.9	26.9	32.6%
Algeria	1992	2005	13	23.5	15.9	32.3%
Honduras	1987	2005	18	43.3	29.9	31.0%
Egypt	1978	2008	30	43.8	30.7	29.9%

Table 3. Top performers, total percentage point decline in stunting. Only countries with ≥9 percentage point total decline are included (26 in all, plus the Northeast Brazil region). Source: Author's calculations from World Health Organization data.

Country	Earliest survey	Latest survey	Period (yrs)	Initial prevalence (%)	Latest prevalence (%)	Total percentage point decline
Northeast Brazil	*1975*	*2006*	*31*	*51.3*	*5.9*	*45.4*
Vietnam	1983	2008	25	64.1	30.5	33.6
Tunisia	1973	2006	33	41.8	9.0	32.8
El Salvador	1975	2002	27	56.2	24.6	31.6
Mauritania	1990	2008	18	54.8	24.2	30.6
Bangladesh	1982	2007	16	71.1	43.2	27.9
China	1992	2005	13	37.6	11.7	25.9
Colombia	1965	2004	37	38.1	16.2	21.9
Bolivia	1981	2008	27	48.6	27.2	21.4
Cambodia	1996	2008	12	58.6	39.5	19.1
Senegal	1992	2005	13	33.7	20.1	13.6
Honduras	1987	2005	18	43.3	29.9	13.4
Mexico	1988	2006	18	28.7	15.5	13.2
Egypt	1978	2008	30	43.8	30.7	13.1
Pakistan	1990	2001	11	54.5	41.5	13.0
Togo	1976	2008	32	39.9	26.9	13.0
Jamaica	1978	2007	29	16.6	3.7	12.9
Jordan	1990	2009	19	20.5	8.3	12.2
Saudi Arabia	1994	2004	10	21.4	9.3	12.1
Nepal	1997	2006	9	61.1	49.3	11.8
Madagascar	1992	2008	16	60.9	49.2	11.7
Morocco	1987	2003	16	34.5	23.1	11.4
Ecuador	1986	2004	18	40.2	29.0	11.2
Dominican Rep.	1991	2007	16	21.2	10.1	11.1
Nicaragua	1993	2003	10	29.6	18.8	10.8
Nigeria	1990	2008	18	50.5	41.0	9.5
Peru	1991	2007	16	37.3	28.2	9.1

Table 4. Top performers, annual percentage point decline in stunting. Only countries with ≥1.13 percentage point annual decline are included and earliest/latest surveys spaced at least 5 years apart are included (10 in all, plus the Northeast Brazil region). Source: Author's calculations from World Health Organization data.

Country	Earliest survey	Latest survey	Period (yrs)	Initial prevalence (%)	Latest prevalence (%)	Annual percentage point decline
China	1992	2005	13	37.6	11.7	1.99
Mauritania	1990	2008	18	54.8	24.2	1.70
Cambodia	1996	2008	12	58.6	39.5	1.59
Northeast Brazil	*1975*	*2006*	*31*	*51.3*	*5.9*	*1.46*
Ethiopia	2000	2005	5	57.4	50.7	1.34
Vietnam	1983	2008	25	64.1	30.5	1.33
Nepal	1997	2006	9	61.1	49.3	1.31
Saudi Arabia	1994	2004	10	21.4	9.3	1.21
Swaziland	2000	2006	6	36.6	29.5	1.18
Pakistan	1990	2001	11	54.5	41.5	1.18
El Salvador	1975	2002	27	56.2	24.6	1.17

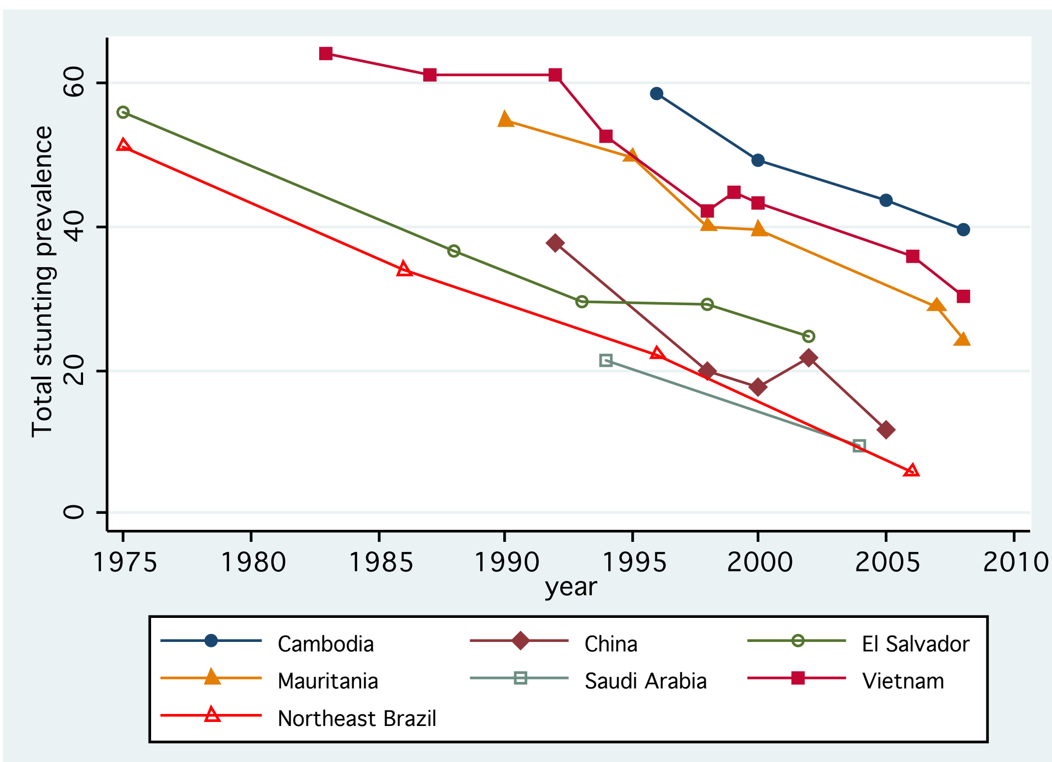
Table 5. Summary of top performers in stunting reduction. Source: Author's calculations from World Health Organization data.

<table>
<tr><th></th><th>Large Reduction Relative to Initial Prevalence
(≥ 28.9% total decline)</th><th>Large Reduction in Absolute Terms
(≥ 9 percentage point total decline)</th><th>Rapid Reduction in Absolute Terms
(≥ 1.13 percentage point annual decline)</th></tr>
<tr><td>Meet all 3 criteria</td><td colspan="3">Northeast Brazil, 75-06
Cambodia, 96-08
China, 92-02
El Salvador, 75-02
Mauritania, 90-08
Saudi Arabia, 94-04
Vietnam, 83-08</td></tr>
<tr><td rowspan="2">Meet 2 of 3 criteria</td><td></td><td colspan="2">Nepal, 97-06
Pakistan, 90-01</td></tr>
<tr><td colspan="2">Bangladesh,82-07
Bolivia, 81-08
Colombia, 65-04
Dominican Republic, 91-07
Egypt, 78-08
Honduras, 87-05
Jamaica, 78-07</td><td></td></tr>
</table>

<table>
<tr><th></th><th>Large Reduction Relative to Initial Prevalence
(≥ 28.9% total decline)</th><th>Large Reduction in Absolute Terms
(≥ 9 percentage point total decline)</th><th>Rapid Reduction in Absolute Terms
(≥ 1.13 percentage point annual decline)</th></tr>
<tr><td></td><td colspan="2">Jordan, 90-09
Mexico, 88-06
Morocco, 87-03
Nicaragua, 93-03
Senegal, 92-05
Tunisia, 73-06</td><td></td></tr>
<tr><td>Meet 1 of 3 criteria</td><td>Algeria, 92-05
Brazil, 96-06
Togo, 76-08
Turkey, 93-03</td><td>Ecuador, 86-04
Madagascar, 92-08
Nigeria, 90-08
Peru, 91-07</td><td>Ethiopia, 00-05
Swaziland, 00-06</td></tr>
</table>

The final graph of this section illustrates the performance of the seven countries that have met all three criteria, as well as the time trend for Northeast Brazil.

Figure 6. Top performers in stunting reduction: countries that meet all three criteria above. Source: World Health Organization Database on Child Growth and Malnutrition.



The figures and tables indicate that, according to the criteria above, a small subset of countries have been exceptional performers in reducing stunting. Of the 129 countries in the WHO database that have time trend information, only six, as well as one country sub-region, Northeast Brazil, meet all three criteria. Only 31 countries in the world, less than one-quarter of those in the database, meet any of the criteria.

The inclusion of Northeast Brazil in the tables and figure above – and as a subject for analysis in Part III – is justified by two factors: the size of its child population and the drastic nature of its stunting reduction experience. The region's under age-five child population exceeds that of every country listed in the tables above except China, Bangladesh, and Mexico. Northeast Brazil reduced its stunting prevalence by an incredible 89% between 1975 and 2006, a figure surpassing that of any nation in the world. Despite a child population that has stayed roughly the same size over the past two decades, around 1.5 million less children in Northeast Brazil were stunted in 2006 than in 1985.[11] This is an achievement exceeded only by China and Bangladesh.

The overall picture of child stunting in the world is one of steady but slow progress over the last several decades. At the current rate of reduction, around 150 million children will continue to be stunted in the coming years, leading to serious losses of cognitive and physical potential, with consequent severe effects on

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[11] Calculations based on data from United States Census Bureau (2010), IGBE (2010), and WHO (2010).

social and economic development. A few countries and regions in the world, however, have succeeded in reducing stunting quickly and dramatically. Understanding how countries are able to overcome the political obstacles to stunting reduction is the focus of the rest of this study.

Chapter 2. Literature Review: How is Stunting Reduced?

Determinants of Child Nutritional Status

The literature examining the determinants of child nutritional status is largely econometric in nature. These determinants are arranged in extremely complex relationships, incorporating a wide variety of interconnected economic, socio-cultural, environmental, and political factors. As a result, interpreting a correlation between an independent variable and nutritional outcomes as causal in nature can be problematic. As discussed in greater detail in Chapters 5 and 6, serious problems of reverse causation and omitted variables bias can exist. This caveat should be borne in mind when reading the following pages.

Although the survey that follows is not exhaustive, over 60 papers are covered, with a bias towards post-2000 work. The search strategy is as follows. The papers below come from published, peer-reviewed work available in the key nutritional, public health, and microeconomics databases.[12] As a first step, the following filter was used: "(child) AND (chronic undernutrition OR chronic malnutrition OR stunting)". Only papers in English were included. The bibliographies of the most cited papers within this group were then used to identify other studies. In this manner, an interconnected web of the most influential papers in the field was

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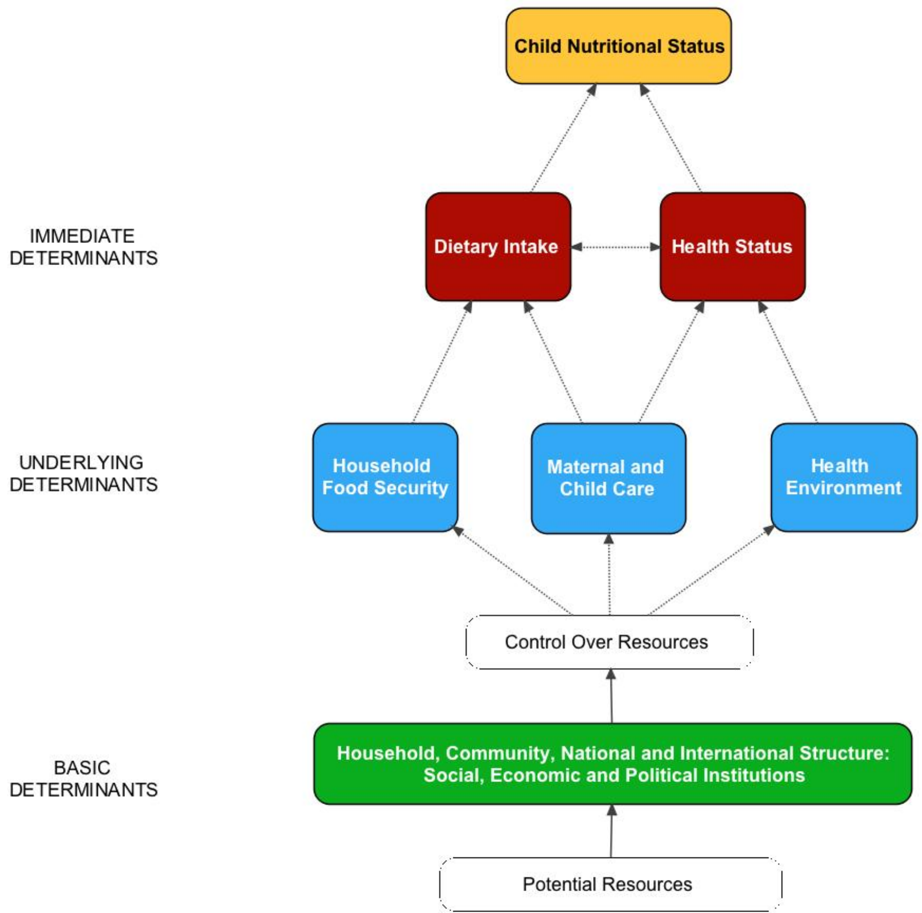
[12] Searched databases are: JSTOR, NBER Working Papers, Project Muse, PubMed, Sage Premier, Scopus, ScienceDirect, Web of Science, and the Wiley Online Library. Google Scholar was also used to locate papers not available through these other databases.

constructed. Because I wished to emphasize recent methodological innovations, I set a target of including at least 60% post-2000 papers; reviewed studies from before this period are generally very widely cited. Finally, I reviewed over 60 papers, drawn from a more comprehensive review of abstracts. The studies included in the final selection are those, then, that I identify as being most substantively and methodologically influential in the literature.

Based on what I regard as their primary contribution to the literature, the studies are categorized in relation to the levels of UNICEF's conceptual framework on the causes of undernutrition: immediate, underlying, and basic (Figure 7).

Figure 7. Determinants of child nutritional status. Source: UNICEF (1988).



Each of the sub-sections below covers a determinant level. It should be noted that the divisions between and within the sections are for heuristic purposes. Most studies provide insights into multiple determinant levels, and I attempt to summarize the wider set of key findings while reviewing each paper. Furthermore, the concept of "determinant levels" is itself problematic; the conceptual framework would more accurately be conceived of as a causal web rather than a causal hierarchy. This point is dealt with at greater length in Part II. The final section reviews recent studies that directly tackle the task of cross-country econometric analysis of stunting, which is most closely akin to the analytical exercise of Part II. Appendix C summarizes the results of the review in table format.

A. Immediate Determinants: Dietary Intake and Health Status

The links between dietary intake, health status, and child nutrition have been extensively confirmed in the scientific literature, and so a review of the top level of the framework, immediate determinants, is kept brief.

Two important points about this top level should be noted. First, the quality as well as the quantity of food consumed is a key consideration for maintaining optimal child nutritional status; micronutrient deficiencies can contribute both directly and indirectly to growth faltering. Stunting, for example, is frequently used as a proxy measure for chronic zinc deficiency (IZiNCG 2004; Bronte-Tinkew and DeJong 2004). Direct links between vitamin A, iron, iodine, and other micronutrient deficiencies and child growth are less well studied, but all of these conditions can lead to chronic illness or disability, increasing the risk of developmental delays or permanent stunting (Black, Brown, and Becker 1984). Poor breastfeeding or complementary feeding practices during the first two years of life are known to have significant effects on stunting (Becker, Black, and Brown 1991; Brown and others 2002; Shrimpton and others 2001) and interventions that tailor nutritional messages and complementary feeding strategies to particular nutritional deficiencies have shown an effect on child growth (Dewey and Adu-Afarwuah 2008; Shrimpton and others 2001; Penny and others 2005).

The second key point regarding immediate determinants of child stunting is that, although the relationship between dietary intake and child growth is intuitively obvious, the impact of health status on undernutrition should be seen as equally important (Scrimshaw and Suskind 1976). Sick children have lower appetite, reduced nutrient absorption, and greater loss of consumed nutrients through diarrheal and other illness episodes. A great deal of evidence indicates that diarrhea is the single greatest illness-related factor in influencing child growth, and some evidence regarding the negative impact of respiratory diseases and malaria also exists (Rowland, Cole and Whitehead 1977; Rowland, Rowland and Cole 1988). A review by Black and others (2008) of longitudinal studies from Bangladesh, Brazil, Guinea-Bissau, Ghana, and Peru finds that each episode of diarrhea in the first two years of life increases the risk of stunting at 24 months of age by five percent (odds ratio 1.05, 95% CI 1.03-1.07) (Assis and others 2005; Black, Brown, and Becker 1984; Checkley and others 2003; Molbak and others 1997; Molbak and others 1994; Moore and others 2001; Valentiner-Branth and others 2001; Ghana VAST Study Team 1993). Given that many poor children in the developing world suffer multiple episodes of diarrhea in the early years of life, the aggregate effect on stunting can be considerable.

The following three sections review studies whose chief contribution pertains to the “underlying determinants” level of UNICEF’s conceptual framework: the care environment, household food security and income, and the health environment.

B. Underlying Determinants: Household-Level Factors

1. The Care Environment

Two topics emerge as particularly important in the relationship of the care environment to stunting: maternal welfare and maternal behavior. The links between paternal education and stunting are also examined in the final sub-section.

Maternal Welfare: Knowledge and Health

The importance of maternal education in contributing to lower stunting is perhaps the single most consistent theme emerging from the econometric literature on the determinants of undernutrition. The majority of studies that test for the link between maternal education and stunting find a strong and significant association.

Using data from the 1996 and 2006 Demographic and Health Surveys in Brazil, Monteiro and others (2009) test the association of child stunting with four potential explanatory variables: maternal education (years of schooling), family purchasing power[13], access to antenatal and delivery care (representing access to health care services generally), and safe water and sanitation connections. The authors find that about 63% of the reduction in stunting over this time period can be attributed to the four tested explanatory variables. Improvement in maternal schooling has the greatest effect, accounting for 25.7% of the decline, followed by

[13] The purchasing power score is calculated by measurement of characteristics that have been found to correlate strongly with family income, including specific consumer good assets, characteristics of the home, and the education level of the head of household). See Associação Brasileira de Empresas de Pesquisas (2008).

family purchasing power (21.7%), health care services (11.6%) and safe water and sanitation (4.3%).

De Lima and others (2010) perform a similar analysis specifically for the Northeast Region of Brazil, extending their analysis to three surveys, the 1986, 1996, and 2006 DHS. They consider the four explanatory variables tested by Monteiro and others (2009), and add one more set: maternal reproductive indicators, including birth order, birth spacing, and mother's age at birth. They calculate generalized attributable fractions of total stunting reduction associated with changes in the distribution of each explanatory variable. Significant associations were found for all determinants in 1996, and for all except health care services in 1986. The improvement in these factors appears to explain about half of the decline in stunting between 1986-1996, and about two-thirds of the decline between 1996-2006. The most important of the explanatories for the prior period are maternal schooling and safe water and sanitation, which accounted for about 10.6% and 10% of the total decline, respectively. Reproductive indicators accounted for another 7.6% and family purchasing power 4.1%. In the 1996-2006 period, family purchasing power (24.9%) and maternal schooling (18.7%) were most important, followed by safe water and sanitation (12.9%), reproductive indicators (11.7%), and health services (8.7%).

A key question regards the pathways through which this maternal education effect occurs. Thomas, Strauss, and Henriques (1991) find that the significant effect of maternal education on child height in rural areas of Northeast Brazil works primarily through access to information sources, especially the reading of newspapers, although this access to information variable may be acting as a proxy for other human capital characteristics. The authors find that the effect of maternal education operates to a lesser extent through higher incomes, another commonly hypothesized pathway. Handa (1999) confirms the impact of female education on child height in Jamaica, controlling for household income, sanitation, and access to community health services. He finds that higher education levels of any woman in the household, not only the caregiver, has positive effects on child growth, indicating that information is a freely shared good within the household. In addition, television use and access to private doctors have complementary effects to education, suggesting that schooling helps women receive and interpret information productively.

Using data from the Philippines, Barrera (1990) also finds that the impact of maternal education on stunting comes less through increases in income and more strongly through increasing the efficiency of health inputs (such as safe sanitation or health services) and by facilitating the reception of information. Glewwe, Koch, and Nyugen (2004), meanwhile, argue that nearly all of the impact of mother's schooling on height-for-age Z-scores (HAZ) in Vietnam occurred through improved health knowledge. Such knowledge is not taught directly in schools, but the literacy and numeracy skills obtained in schools facilitate learning of such information outside of school. Webb and Block (2004), using data from Indonesia, suggest that different types of nutrition knowledge affect different types of undernutrition. They find that maternal education is indeed linked to lower stunting, but short-term nutritional status is more responsive to specific nutrition information. Stifel, Sahn, and Younger (1999) find that the effects of primary and secondary education differ. While maternal education coefficients for secondary schooling are generally significant in their nine country Sub-Saharan African sample, primary school maternal education has a strong association with height-for-age only in a small subset of the sample.

Frost, Forste, and Haas (2005) also attempt to understand the pathways through which maternal education reduces stunting. Using data from the 1998 Bolivia Demographic and Health Survey (DHS), they include variables related to socioeconomic factors, maternal knowledge, health care attitudes, maternal autonomy, and reproductive behaviors into their various models, and assess how inclusion of these variables affects the maternal education coefficient. In contrast to the studies cited in the previous paragraphs, they find that the impact of maternal education on stunting works most strongly through the socioeconomic variables of household wealth (assets) and household environment (electricity, water, sanitation, house quality) as well as through the variables dealing with utilization of health services. Birth parity and birth spacing are also significant, independent of the maternal education pathway. The authors conclude that maternal education is an important vehicle for socioeconomic development, which then reduces stunting rates. However, they also note that even in the most complete model including all of the pathway variables, maternal education continues to have a significant effect, suggesting that there are unidentified pathways through which stunting is affected by improvement of maternal education. Rubalcava and Teruel (2005), exploring the related topic of maternal cognitive ability, also find that the strong effects of improved cognitive ability on reducing stunting appear to work through increased household income. The effects are more pronounced for first-time rather than experienced mothers.

Using data from northwest Uganda, Vella and others (1994) also find that both income and mother's education are significant independent predictors of stunting. They assert that maternal education has a relatively greater impact than income in influencing recovery from stunting. Attanasio and others (2004) use data from Colombia to confirm the powerful correlation between maternal education and HAZ; household consumption, sex of child (boys are more stunted), presence of a hospital, and altitude are also important correlates. Seerabutra and others (2006), in a survey of two rural communities in Guatemala, find that children with illiterate primary caregivers are five times more likely to be stunted than those with literate caregivers. In addition, larger household size is associated with a higher risk of stunting; children living in families with at least four children are three times as likely to be undernourished, probably due to dilution of household resources.

In contrast to many of the papers reviewed above, Desai and Alva (1998) contend that the strength of the causal links between maternal education and height-for-age should be questioned. They examine DHS data from 22 countries and find that, once controlling for paternal education, sanitation, and area of residence, maternal education has a significant effect on stunting in only six of the 22 examined countries (Sri Lanka, Thailand, Bolivia, Colombia, Brazil, and Guatemala), and only among children between 12-36 months old. These results are consistent with earlier work by Wolfe and Behrman (1987) in Nicaragua, who find that holding family background factors constant by using proxy controls such as the education levels of the mother's mother or sibling eliminates the impact of maternal schooling.

The majority of the studies above that find associations between maternal education and stunting prevalence do control for factors included in the Desai and Alva (1998) and Wolfe and Behrman (1987) studies. However, as with many other variables, a vigorous debate about the importance of maternal education continues, with skeptics charging that the indicator is serving as a proxy for other variables, and that the strength of association is sensitive to model specification and the time and place from which the dataset is assembled. In general, quality of schooling and factors that enable or hinder female access to information sources in the post-schooling years seem to affect the relationship. Also important are the social, economic and political opportunities that exist for women in a given country – i.e., what women are able to do with the education they gain. In some cases, the "caregiving and health care-seeking behavior effect" of increased education seems to be the primary pathway to lower stunting; in others, the "income effect" appears to be predominant. However, it can be said that, while the effect of maternal education is contextual, the literature does seem to confirm that the broader variable of caregiver knowledge does have a strong, robust association with child nutritional status. As Webb and Block (2004) point out, that knowledge can come in other forms than formal schooling.

Maternal physical status is also commonly found to have a strong correlation with child stunting, suggesting the importance of intergenerational effects. Gragnolati (1999) finds that maternal height is an important determinant of stunting in Guatemala, a conclusion reached by many of the papers reviewed in the preceding paragraphs. The author also asserts that parental education, household income, and community characteristics such as the presence of government health care facilities (which offer services at a reduced fee) and safe water connections are all significant correlates of child nutritional status.

Surkan and others (2007) look at maternal psychosocial factors that affect child growth. Using data from Northeast Brazil, they find that the presence of outside relationship support – that is, the availability of persons outside the immediate family unit to provide assistance to the mother when there is conflict in the household – is significantly correlated with lower stunting among preschool children. Other psychosocial variables, including material support and maternal positive social interaction, were found to positively correlate to other nutritional indicators – underweight and wasting prevalence. Bhutta and others (2008), in a meta-review of the literature, state that, although little data is available to assess the impact of mental health support interventions on stunting, "intermediate data and observational studies" lead the authors to estimate a 3-5% stunting reduction associated with such programs.

Maternal Behavior: Childcare and Work

Infant and child feeding practices are also important determinants of stunting. Brennan, McDonald, and Shlomowitz (2004), using data from India's 1998-99 National Family Health Survey, find that key infant feeding practices – including exclusive breastfeeding for infants under six months, use of colostrum, adequate supplementary feeding, and hygienic bottle feeding practices – are all associated with lower rates of severe and total stunting. They also find that immediate feeding after delivery and maternal autonomy have no effect, and that longer breastfeeding is associated with greater stunting prevalence, a finding that suggests that children may not be receiving adequate supplementary foods or that mothers may be responding to stunting by extending the breastfeeding period. Tharakan and Suchindran (1999) and Asenso-Okyere and others (1997), in Botswana and Ghana respectively, also confirm that prolonged breastfeeding increases the risk of stunting. Brennan, McDonald, and Shlomowitz (2004) also find that maternal education, maternal BMI, household wealth and birth order are also correlated with the stunting rate in the expected directions. Unobserved effects at the state level are also significant, pointing to the importance of context-specific factors not picked up by standard variables.

Ukwuani and Suchindran (2003) look at the impact of mother's work outside the home on nutritional status of infants (0-11 months) and children (12-59 months) in Nigeria. After controlling for socioeconomic variables, however, the data is inconclusive; the authors state that the regression results suggest that mother's work reduces stunting during infancy and increases stunting during childhood, but

– with the exception of a “paid work with child accompanying the mother” variable being correlated with an 18% less chance of stunting among children – the coefficients for the work variables are generally not significant at the 10% level. Instead, low household wealth, polygynous marriage, sex of child (male), lack of immunization, and poor sanitation are stronger explanatory variables for higher stunting among infants. Among older children, less maternal education, lower household wealth, religion (non-Christian), sex of child (male), lack of immunization, geographical region of residence (northern Nigeria) and diarrheal incidence are the strongest correlates of higher stunting.

Improvements in income, even through mother’s work, may not have gender-neutral impacts on child nutritional status. Haddad and Hoddinott’s (1994) collective household analytical approach finds that increases in maternal income benefit boys’ growth more than girls’ growth. However, in the case of the study location of Cote d’Ivoire, such an effect has a positive effect on intrahousehold equality, as boys are generally more stunted than girls.

It is worth noting that childcare practices are strongly influenced by maternal knowledge and education, and thus policy interventions to increase the latter can work through improvements in childcare to reduce stunting.

Paternal Education

Another key debate in the econometric literature is whether paternal education also has a strong effect on reducing stunting. Webb and Block (2004) find paternal schooling to contribute to lower stunting. Using ordered logistic regression techniques, Tharakan and Suchindran (1999) also support this position, stating that maternal and paternal education both have a strong and significant impact on stunting rates.

Using data from a 1996 household survey in Papua New Guinea, Gibson (1999) finds that maternal education is three times more effective than paternal education in reducing stunting. An extra year of maternal schooling is associated with a 3% reduction in stunting prevalence. The pathway of effect appears not to be through household income increases, but rather through care practices and household decision-making. Household expenditure levels and maternal and paternal height also are significant correlates of stunting, although controlling for these factors does not eliminate the impact of maternal education (but does reduce it). However, using this same dataset, Gibson (2002) finds that measurement error and endogeneity issues affect conclusions about whether income or maternal education has more powerful effects on stunting. Although use of ordinary OLS points to maternal education as a much stronger correlate of stunting than household income, use of instrumental variables regression to correct for measurement error and endogeneity bias reverses this conclusion, pointing to the importance of underlying assumptions in producing regression results, an issue discussed further in Part II.

Semba and others (2008) find that maternal and paternal education both strongly influence stunting in Bangladesh and Indonesia. A greater level of maternal formal schooling (e.g., secondary as opposed to primary) decreased the odds of stunting by 4.4-5%, averaged across the two countries. The aggregate effect of paternal education was somewhat smaller, although this factor exceeded maternal education impact in Bangladesh, which may have to do with the relatively limited autonomy of women in the country, illustrating that the social and economic context mediates the effect of education. Higher levels of parents' education were associated with beneficial caregiving behaviors, although the behaviors themselves did not show a direct effect on stunting when included in a separate regression. Greater maternal age, sex of child (boys), lower maternal height, and higher household expenditure were all associated with a higher risk of stunting.

In sum, paternal education appears to have an impact on reducing stunting, although generally less than that of maternal education.

Household Structure

Household-level demographic factors are correlated with stunting outcomes. Bronte-Tinkew and DeJong (2004) find that children living in single-parent or cohabitating households in Jamaica are three to five times more likely to be stunted than those living with two parents, controlling for socio-economic and parental characteristics. Especially at risk are children living with siblings in single parent or extended family poor households. Parental education also plays a role in determining stunting rate in this study. The findings support the hypothesis that different household structures have implications for how much nutritional support individual children receive.

David, Moncada, and Ordonez (2004) also highlight the importance of household demographic factors in determining stunting in Nicaragua and Honduras. Smaller household size and greater birth spacing, as well as greater household income (proxied by expenditures) are correlated with better nutritional outcomes in both countries. In Honduras, maternal education and height are also significant, although this was not the case in Nicaragua. Community-level variables, either included explicitly or as unobserved fixed effects, were generally not important (in contrast with the studies in Ethiopia and Ghana discussed in the "Community Structure" section below). The differences between countries and regions underscore the contextual importance of the determinants of child stunting.

Strauss (1990) finds that in polygynous households in Cote d'Ivoire, children of senior wives are taller than children of junior wives, suggesting that location-specific cultural variables are important to include in stunting models. The same study finds that maternal education has a small positive correlation with height, as do maternal height, land per adult, lack of illness and daily male agricultural wage.

2. Household Food Security and Income

As would be expected, greater household food resources and incomes are also associated with improved child growth, although the magnitude of the effect in comparison with maternal/child care and health variables is debated. Using data from a six-village study in rural Guatemala, Immink and Payongayong (1999) find that low per capita food availability is the strongest correlate of stunting risk among preschool children. Morbidity, as proxied by diarrheal incidence, was also a significant determinant, but was overshadowed by food availability. In addition, and in contrast to the general assumption that market participation is correlated with greater food security, consumption of own-production was correlated with better nutritional outcomes. The authors also note that participation of school-age children in labor activities is not a risk factor for their own nutritional status, but is correlated with poorer nutritional outcomes for their preschool siblings (the mechanism behind this relationship, however, is not understood).

Glewwe, Koch, and Nyugen (2004) find that, although Vietnam experienced rapid economic growth in the 1990s, only a small proportion of the impressive total reduction in child stunting rates was due to household income improvements. The authors surmise that better access to health services, especially to oral rehydration salts and goods from private pharmacies, might have impacted child stunting; in general, however, very little of the variation in stunting is explained by the income and health services variables. Parental height and maternal education appear to be stronger explanatory factors. However, the authors do state that aggregate economic growth may have an important secondary effect by increasing the government's ability to spend on the health and education sectors.

A meta-review of the program evaluation literature by Bhutta and others (2008) finds that complementary feeding and conditional cash transfer programs both have significant effects on stunting. Among food-secure populations in China, Peru, and Brazil, complementary feeding education was found to increase height-for-age Z-scores (HAZ) by 0.25 (95% CI 0.01-0.49) (Guldan and others 2000; Santos and others 2001). Among food-insecure populations in South Africa, Ghana, Vietnam, Ecuador, India, and Nigeria provision of complementary food is found to increase HAZ by 0.41 (95% CI 0.05-0.76), with or without educational strategies (Oelofse and others 2003; Adu-Afarwuah and others 2007; Lartey and others 1999; Schroeder and others 2002; Lutter and others 2008; Bhandari and others 2001; Obatolu 2003). In addition, conditional cash transfer programs in Colombia, Mexico, and Nicaragua have all had positive impacts on child height. The Familias en Acción Program in Colombia increased average height in children aged 0-12 months by 0.44 cm (Mesnard 2005). PROGRESA/Oportunidades in Mexico reduced the prevalence of stunting by 10% in the 12-36 month age group, and was associated with a 16% increase (1 cm) in mean growth rate per year (Behrman and Hoddinott 2001). The Red de Protección Social in Nicaragua was associated with a decline in stunting from 41.9% to 37.1% over two years (Maluccio and Flores 2005).

Many of the studies reviewed in the previous care environment section, as well as the following health environment section, also include household income as an independent variable, although few include direct measures of food availability. Household income usually has a significant impact on stunting in this body of work, although the magnitude of the impact seems to vary across studies. Again, the lesson is that the strength of the causal relationship depends on the context, especially whether women have a voice in expenditure decisions.

3. The Health Environment

A range of health environment and services variables are correlated to stunting rates. Using data from Lesotho, Esrey and others (1988) were among the first to definitively establish the link between access to improved water and improved child height outcomes among the 1-4 year age group. The effect is thought to work through reduced diarrheal morbidity, although this was not established by the research. Von Braun and others (1989) reach similar conclusions in the work on the Gambia, showing that the quality of village drinking water is strongly associated with stunting outcomes.

In a recent study, Barber and Gertler (2009) look at the relationship between stunting and available health staff resources – i.e., doctors, nurses, and midwives in both primary and auxiliary health centers – in 1990s Indonesia. They find a significant negative correlation between health staffing and stunting rate for all child groups (<18 months, <24 months, and <36 months). Their estimates indicate that the greatest reductions in stunting are associated with the presence of MDs; adding one doctor where there are none reduces stunting in the <18 month group by 3.2%, although the marginal gains to adding more doctors are much reduced. Adding nurses or midwives has smaller but still significant effects.

Lavy and others (1996) reach similar conclusions for Ghana, showing that greater numbers of doctors and higher drug availability are correlated with improved child height. Staple food prices, water and sanitation, household income, and parental education and height are also important determinants. Thomas, Lavy, and Strauss (1996) also find that presence of personnel, availability of medicines and improved infrastructure in local health centers in Cote d'Ivoire are correlated with better HAZ scores; parental height, paternal education and prices of selected foods are also important correlates. Valdivia (2004), in contrast, finds that Peru's primary health sector expansion of the 1990s had positive but only small impacts on stunting, and the effect was only significant in urban areas. Maternal education, maternal height, home language (Spanish vs. indigenous), assets, and geographical dummies were all more significant than the quality of health infrastructure.

An extensive program evaluation literature exists around the impact of various household-, maternal-, and child-level interventions on child stunting. Bhutta and others (2008) have performed a meta-review of this literature. They find that sufficient evidence exists to call for the implementation of a basic set of interventions in the 36 countries with the highest burden of child undernutrition and mortality. This set includes breastfeeding promotion, behavior change communication to improve complementary feeding practices, zinc supplementation as well as use of zinc to manage diarrhea, Vitamin A fortification, universal salt iodization, handwashing/hygiene interventions, and treatment of severe acute malnutrition. They also encourage conditional cash transfer programs, deworming, iron fortification/supplementation, and insecticide-treated bednets in specifically relevant contexts. In terms of health interventions, they find zinc supplementation and deworming to be especially effective specifically for child stunting. An analysis of various zinc supplementation studies shows a weighted average effect size for change in height of 0.35 (95% CI 0.19-0.51) (Brown and others 2002). Deworming is associated with a 0.14 cm (95% CI 0.04-0.23) height increase for a single dose and 0.07 cm (95% CI 0.01-0.15) for a multiple dose for up to one year of follow-up (Dickson and others 2000). Overall, Bhutta and others (2008) conclude that complementary feeding interventions and zinc supplementation are the two most effective intervention strategies against stunting. Ninety-nine percent coverage of complementary feeding would reduce prevalence of stunting at 24 months by 17.2%, and 99% coverage of zinc supplementation would reduce prevalence of stunting at 24 months by 15.5%. The two interventions together would thus cut stunting in the 36 most-affected countries by almost one-third.

C. Basic Determinants: Macro-Level Structure

The section below looks at studies yielding information about "basic level" determinants pertaining to the social, economic, and political structure of communities, sub-national units, and countries, as well as the international environment.

1. Community Structure

Community-level factors can also impact stunting. Asenso-Okyere and others (1997) look at the determinants of stunting in Ghana, using data from the 1987-1988 Ghana Living Standards Survey. They find that the presence of electrification in the community surveyed, which may be interpreted as a proxy for community services, community wealth, and/or proximity to urban centers, is one of the two strongest explanatory factors of stunting, along with the long-term nutritional status of parents (as measured by height).

In a study of Peru, Alderman and others (2003) find that investments made by households can have positive externalities in the community. The strongest effect is for maternal education: the overall level of maternal schooling in a community has positive impacts on child nutritional status even for households where mothers have not attended school. Water and sanitation also have similar, although weaker, effects. The authors state that one policy implication of this finding is to pursue community-level rather than household-level targeting to maximize intervention impact. Another key conclusion of the study is that positive externalities depend on the initial level of the variable measured. For example, improvements of low community levels of sanitation have a strong impact on reducing stunting within households, but positive externalities of this type diminish when safe sanitation coverage reaches higher levels in the locality.

Christiaensen and Alderman (2004), using Ethiopian data, find that a community's ability to correctly diagnose growth faltering is correlated with lower stunting rates. They use this variable as a proxy for maternal education, but the variable in its own right suggests that policies to increase community diagnostic capacity – either through women's schooling or other pathways – should complement development interventions. Household resources and food prices are other key correlates of stunting in this study.

Silva (2005) looks at the determinants of stunting rates in Ethiopia, using the 2000 nationwide DHS dataset. She finds that access to safe water and sanitation at the household level does not seem to affect stunting rates, but notes that there are impacts on stunting of access to safe water and sanitation at the community level, suggesting that there are some positive externalities to neighborhood access to these resources. This is particularly so in communities with initially very poor access to safe water and sanitation; as in Alderman and others (2003), the effect on stunting reduction is reduced as access extends to more households in the community. However, the author notes that unobserved variables correlated with access to safe water and sanitation may be driving these effects. Silva also finds that in rural areas maternal education, maternal height, household wealth, and the number of children under age five in a household are all highly significant, although the effect of maternal education is relatively small – a result that the author theorizes is due to the relatively low level of maternal education levels in Ethiopia. The intergenerational impact of maternal height is also relatively small.

2. Sub-National Structure

Using data from Ecuador, Larrea and Kawachi (2005) find that greater inequality (measured by the Gini coefficient of consumption) at the provincial level is significantly and strongly correlated with higher levels of stunting, even when controlling for a wide set of socioeconomic and demographic variables. More local forms of inequality, however – in census zones, parishes, and municipalities – do not appear to affect stunting. The authors speculate that provincial equality impacts stunting by affecting the availability of government services, especially social development programs, most of which work at the provincial level. They also suggest that environmental health factors, including infectious diseases and pollutants, work on regional scales. These governmental and environmental factors are theorized to have a greater effect on stunting than phenomena associated with inequality across more local levels. The authors fit the data to both standard multiple regression and multi-level simultaneous equation models, and find similar results.

Using data from Bolivia, Morales, Aguilar, and Calzadilla (2004) examine the impact of geographical and cultural factors, especially altitude and Quechua identity, on stunting. They find that altitude does indeed have a significant effect, a phenomenon that may be explained by reduction of maternal oxygen transport, fetal hypoxia, and limited fetal growth. The Quechua cultural variable is also significant (although its effect is reduced considerably when maternal height, skills and assets are controlled for), but the reason for this effect is unclear. Household asset variables and maternal education are also significant. Overall, the paper highlights the importance of considering sub-national ecological and social particularities when designing policy response to undernutrition.

Griffiths and others (2002) find that the covariates of stunting vary widely between the three states in India they analyze, Maharashtra, Tamil Nadu and Uttar Pradesh; only size of child at birth and breastfeeding practices were significantly associated with stunting in all three states. Their findings point to the importance of developing not only country-specific but also state-specific policies to address chronic undernutrition. Other key findings of this study include rejection of the hypothesis that sex-selective nutritional discrimination is present within households, as well as the observation that undernourished children appear to cluster at the family level, a result that persists when controlling for socioeconomic and demographic variables.

Fahrmeir and Khatab (2008) use spatial regression techniques to identify the covariates of stunting in Nigeria, using data from the 2003 DHS. They find that disease and stunting patterns are positively correlated, indicating a potential synergy between illness incidence and chronic undernutrition. Most of their other results are also as expected: maternal education, antenatal care, access to safe sanitation, having electricity, higher age of mother at childbirth, and the presence of a income-earning mother reduce stunting; the sex of child (boys), incidence of diarrhea, and poor maternal BMI (very low or very high) increase risk of stunting. However, the use of geographic methods also helps to illuminate small-scale district-level patterns and suggests, in particular, that geographical factors influence stunting even when the usual set of determinants is controlled for. In particular, spatial variables omitted from the model appear to be important in causing the high undernutrition rates in northeastern Nigeria. Similarly, Kandala and others (2001) find that sub-national spatial factors influence stunting rates in Tanzania and Zambia, controlling for socioeconomic and demographic variables.

The determinants of stunting appear to be broadly similar in rural versus urban areas, although stunting rates are almost always higher in the former. Garrett and Ruel (1999) find that sex of child, maternal education, household expenditures, household size, land ownership and number of preschool children in household are significant common determinants of HAZ in both rural and urban areas. Maternal education and household expenditure show a significant interactive effect, suggesting that higher levels of maternal schooling enhance the impact of expenditures, perhaps because mothers are able to make better decisions under a given household budget constraint. The one key difference between rural and urban areas appears to be the influence of seasonality on stunting in rural areas; Schwekendiek (2009) examines the impact of seasonality in more detail in his paper on stunting in North Korea, focusing particularly on the impact of month of birth.

Smith and others (2004) find similar results in a cross-country investigation of the determinants of urban and rural stunting in 36 developing countries. Although levels of the four determinants examined – women's status, maternal education, access to safe water and sanitation, and household economic status – vary widely between urban and rural areas, the same causal pathways are implicated in the causation of stunting. Differences in access to maternal prenatal and delivery care, complementary feeding practices, and immunization all drive stunting prevalence differentials between urban and rural areas. The authors conclude that similar anti-undernutrition policy frameworks can be applied to both urban and rural areas, although targeting approaches will likely need to differ.

Fotso (2007) also disaggregates stunting by urban/rural area for 15 sub-Saharan African countries. He finds that differences in stunting rates between urban and rural areas are largely driven by socio-economic variables, including household wealth, maternal education, and community-level variables.

3. National and International Structure

Levine and Rothman (2006) look at the impact of trade openness on child stunting. They find that greater trade openness is associated with a slight but significant reduction in stunting rates, controlling for regional effects. They also examine the pathway through which this effect occurs, and find that the impact of trade openness on accelerating GDP growth explains most of the correlation. The increased ability of governments to increase health sector spending due to trade openness is a less important but also significant pathway. The authors suggest that these results imply that trade has positive impacts on child nutrition, but is not a sufficient condition for meaningful reductions in stunting prevalence.

Using national data from 70 countries and sub-national data from 45 countries, Frongillo Jr. and others (1997) find that higher per-capita energy availability, female literacy, and GNP per capita are the strongest explanatory factors of child stunting rate; all appear to have a curvilinear relationship to stunting rates. National-level factors, as opposed to regional or sub-national factors, explained 76% of the variation in stunting.[14] Harttgen and Misselhorn (2006), in an investigation of the so-called Asian Enigma – why, despite generally better socio-economic conditions, undernutrition rates are higher in many South Asian countries than in sub-Saharan African countries – use multilevel modeling techniques to look at the determinants of stunting in Bangladesh, India, Mali, Nigeria, Uganda and Zimbabwe. They find that the covariates of stunting differ by country; the only explanatories significant in at least 5 of the 6 countries are maternal education, maternal BMI, and household asset levels (a pooled regression does cause most of the included variables to be significant, although

[14] This influential study, however, has important limitations, particularly in the choice of variables to represent basic-level determinants: measures of militarization, urbanization, industrialization, population density, and female-male ratio of labor force participation are used as measures of a country's institutional structure, but serious endogeneity problems with each of these – that is, correlation with unobserved factors (especially policy decisions, ecological context, and cultural norms) in the error term – are likely to exist. Further, no political/ideological or economic structure variables survive initial tests for significance, and so the testing of basic-level variables is at best incomplete.

the R^2 of the model is quite low). They also find that, controlling for a wide set of community, household and individual characteristics, the South Asian regional dummy remains a significant explanatory of stunting, suggesting that additional unobserved supra-national factors remain important in understanding the Asian Enigma. Van de Poel and others (2007) find that supra-national regional effects persist as correlates of stunting inequality, even when including a broad set of socio-economic and demographic factors.

In contrast to some of the studies above, however, Heaton and others (2005) find relatively little cross-national variation in the determinants of stunting. Using DHS datasets from 42 countries, they find that a variety of family-level effects on stunting are significant, particularly socioeconomic factors and maternal education (the explanatory power of the models, however, is rather low; Rsq=.073 in the full model). Once these characteristics are controlled for, however, country-level variables do not have a large impact. The authors state that maternal education and breastfeeding promotion policies, in particular, are applicable and valuable in countries across the world.

D. Recent Cross-Country Studies

Finally, the studies of the determinants of child stunting that utilize a cross-country dataset are reviewed in more detail in the following pages. These are the studies that most closely approximate the analytical efforts in Part II of this research. To my knowledge, five such studies have been published since 2000:

Wagstaff (2003), Milman and others (2005), Heaton and others (2005), Boyle and others (2006), and Heltberg (2008).

Wagstaff (2003) seeks to explain why stunting prevalence (and other child health outcomes) varies between populations with similar incomes – in the case of this study, at or below the international extreme poverty line of $1/day – but living in different countries. He finds that, among these populations, greater per capita health spending is associated with lower stunting, controlling for per capita income (in fact, income is insignificant when per capita health spending is included). However, Wagstaff's models suffer from very small sample size and low explanatory power – in the case of stunting, only 28 country observations are included, and the R-squared of the model is only .062.

Milman and others (2005) look at the determinants of change in stunting rates among a set of 85 developing countries, using data between 1970 and 2001. They find, in a final model including both "underlying" and "basic" factors corresponding to the UNICEF conceptual framework, that the most significant correlates of poor improvement in stunting are high initial rate of stunting, low initial value added in agriculture, unequal initial income distribution, poor initial and little change in lack of access to safe water, and low initial female literacy rate. They find that initial immunization rate and initial government consumption are not significant at the 95% level in the final model (but are significant at the 90% level). This final model explains about 65.5% of the variation in child stunting. Additionally, they find that a host of other factors are insignificant determinants of stunting, including per capita GNP, civil liberties and political rights, degree of urbanization, daily energy supply, women as percentage of the labor force, number of ministerial positions occupied by women, oral rehydration therapy use, HIV/AIDS prevalence, ethnic fractionalization, public health expenditures as a percentage of GDP, official development assistance, and external debt.

Heaton and others (2005) aggregate household data from 42 Demographic and Health Surveys (DHS) conducted after 1990 in Latin America, Africa, and Asia. In addition to household-level determinants of stunting, they analyze a small set of national-level variables: GDP per capita, family structure (traditional vs. nontraditional[15]), and health care expenditure per capita. Although the small number of country-level observations casts doubt on the reliability of the parameter estimates, they find that socio-economic status, as measured by an index of major assets, is by far the strongest determinant of stunting, followed in the expected directions at the 95% significance level by maternal education, utilization of child health care services (prenatal care and assisted delivery by a doctor), communication within the household[16], birth interval, mother's age at first birth, rural residence, sex of the child (girls were more likely to be stunted), and nontraditional family structure. Age difference between parents was also

[15] Heaton and others define this variable on p.101: "Nontraditional family structure is based on a factor analysis – performed at the country-level – of the percent of first births that occurred before marriage, the percent of women in unions that do not have formal marriage, and the percent of households headed by women".

[16] Communication among parents in measured by an index of three variables: whether the couple had discussed family planning, if the couple had consensus on the desired amount of children, and if the wife controlled income from her earnings.

significant, but not in the expected direction – a greater difference was associated with lower stunting. However, the explanatory power of the models is extremely weak – in the most robust specification, only 7.3% of the variation in stunting is explained by the included independent variables.

Boyle and others (2006) also aggregate the results from 42 DHS, conducted between 1994 and 2003. They attempt to segregate the determinants of stunting into groups of variables arranged at the child, household, sampling cluster, and country level. They find that nearly three-quarters of the variation in stunting is associated with child-level factors, 12% is associated with household-level factors, and the rest is about equally divided between sampling cluster and national-level factors. They use two wealth measures: country-level GDP per capita and a household-level asset index. While Boyle and others find all of their primary variables to be significantly associated with stunting, including both measures of wealth, maternal education, maternal age, and sex of the child, the overall explanatory power of their model is weak: only 17.1% of the variation in child stunting is explained. Disaggregating the slope of the key parameters by country, they find that important country-level differences exist both in the strength of association and interaction effects with other variables; thus the context in which, for example, efforts to increase girls' enrollment in education occur – including factors like existing levels of income and household assets – will determine the impact on child stunting.

Heltberg (2008) concentrates on the association between income per capita and stunting prevalence. Analyzing 166 "spells of change" – time periods for which data on both income per capita and stunting prevalence are available for both the beginning and end year – in the developing world, he finds that higher income has a significant association with lower stunting, controlling for initial inequality and initial incidence of stunting. However, he finds this income impact to be small, stating that "halving stunting from a level of 30 percent through economic growth alone would require 3.7 percent real growth per capita for 25 years". The proportion of explained variation is low in all of Heltberg's models, with the best-fit model having an R-squared of 0.18.

In summary: maternal education remains important in the cross-country models above; the effect of income seems to be pronounced in the Boyle and others (2006) and Heaton and others (2005) papers, and weak in the others; other determinants vary in their significance and strength; and generally the explanatory power of the models is low (with the exception of the Milman and others (2005) final model, although specification problems call into question the reliability of the results in this study).

The low explanatory power of the models reviewed above, the disagreement on key results, and a need to utilize new data from the WHO Global Database of Child Growth and Malnutrition – which has expanded considerably in the last five years – all point to a need to re-examine the cross-country relationship between child stunting and its determinants, the topic of Part II.

Chapter 3. Literature Review: The Political Determinants of Pro-Poor Public Action

The review of the econometric literature of the correlates of child stunting in the last chapter revealed certain patterns. The results suggest that three policy outcomes are particularly important in reducing stunting:

1. **Growth in incomes of poor rural households**. In many developing countries, the group at greatest risk of undernutrition is the rural poor, especially landless workers and smallholder agriculturalists. Thus policies to increase on-farm smallholder profitability, generate rural employment, and provide income-based social protection safety nets are key pathways to lower stunting.

2. **Improved maternal knowledge and gender equality**. The econometric literature points to various characteristics of female well-being – especially maternal knowledge (usually measured through years of schooling), caregiver power in intra-household decision-making, and physical health of women and girls – as strong determinants of child nutritional status. All of these are components of the larger issue of gender equality and women's power; societies where men and women have equal power are those in which, *ceteris paribus*, child health is improved.

3. **Improved public health conditions**. Especially important are basic health services pertaining to antenatal, postnatal, and infant care up until age two.

Access to clean water and safe sanitation, particularly through its effect on reducing diarrheal diseases, is also crucial.

These correlates of stunting reduction thus suggest that six sets of public policies are of particular importance:

- *Direct nutrition policies*, especially breastfeeding promotion, complementary feeding support and micronutrient supplementation programs;
- *Food price policies*, especially those that pertain to prices of crops grown by smallholders and food staples consumed by the poorest;
- *Smallholder agricultural production and agricultural labor policies*, especially land tenure, input subsidy, marketing support, and wage policies;
- *Social protection policies*, especially conditional cash transfer interventions;
- *Health policies*, especially antenatal, neonatal, and postnatal care until age two, the creation of safe water and sanitation systems, and health extension services focused on improving caregiver knowledge of child feeding and hygiene practices; and
- *Education policies*, specifically increased enrollment of females in primary and secondary school.

The effect of these policies on the poor can, however, be ambiguous in some cases. Low food prices may help poor net consumers but hurt poor net producers, especially where the increased demand resulting from low prices cannot be met by increased supply (de Janvry and Subramanian 1993). Minimum wage policies can help landless workers but hurt smallholders reliant on employed labor. Land reform can improve equity of rural wealth but, depending on availability of smallholders to credit, complementary inputs, and extension services, it may have negative short-run effects on a country's agricultural productivity, which would hurt poor net consumers. Overall, most of the policies above imply increased government expenditure, which has ambiguous effects on both short- and long-term growth. Thus stunting reduction depends not only on whether the right policies are chosen, but also the actions a government takes to adapt policy packages to the micro- and macro-economic environment.

Under what circumstances do governments choose the right policies and adapt them effectively to bring about stunting reduction? This subject – the political determinants of pro-poor public action – is at the heart of this study. In the following sections, the literature on this issue, largely comprised of country-specific analytical narratives and cross-country econometric models, is summarized.

Hypotheses of political behavior can be classified into two broad categories: interest-based theories and ideational explanations. The former relies on the assumption of self-interested power-maximizing actors and the latter emphasizes the role of values and beliefs in determining political action. While the categories are not incompatible, and indeed most contemporary scholars utilize behavioral models that fall somewhere between the two, the dichotomy is useful for categorizing the primary emphasis of many of the studies reviewed in the subsequent pages. The first section reviews interest-based explanations of political behavior, while the second looks at ideational theories. The third section looks at the influence of historical contingencies on policymaking. The chapter concludes by discussing implications of the literature for building a model of the political economy of undernutrition.

A. Interests

Interest-based theories suggest that the interests of three types of actors matter in whether pro-poor policies are implemented and sustained: policymakers themselves, the bureaucracy of the state, and societal groups.

1. The Executive

Theory focusing on the interests of the executive, and applied to the politics of rural development, rests on the simple and elegant foundation created by Bates (1981). In *Markets and States in Tropical Africa*, Bates argued that many governments tax agriculture, shelter industrial elites, and pursue a low-price food policy to win the political backing of influential urban groups. Price-setting of both agricultural inputs and outputs by state marketing boards generates noncompetitive rents that are surrendered to politicians, government bureaucrats, and a small group of rural elites. The free-rider problem identified by Olson

(1965) prevents the rural underclass from taking effective collective action to pressure policymakers.

At least until the late 1980s, the empirical evidence generally backs Bates' claims of executive interest-driven bias against agriculture. Anderson and Valenzuela (2008) have created a database for cross-country analysis of agricultural price distortions among a set of 75 countries, representing over 90 percent of the world's agricultural production and spanning from the mid-1950s to the present day. Two aggregate measures derived from this data have been frequently employed in the political econometric literature examining support for, or bias against, agriculture. The first is the Nominal Rate of Assistance (NRA), which represents the percentage by which policies have raised or lowered gross returns to agriculture in relation to what they would be in the absence of the policies. The second is the Relative Rate of Assistance (RRA), which measures the percentage by which the price of agricultural tradables relative to non-agricultural tradables is above or below what it would be in the absence of government intervention. Both measures show that, in aggregate, developing world governments taxed the agricultural sector heavily at least until the late 1980s. They utilized various means to do so, including direct taxation of export plantation crops, establishment of mandatory procurement prices, and – perhaps most prominently – currency overvaluation (Bates 1981; Krueger, Schiff, and Valdes 1991; Anderson 2009).

Anderson and others (2010) note that the NRA for developing countries as a group rose from -26 in the late 1950s to -18 in the early 1980s, and finally became slightly positive by the late 1990s. The latter trend was driven mostly by lower export taxation, with import protection actually showing as slight upward trend. RRAs have also been rising since the late 1980s for developing countries as a whole, although this is largely due to reduced protection for nonfarm products, as opposed to increased protection for farm tradables. It is worth noting that NRAs are not uniform across a country's entire agricultural sector. Instead, they show considerable variation across crops, although there are some discernable cross-country patterns, most notably consistent support of sugar, rice, and milk and, conversely, little distortion of intensive livestock products (Anderson and others 2010).

Bates and Block (2010) confirm that support to agriculture is lower where the rural population share is greater, suggesting that free-rider issues and other difficulties of collective action prevent farmers from lobbying effectively for pro-agricultural policies. However, this is only the case where one political party dominates government. When party competition exists, the relationship is reversed and rural population share and agricultural protection are positively correlated, suggesting that electoral competition enables farmers to exert political influence. This relationship between competitive elections, rural population share, and agriculture support holds for importables, but the effect is not significant for exportable farm goods. Olper and Raimondi (2010) support these conclusions, showing that transition to democracy is correlated with an NRA increase of 3 to 4 percentage points. They also note that the character of democracy also matters: proportional (versus majoritarian) systems have a stronger correlation with higher agricultural protection, likely due to the increased power of organized minorities in such systems. The proportional system-NRA relationship is strengthened when a parliamentary (versus presidential) system is in place, probably because parliamentary systems promote larger government budgets (Persson, Roland and Tabellini 2007). Bates and Block (2010) also indicate that support to a particular region is increased when the chief executive hails from that area, further backing the hypothesis that executive interests drive policy choices.

Interests-based theory can also illuminate why nutrition policies and programs, even after implementation, can yield few benefits. As Pinstrup-Andersen (1993) points out, nutrition policies often involve sizable government transfers and thus offer the opportunity for significant rents. If groups not at risk of undernutrition are more politically powerful, they will capture these rents and undermine the effectiveness of the policies, a situation that appears to obtain for many of India's child development and social protection programs currently.

A focus on executive self-interest suggests that stunting reduction can only come about if poor rural populations – in which the vast majority of the world's undernourished children are concentrated – possess the political power necessary to exert pressure on policymakers in electoral and other political bargaining forums, thus altering policymaker calculations of self-interest. Varying types of political pressure mechanisms to compel the types of policy changes listed above may exist, including rural peoples' mass movements, alliances between politically strong elites and the rural poor to advance common interests, or the participation of women in the political process, which may push child welfare to a more prominent position on the policy agenda (BIBS, personal communication). The topic of external pressure is discussed below in the section "Societal Interest Groups". The country narratives of Parts III and IV explore some of these mechanisms in detail.

2. The Bureaucracy

Bureaucratic interests can support or counterbalance executive interests. Evidence from various countries indicates that once policies and programs are sufficiently institutionalized – that is, once they have established a support base within the bureaucracy and neutralized opposition within and outside of the state – they may endure changes of government (Pinstrup-Andersen 1993). For example, Chile's milk distribution scheme, originally universalized under the populist and socialist regimes of Frei and Allende, survived the rightward shift under Pinochet in the early 1970s because few government bureaucratic lobbies had a stake in its dissolution (Hakim and Solimano 1978). Similar forces ensured the survival of the United States food stamp program during the Reagan years (Andrews and Clancy 1993), as well as the large-scale conditional cash transfer programs in Mexico and Brazil – PROGRESA/Oportunidades and Bolsa Escola/Bolsa Família – in the late 1990s and early 2000s.

Conversely, withdrawal of explicit support for a policy from the executive level may endanger its survival prospects if there is no bureaucratic lobby to support it in times of political transition or reorganization. Such erosion of bureaucratic support is of particular concern with nutrition, as it lacks a natural institutional home within government (Natalicchio and others 2009). Mosquera (1993), in his analysis of Colombia's National Food and Nutrition Plan (PAN) in the late 1970s and early 1980s, recounts how the initial success of the program was due to high-level political support that enabled it to dictate intervention strategies to various ministries. The change of government three years after the program's inception, however, led to erosion of this high-level support. Coordination between ministries then gradually weakened and PAN was eventually regarded as superfluous and even as an unwanted interference in the work of sectoral agencies. This story is not uncommon in the experience of integrated nutrition programs; given the short duration of election cycles, the high-level support necessary to keep the nutrition agenda prioritized is rarely sustained. In the context of 1980s Egypt, Holt and Roe (1993) contrast such unsuccessful examples of policy reform requiring inter-ministerial coordination with the highly successful agricultural production reforms carried out by a single ministry acting alone.

Thus the success of a policy initiative depends strongly on the reaction it elicits within the implementing bureaucracy. Overall, Grindle and Thomas (1991) suggest that concentration of costs in government, high need for technical management, and a lengthy implementation process are all common program factors that are likely to produce opposition within the bureaucracy.

3. Societal Interest Groups

Societal interest groups – business lobbies, labor unions, consumer organizations, and civil society advocates – also influence policymaking. Bates' theory of the bias against agriculture, for example, depends on the link between the interests of urban elites and the interests of the executive. De Janvry and Subramanian (1993) note that while the government may face pressure to provide production subsidies or institutional rents to powerful rural elites to mitigate some of the negative effects of cheap food policy, no such compulsion exists vis-à-vis the politically impotent rural poor.

Thus the survival of stunting reduction policies may depend on whether politically powerful groups benefit from programs, either intentionally – as in untargeted programs – or through leakage of benefits, as occurs on a massive scale in India's Public Distribution System (GoI 2005). Even well managed, effective programs face politically motivated extinction if there is no societal constituency to support them, as occurred with Colombia's PAN in the early 1980s (Mosquera 1993). Similarly, the reorganization of the Sandinista government in 1985 in Nicaragua resulted in weakened links between food program planners and the coalition of community organizations that had previously been the most powerful advocate of food consumers in the country (Utting 1993). Without grassroots resistance from this coalition, the government was able to carry out radical food policy reforms, including a drastic reduction of food subsidies. A coalition of industry and labor groups successfully prevented various Brazilian governments, both before the 1964 military coup and after the 1975 political opening, from undertaking measures to deal with runaway inflation and a deteriorating balance of payments (Lal and Maxfield 1993). Grindle and Thoumi (1993) point to the repeated failure of policymakers in Ecuador to enact macroeconomic policy reform in the 1980s in the face of interest group opposition.

Overall, Grindle and Thomas (1991) suggest that the reforms most likely to lead to public opposition are those that result in dispersed costs within society, create a concentration of benefits within government agencies, require a high degree of administrative intervention and/or public participation to implement successfully, and are highly visible immediately.

There are two main implications of interest group analysis with respect to stunting reduction. First, improvements in the policy environment around nutrition are dependent on the ability of groups to collectively organize and pressure policymakers. However, organized political action specifically around chronic undernutrition has been rare, likely because the presence and causality of stunting is often not salient to households themselves, as the symptoms are not easily recognized or attributed to nutritional deficiency. McGuire (2010), for example, points out that citizens more often pressure policymakers for curative health services rather than the kind of preventative services that would lead to improved child survival. Rural movements often do, however, focus on economic and social protection policies, and these types of policies can lead to improvements in child nutritional status.

The second implication of societal interest group analysis is that cost/benefit analyses of nutrition policies need to take into account the benefits to politically powerful non-target groups as well (Hopkins 1993). Pinstrup-Andersen (1993), summarizing a set of case studies about the political economy of food and nutrition policies in various countries, concludes that coalitions with politically strong non-poor actors provide the best opportunity for the poor to influence policymaker behavior, especially in countries where democratic mechanisms are weak. Non-poor actors, for their part, may choose to ally with the poor because poor households offer legitimacy for implementation of redistributive policies, and because the economic benefits of these policies can be partially distributed to the non-poor. The relative political ease of implementing universal food subsidies (as opposed to subsidies targeted to the poor) in India, Sri Lanka, and Egypt demonstrates the political power of coalitions (Sahn and Edirisinghe 1993; Adams Jr. 1993; Drèze and Sen 1989).

However, standard interest-group analysis may prove ineffective for the many developing world contexts in which an "authoritarian equilibrium" persists – that is, where leaders have the economic or military means to preserve a patrimonial government resistant to pressure from interest groups (or have the ability to prevent potential groups from organizing effectively). Pryor (1990), for example, notes in his comparative political economy of post-independence Malawi and Madagascar that interest groups had little influence on poverty reduction policymaking. Van de Walle (2001) argues that clientelism drove policy choices in many African countries in the last two decades of the 20th century. He states that, unlike in Latin America, clientelism in Africa did not take on a populist character wherein elites depended on social groups to maintain power. Rather, African states have been relatively autonomous from society, and state resources have been used to accommodate potential competitors within the elite class.

Bates and Krueger (1993), relying on a set of eight developing country case studies, also note that interest groups had little impact on macroeconomic policy reform. They suggest that this may be the case not only because policymaking elites are insulated from pressure, but also because groups have difficulty calculating their interests and thus do not take effective action. Results from Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) suggest that policymaker actions are driven to a much greater extent by the objective of improving national welfare than by lobbying pressure. Haggard, Cooper, and Moon (1993) assert in their study of South Korea's 20th century development that although the sustainability of policy reform may depend on preserving the support of interest groups who benefit from reforms, the successful initiation of reform – that is, breaking of the status quo – may depend on exactly the opposite: the government's ability to act autonomously from pressure groups.

These studies taken together make the point that the balance of power between state and social forces, and their relative autonomy from each other, are critical variables in assessing which policies are chosen and whether they are implemented successfully. Countries with strong, autonomous states and weak societies – that is, states that can "penetrate society, regulate social relationships, extract resources, and appropriate or use resources in determined ways" (Migdal 1988, p.50) while successfully resisting societal groups' attempts to counter these actions – are able to implement policy effectively, although policy choices will be determined largely by the interests and ideas of state actors. Countries with strong states and strong societies will also have strong implementation capability, but policy choice will be determined by how political institutions permit or restrict state and societal actors in asserting their interests. Countries with weak states will have poor policy implementation capability, regardless of how policies are chosen.

B. Ideas

Ideational theories relax the assumption of self-interested actors and hew closer to constructivism, arguing that personal or party values, beliefs, and ideologies can compel policymakers to prioritize policies that reduce child stunting, even when the costs of such action exceed the benefits to person or party.[17] Grindle and Thomas (1991) discuss in detail how ideas, group interests, and values can affect the motivations and actions of policymakers. They assert that ideational theories do not only focus on the institutional context in which decisions are made – the durable norms that constrain and channel options for action – but also on more contingent influences on policymaker ideas and values, such as personal life experiences, shifting socio-cultural trends, organizational and bureaucratic norms, and the technical knowledge of epistemic communities. Grindle and Thomas make the point that policymakers generally have a range of options to respond to issues, and although the boundaries of this range – what is politically possible – may be circumscribed by the realities of competing interests, choosing *within* the range is often guided by ideational motivations. It is also worth noting that

[17] It should be noted that both interests-based and idea-based explanations are compatible with the notion that institutional forces – i.e., durable social, bureaucratic, or organizational norms – can influence decision-making. For example, self-interested policymakers may modify their strategies based on the institutional environment, and institutions can promote certain values or beliefs that affect behavior. In addition, Bates and Krueger (1993) point out that institutions are often necessary to push individuals to commit to collectively rational strategies.

policymakers' calculations about what is politically and bureaucratically feasible may retrospectively prove incorrect, and thus policy formulation (or the failure to formulate effective policies) is determined not only by competing interests but also by the perception of the political environment by the involved actors. The overall point, however, is that policymakers have a significant degree of autonomy, a proposition which runs counter to the expectations of approaches that emphasize the primacy of interests in policy formulation and implementation.

The experience of the food stamp program in the United States illustrates well the influence of ideas on policymaker action. In contrast to strong political opposition to a wide variety of other welfare programs, food stamps have retained support in the country among policymakers and the public since their inception, even after the delinking of the food stamp program from agricultural surpluses. In a detailed case study, Andrews and Clancy (1993) argue that reason for this popularity is primarily ideational: a focus by civil society groups on hunger in America in the 1960s and 1970s, as well as support for anti-hunger interventions from various presidential administrations and high-ranking officials in this time period, especially Secretaries of Agriculture Hardin and Bergland, implanted the idea within the public and policymaking community that the state has the responsibility to provide a safety net for those who are hungry (Andrews and Clancy 1993; Poppendieck 1985). Even a concerted effort by the Reagan administration to drastically reduce food stamp program expenditures in the 1980s met with only modest success in the face of strong resistance from anti-hunger civil society organizations. Shiffman and Smith (2007) provide another example of the importance of ideas in their case study of the political economy of maternal mortality, a global public health issue closely linked to child nutrition. They show how the influence of epistemic communities, as well as strong leadership, was critical across countries for generating political will around the issue. More generally, Pinstrup-Andersen (1993) notes that there is a hierarchy of government support for policies based on the degree to which they seem to visibly and directly address current suffering: "[A review of food and nutrition policies suggests that] [f]ood stamps limited to basic staple foods are likely to receive more support than cash transfers, food supplementation schemes directed at preschool children in poor families will receive more support than food stamps for the same families, and efforts to promote child survival will receive more support than general primary health care".

Another variant of ideational explanation focuses on party ideology. Drèze and Sen (1989) have described in detail how left-leaning governments in Cuba, Sri Lanka, and Kerala state of India have intentionally pursued redistributive policies in the health, education, and agriculture sectors to combat hunger and undernutrition, with generally impressive results. De Janvry and Subramanian (1993) stress the importance of ideological factors in bringing about radical shifts in food policy during macroeconomic crises in Egypt in the 1970s and 1980s. Bates and Kruger (1993) find that economic theories played a strong role in shaping policy packages in Ghana, Chile, and Zambia in the 1970s and 1980s. More recent achievements in reducing child stunting in China and Vietnam can also be traced to ideological commitment to redistributive transfers, although both of these countries also undertook growth-fueling market liberalization reforms during the period of nutritional improvement (Drèze and Sen 1989; Glewwe, Koch, and Nyugen 2004).

To identify ideological commitment as influencing the welfarist orientation of states, however, begs the question as to the origins of this commitment. Sahn and Edirisinghe (1993) identify a set of factors in Sri Lanka:

> [The concerns for the indigent] partially emanate from the political power of the poor, as exerted through long-standing democratic traditions. In addition, the strong intellectual and academic tradition of social welfarism that exists in universities and other institutions in Sri Lanka undoubtedly influences government officials and policy makers, encouraging a concern for and awareness of the needs of the poor. This, coupled with the pride that accompanies the international acclaim received for basic human needs accomplishments, also perpetuated a sensitivity to the needy.
>
> (p.46-47)

Yet this explanation leads to deeper questions. Why did democratic traditions take root so strongly in Sri Lanka and other countries? What are the origins of the "intellectual and academic tradition of social welfarism"? Do the domestic political rewards of "international acclaim" vary across countries, and if so, why? These are some of the questions explored by the Brazil and India narratives in Parts III and IV.

With respect to agriculture, Dutt and Mitra (2010) find that the political ideology of government influences the extent of protection, and that this relationship varies based on whether labor is mobile or immobile across sectors. In an immobile labor scenario, left-wing governments increase protection of agriculture, which lifts incomes of agricultural workers and landowners. In a mobile labor scenario, the relationship of ideology to protection depends on the level of income. In poor countries, where the food share of the household budget is high, left-wing governments lower protection of agriculture in order to increase welfare of the net-consumer labor force. More generally, Masters and Garcia (2010) note that similar types of agricultural policy reforms tend to occur in historical clusters, driven by prevalent ideological trends. The 1960s and 1970s saw heavy taxation of agriculture, underlain by the belief that support to import substituting industries was the key to economic growth. The 1980s and the 1990s saw the gradual reversal of this trend and towards liberalization of export trade, driven in part by deteriorating balance of payments situations in the wake of oil price increases and tightening global credit markets (Bates and Krueger 1993). Recent years have seen a resurgence of policies that reflect the notion that agricultural productivity is central to development.

Grindle and Thomas (1991), utilizing information from a set of case studies of policy reform decision-making processes undertaken by developing countries in the 1980s, create a model of political behavior that clearly summarizes a broad set of ideational and institutional considerations. Their model has two major components: the character of policy elites and the environment in which they try to achieve their goals. The character of policymakers encompasses their personal values and goals, their ideology, their professional training, their past personal experience, and their position in government and in the political party. The environment is understood here to include both the political institutions in which policymakers operate (especially degree and nature of democratic accountability; vertical, horizontal, and geographic concentration of power within government;

administrative and bureaucratic capacity; party competition; access of lobbies to policymakers) and the particular historical moment they find themselves in (discussed in the following section).

It should be noted that ideas-based causal explanations are not necessarily incompatible with interests-based theory: ideologies can be "chosen" or modified precisely because they offer self-interested actors a means to gain the support they need to maximize power or wealth. The key distinction is that ideational theories suggest that values drive policy choices even when such choices come at cost to self- or party interest. There are more complex possibilities; for example, policymakers may pursue policy knowing that it holds short-term costs to the individual or party but also has the potential to bring long-term benefits. Political institutions influencing the degree and quality of democratization, the autonomy of the state, the possibility of incumbency, and so on will also influence such calculations.

C. Historical Contingency

The circumstances of history often determine whether interests and ideas will lead to policy action, and thus to stunting reduction. This section reviews the literature examining the links between the prevailing macroeconomic and macropolitical environment and food and nutrition policies.

1. Macroeconomic Constraints

De Janvry and Subramanian (1993) point to the strong role of macroeconomic factors in shaping the evolution and lifespan of food subsidy programs. They note that the 1973 oil price shock lifted world food prices and developing country food import bills. These rising expenditures in the face of sluggish domestic growth in staple crop production necessitated drastic scaling back of food subsidy schemes in Egypt and Sri Lanka by the end of the decade. Price volatility on international markets of key food commodities has also played an important role in worsening terms of trade and forcing governments to reduce welfare programs. The process of restoring macroeconomic balance, for example through currency devaluation and fiscal austerity, can itself force governments to shrink food subsidy programs, as food imports grow costly and budgets become tighter. Grindle and Thomas (1991) argue that economic necessity may often contradict the logic of political interest, but when a crisis point is reached the economic necessity will outweigh and transform the political logic.

The Sri Lankan case also highlights the interconnectedness of ideological commitment and economic opportunity in successful implementation of policy. At least until the early 1980s, Sri Lankan governments consistently championed redistributive social programs, not only in the food sector but also in health and education (Sahn and Edirisinghe 1993). The implementation of welfarist policies, however, would have been difficult if the macroeconomic environment, especially the ability of the country to tax its tea export sector to pay for the food subsidy schemes, had not eased fiscal constraints (Thorbecke and Svejnar 1987). Similarly, the oil and price shocks of the 1970s forced the government's hand in scaling down the size of the subsidy programs – and would have done so perhaps regardless of the ruling party's ideology. The survival of the post-1977 austerity policies themselves was linked to macroeconomic factors as well, especially an increase in world tea prices and the willingness of international lenders to extend financing to the government in the wake of the neoliberal reforms. The resultant growth in GDP provided the Sri Lankan government the political cover needed to scale back the food subsidies.

The experience of Nicaragua under Sandinista rule also illustrates the importance of macroeconomic constraints, even in a situation where ideological commitment to pro-poor policy is clear (Utting 1993). Sandinista food policy included the establishment of a new food marketing system selling staple foods at set prices, agrarian reform through expropriation of lands owned by followers of the Somoza regime, and an increase of investment in small-scale agricultural production, health, and education. The new policies quickly encountered serious fiscal constraints, however. Expanding deficits in the early 1980s, driven largely by falling world prices for major exports, greater defense spending against the internal insurgency, an overvalued exchange rate, and difficulties in accessing capital and output markets due to the U.S.-driven economic blockade, forced a reduction of subsidies by 1985.

Thus the ability to sustain nutrition and food security policies over time depends on whether the government has the means to ward off adverse macroeconomic circumstances, either through increasing exports, attracting foreign aid or investment, or designing redistributive programs in ways that fuel short-term growth.

2. The Perception of Crisis

The observation that macroeconomic realities force policy change is linked to a more general pattern: radical food policy reform almost always occurs in times of economic or political duress. For example, food subsidy programs in India, Pakistan, Bangladesh, and Sri Lanka have their roots in World War II rationing efforts designed to assure food security in a time of shortage and inflation (de Janvry and Subramanian 1993; Sahn and Edirisinghe 1993). Economic or political shocks create space for radical shifts in the government's role. Such shifts do not always move in the direction of increased intervention. In the Sri Lanka and Nicaragua examples mentioned above, as in many developing countries in the 1980s, fiscal and political crises allowed governments to make the argument that a smaller welfare state was part of the necessary solution to the crisis. Many of the radical, highly unpopular reforms undertaken in this period – notable examples include macroeconomic reform in Guatemala, Costa Rica, Panama, and the Gambia, financial system reform in Turkey, and trade policy reform in Indonesia and Bangladesh – came in the wake of external pressure from the IMF and World Bank to carry out stabilization and structural adjustment programs (Grindle and Thomas, with Reifenberg 1991). Bates and Krueger (1993), reviewing a set of case studies of policy reform in developing countries between the 1960s and 1980s, state that balance-of-payments difficulties and runaway inflation are the most common triggers of radical policy reform.

Grindle and Thomas' (1991) conceptual framework of the determinants of policy reform supports this logic. They state that the perception of crisis produces pressure for radical reform and top-level engagement, whereas incremental policy change shaped by middle-level policymakers is usually the response to non-crisis situations. Grindle and Thomas also assert that policymaker concerns focus on different criteria during crisis versus non-crisis situations. During crises, policymakers weigh the implications of policy on macro-political factors, especially government stability and maintenance of broad-based popular support. During non-crisis situations, micro-politics dominates, especially the maintenance of bureaucratic and clientelistic support. Swinnen's (2010) review of the literature on the determinants of agricultural price policy also suggests that crisis situations shape the degree of policy adjustment. In pre-crisis situations, institutional rigidities prevent ambitious policy reforms, but during the crisis and post-crisis periods institutional norms may weaken to such an extent that policy adjustments have radical effects.

In the case of chronic undernutrition specifically, however, it is unclear what would compel a perception of crisis. Although the impacts of stunting on children, households, and entire economies are severe, the issue is rarely salient to policymakers or the public. However, perceived crises outside the narrow field of nutrition may lead to wide-ranging policy reform that has the potential to reduce stunting. McGuire (2010) notes that public health emergencies brought to light by media reports and academic studies – examples include a cholera epidemic in Brazil in the early 1990s, a measles epidemic in Costa Rica in 1992, a survey showing high maternal mortality in Indonesia in 1994, and even a survey showing extremely high undernutrition in Thailand in the early 1990s – galvanized a push for the kind of broader health policy reform that improves child survival.

3. Historical Trajectories

The constraints of the historical moment may affect the willingness or ability of policymakers to take substantive action against undernutrition. For example, Swinnen (2010), in a review of the literature, notes the strong positive correlation between GDP per capita and assistance to agriculture, and suggests that certain characteristics inherent in the growth path of countries influence this relationship. First, consumer and industrial pressure for lower food prices is likely to decrease as the percentage of household budgets devoted to food falls, as a normal part of the growth process. Second, as the percentage of the population working in agriculture declines, the total cost to society of support to agriculture also decreases, which raises the willingness of governments to provide this support. Third, as an economy grows the increase in agricultural incomes is likely to be lower than the increase in non-agricultural incomes. This lifts the returns to investment in political lobbying activities, and so farmers will seek greater political support. Relatedly, as the size of the agricultural sector shrinks and the threat of new entry is reduced, potential rents from political support increase, also compelling greater lobbying effort. Fourth, as the state begins to receive tax revenue from non-agricultural sectors, the need to tax agriculture decreases. Fifth, collective action difficulties among farmers are eased as the size of the group decreases and rural areas are better connected through transport and communications infrastructure. The overall point is that interests are shaped by the structural characteristics of the economy and polity, which themselves are a function of where a country lies on its historical trajectory.

Historical trajectories can also influence interests and ideas in more difficult to discern ways. Lal and Maxfield (1993) show how Brazil's low labor-intensity of production reduced industrial opposition to rising nominal wages driven by inflation. As a result, both industry and labor had a political stake in resisting measures to stabilize inflation, and their coalition accomplished exactly that throughout Brazil's 20th century history. As the country's economic structure changes, however, such political partnerships may become less feasible, with implications for the possibility of policy reform. Similarly, Haggard, Cooper, and Moon (1993) assert that the ability of the South Korean government to introduce major wage-reducing policy reforms in the 1960s was facilitated by the low level of inequality then existing in the country.

Historical inertia can affect ideological positions as well; values and ideas are not chosen by each administration independent of the ideological legacy of their predecessors. Humphreys and Bates (2002) find in their cross-country regression that policies tend to persist once chosen, despite changes in macroeconomic circumstances. Meanwhile, Pryor (1990), in arguing that trends in political ideology have strongly influenced the content of development policy in Malawi and Madagascar, speculates about the origins of these ideologies. He notes that colonial history played a role; Marxist ideas suffused independent Madagascar's policy blueprints because the country's future leaders had been schooled in France, where Marxism was more in the political and academic mainstream than it was in the United Kingdom, Malawi's former colonial ruler. In addition, Pryor argues that the greater intrusiveness of French economic interests in the colonial period led post-independence leaders in Madagascar to equate capitalism and colonialism to a much greater extent than was the case in Malawi, where British economic involvement was on a smaller scale. Nationalist sentiment stemming from colonial experience thus led to a partial rejection of capitalist ideas in Madagascar.

D. Implications of the Political Economy Literature

At first glance, there appear to be inconsistencies in applying either interest-centered or idea-centered theories universally to examples of undernutrition reduction. For example, in much of India – the subject of Part IV – rural political power is thought to have a considerable impact on elections, yet undernutrition remains very high in most states. In Northeast Brazil, the focus of Part III, rural mobilization specifically around the issue of undernutrition appears limited, yet nutritional outcomes have been impressive. During the rule of Sonia Gandhi and Manmohan Singh in India, as well as during the Lula government in Brazil, ideational factors operating at the personal and party level have influenced policy against undernutrition, but similarly left-leaning governments at the state-level in India, such as in West Bengal, have been unable to translate ideology into impact, although others like Kerala have indeed done so. Meanwhile, center-right and centrist governments in Brazil during the 1980s and 1990s made considerable progress against undernutrition.

One explanation for these contradictory impressions is that neither political pressure nor ideas is the key factor influencing nutritional change, and indeed one of the possibilities to be explored in this research is that improvements in child stunting rate are the unintended results of policymakers pursuing goals not specifically centered on poverty, especially aggregate economic growth. In this case, initial conditions – for example, inequalities in income or education levels – can influence how sensitive nutritional improvements are to aggregate economic growth. However, evidence from Brazil and other countries suggests that a specific policy focus on providing social protection and health services even in the absence of economic growth may be sufficient to produce drastic declines in stunting (Drèze and Sen 1989; Monteiro and others 1992; Monteiro and others 2009). One objective of this research is to ascertain whether there are indeed consistent political patterns obscured by the initial conflicting impressions.

Beyond this issue, however, there are three major implications of the political economy literature for this research. The first is that the interests-based and ideational models are reconcilable. Grindle and Thomas (1991) create a strongly ideational model of political behavior, yet they state in their broad-ranging study of policy reforms in developing countries in the 1980s that the answers to the questions of "who gets hurt?" and "when do they get hurt?" largely determined the political reaction to proposed reforms. In other words, the key questions are indeed focused on whose interests are affected (and when), but how policymakers react to the answers depends on whether their prior beliefs and ideas push them to value the interests of a given group – the rural poor, industry, the bureaucracy, etc.

The second implication is that, regardless of which forces enabled the initial formulation and implementation of pro-poor policies, the *sustainability* of these policies and their *effectiveness* in reducing stunting depends on two major factors: rural political enfranchisement and the rate of short-run economic growth. Genuine (rural) democratization is the clearest path to the objective of political enfranchisement. Such a process may indeed be occurring in India, where rural interests – meaning not simply powerful landowners, but also large voting lobbies of small and medium-sized farmers as well as landless rural laborers – are influencing the campaign platforms and governing policies of the major political parties. The willingness to defend agricultural subsidies and minimum crop support prices, even in the face of strong political pressure internationally and strong fiscal pressure internally, is one sign of this emerging rural power in India; another is the expensive and expansive National Rural Employment Guarantee Scheme (NREGS), which provides 100 days of employment to every rural household in the country, on demand by the household itself. However, continuity of policies to reduce undernutrition is complicated by the fact that such processes of enfranchisement usually take decades to unfold – a much longer time frame than the lifespan of most political administrations.

The second goal, to design redistributive food and nutrition policies in a way that fuels short-run growth, may be even more difficult. There are potentially two ways in which food subsidies and economic productivity can be linked: through stimulating agricultural and livestock production in response to greater demand, and through the effect of increased food intake on improving health and thus labor productivity. The first requires that supply response of small farmers and herders is elastic, which for most countries would necessitate significant investments in fertilizer, water, and seed input availability, addressing soil degradation problems, and ensuring that credit and output markets are functioning. The effect of improved nutrition on economic productivity, meanwhile, is a necessarily slow process, taking decades to fully manifest, although its long-run effects can be profound: Fogel (1994) estimates that nutritional improvements are responsible for about 30 percent of Britain's per capita GDP growth in the last two centuries.

The final implication of the political economy literature for this research is methodological. The review suggests that econometric methods and qualitative analysis can be complementary means to understanding the political economy of undernutrition. Cross-country econometric methods have been used – most notably in the literature around the political economy of agricultural price policy – to identify the structural correlates of change: level of wealth, institutions of political participation, ecological endowments, and the like. Meanwhile, qualitative analyses are useful in examining the impact of country-contingent factors such as the distribution of political power, prevalent ideologies, and historical legacies. This study uses both approaches. In Part II, I develop a cross-country econometric model of the determinants of stunting reduction, and Chapter 11 in Part IV also uses this model in looking at cross-state variation in India. In the bulk of Parts III and IV, meanwhile, qualitative narratives are used to explore policy and political economy questions not amenable to quantitative analysis.

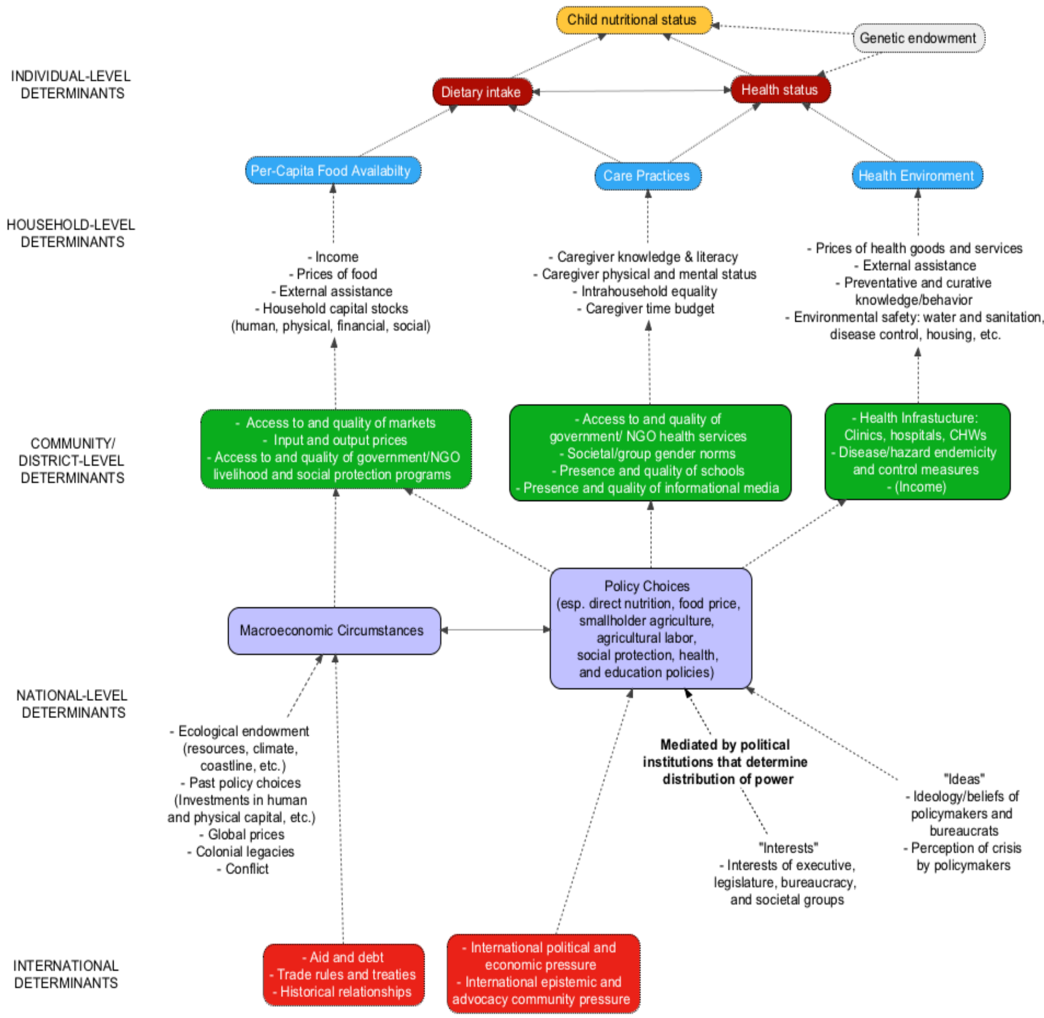
Chapter 4. Methodology of the Study

The following chapter outlines the methodology of this work. The first section describes the conceptual framework driving the study as a whole. Section B then briefly summarizes the approach of the econometric analysis in Part II, although the details of model construction, estimation strategy, and data are left to Chapter 5. Section C lays out the hypotheses explored in the Brazil and India narratives of Parts III and IV, and describes the process-tracing approach used to confirm or reject the listed hypotheses. Each link in the process-tracing causal chains for each hypothesis is diagrammed for Brazil and India both.

A. Conceptual Framework

The conceptual framework of this study builds on the UNICEF model (Figure 7), differing especially in the depth of detail with respect to the "lower" determinant level relationships. Instead of using the language of a hierarchical causal framework, however, the determinants of child undernutrition are divided in this study into "geographical" categories, isolating sets of variables operating at the individual, household, local (community/district), national, and international levels (Figure 8 below).

Figure 8. Conceptual framework of the determinants of child nutritional status.



The individual and household categories are similar to UNICEF's "immediate" and "underlying" levels. Most proximately, the child's dietary intake and health status determines his or her nutritional status. Next, household level per-capita food availability, care practices, and health environment determine the child dietary intake and health status. Per-capita food availability is a function of the household's income, assets (productive assets used to generate income as well as those able to be sold and converted into food), and external assistance (in the form of cash, food, or assets). Care practices are a function of the caregiver's physical and mental status, her knowledge of appropriate feeding and health practices, the time she has available for caregiving (itself a function of household demographics, income levels, and cultural norms), and intra-household equality – the ability of the caregiver to make decisions about how to distribute food and health resources within the household. The household's risk of illness is a function of each individual's genetic propensity for particular illnesses, the household's knowledge of practices to prevent illness and seek curative help, and the quality of the health environment, including safe water and sanitation, housing quality and density, and adequate clothing.

Factors working at the community and district levels determine household per-capita food availability, care practices, and risk of illness. Household income and assets are a function of its access to markets, especially food, labor, and agricultural/livestock input and output markets, the existing physical infrastructure and policies that determine transport and transaction costs, and government livelihood extension and employment policies. Household access to aid is a function of government/NGO assistance policies. Caregiver physical and mental status, knowledge, and time budget, as well as intra-household equality, are a function of access to schooling and informational media, cultural norms around gender equality, and government health extension policies.

A household's knowledge of preventative and curative health behavior and the quality of its health environment is a function of the existing health infrastructure (health facilities, community health workers and other skilled personnel, hospitals, etc.), as well as vulnerability to illness or natural hazards arising out of a combination of the geographical endemicity of a given disease/hazard threat and the measures taken to control the threat.

The government's policy choices and the macroeconomic circumstances faced by the country are the determinants of these community/district level factors. Macroeconomic circumstances arise out of a country's ecological endowment – its natural resources as well as certain important geographical attributes (proximity to coastline/ navigable water sources, stability and wealth of neighboring countries, etc.) – the policy choices it has made in the past, and a set of historical contingencies, including conflict, global prices, and the institutions arising out of its colonial experience. As noted in the second part of Chapter 2, policy choices are a function of the interests and ideas of policymakers and bureaucrats. The political institutions in a society shape interests and the degree to which various societal groups can participate in politics, the balance of power between the executive and legislature, and so on. Policy choices are also clearly influenced by macroeconomic circumstances, and vice versa.

Finally, international factors influence a country's macroeconomic circumstances and its present-day policy choices. Aid/debt and trade arrangements can ease or worsen a country's macroeconomic situation. Historical patterns of interaction between countries – for example, extraction of resources and investment in infrastructure – are also important. International political and economic pressure from other governments, as well as the influence of international epistemic and advocacy communities, also help to determine domestic policy choices.

The conceptual framework in Figure 8 above is used to construct a formal theoretical model of the determinants of undernutrition in Chapter 5 that will guide the econometric analysis. The framework also informs the country-level analyses of Brazil and India in Parts III and IV.

B. Econometric Analysis

The cross-country econometric analysis performed in Part II is based on two models: a reduced-form policy model and a political economy model. The reduced-form policy model is represented in Chapter 5 by a series of equations summarizing relationships shown in the “top” part of Figure 8, the determination of child stunting by policies (and macroeconomic circumstances) through intervening individual-, household-, and community/district-level factors. The political economy model, meanwhile looks at directly at the correlation between variables at the “bottom” half of Figure 8 – political institutions and ideologies, ecological endowments, conflict, and so on – and stunting prevalence.

The reduced-form policy model was constructed by identifying the variables most strongly associated with child undernutrition in the literature, and then placing these variables in relation to one another in the manner suggested by the conceptual framework. The result is the set of 19 structural equations that appear in Chapter 5, the last of which represents the reduced-form policy model. Literature providing justification for each variable’s inclusion is cited following each equation. The political economy model is based on a single equation that adds political economy variables theorized to be exogenous to the set of determinants examined by the reduced-form policy model; thus the political economy model builds on the causal logic used to construct the policy model.

Both models are described in greater detail in Chapter 5, but a preliminary note about the various levels of causation implicit in the reduced-form model is warranted here. As noted above, the model begins at the individual level and, following the logic of the conceptual framework, proceeds through factors operating at the household, community, and national levels. The ultimate focus of the reduced-form equation (19) is on the *national-level* policies (and relevant control variables) that determine the *individual-level* outcome of child stunting. However, to maintain coherence between the dependent variable and its potential explanatory factors, stunting is also measured as a national-level prevalence. This national-level prevalence could be conceptualized at the individual level as the probability that, in a given country and year, a randomly selected child under the age of five would be at least moderately stunted (that is, have a height-for-age below two standard deviations from the WHO reference mean).

Table 6 below summarizes the total set of variables that appear in the 19 structural equations of Chapter 5, splitting them into "endogenous" and "exogenous" variables; the latter appear in the final reduced-form policy equation (and many appear in the political economy model as well), and the former are conceptualized as intervening variables and appear in the intervening set of structural equations. The causal logic of the model concerns itself primarily with poor rural households, particularly smallholder farmers; hence the emphasis on agricultural prices and policies. This is due to the fact that about half of the world's undernourished population is thought to reside in small farm households, and an additional twenty percent are landless agricultural workers (Sanchez and others 2005). The key variables of interest are the policy variables, highlighted in bold in the table below. The variables are numbered in the order in which they appear in the set of structural equations. This table is also reprinted in Chapter 5.

Table 6. Variables in the policy model system of equations.

Endogenous Variables		Exogenous Variables	
η_1	Child long-term nutritional status	ξ_1	Household dependency ratio
η_2	Child dietary intake	ξ_2	Maternal/child health policies
η_3	Child health status	ξ_3	Consumer food price policies
η_4	Household food availability	ξ_4	World market food prices
η_5	Household caregiving practices	ξ_5	Cultural gender equality norms
η_6	Household health environment	ξ_6	Environmental threat policies
η_7	Household income	ξ_7	Environmental context: disease vectors
η_8	Food prices on national markets	ξ_8	Agricultural producer price policies
η_9	Caregiver knowledge	ξ_9	Global agricultural output prices
η_{10}	Caregiver physical/mental health	ξ_{10}	Global agricultural input prices
η_{11}	Intra-household equality	ξ_{11}	Environmental context: household production system
η_{12}	Disease threats	ξ_{12}	Educational policies
η_{13}	Agricultural input/output price ratio	ξ_{13}	Macroeconomic circumstances
η_{14}	Household physical capital		
η_{15}	Household natural capital		
η_{16}	Caregiver educational background		
η_{17}	Caregiver access to media		
η_{18}	Caregiver participation in paid work		

To reiterate, the emphasis of the model is not on estimating the parameters of the household-level intervening variables, but rather to focus on the association between national-level policies (and selected control variables) and child stunting outcomes. The system of equations below follows the contours of household health/nutrition production function approaches commonly found in the literature (Becker 1965; Singh, Squier, and Strauss 1986; Strauss and Thomas 1995), but focus more centrally on arriving at a reduced-form equation of policy determinants. It is this last equation that is empirically estimated in Part II using cross-country data.

Note that "endogeneity" and "exogeneity" does not refer in this model to whether a variable is endogenous or exogenous to the household, as is common in many household-level econometric models of the determinants of undernutrition. Rather, the exogenous variables here are those that, in theory: 1) do not themselves have observable determinants that are causally linked to child stunting, within the relevant time frame, through pathways other than the exogenous variables in question; and 2) are not themselves determined by child stunting (the problem of "reverse causality").

An example clarifies the first point. "Household dependency ratio", the first exogenous variable in the list, is in the long-run partially endogenous to the household, in the sense that households make fertility decisions based on contraception availability, the presence of social security systems, gender equality norms, and so on. However, the assumption in this case is these factors do not directly affect child stunting except through dependency ratio (as in the case of contraception availability and social security systems) or that these other factors are included as other exogenous variables in the model (in the case of gender equality norms). The system of equations presented in Chapter 5 makes the case for both of these contentions. The overarching goal is to arrive at a model specification that does not contain the threat of omitted variable bias.

I argue the second point – that reverse causality between child stunting and the "exogenous" determinants is not a major concern – on both conceptual and empirical grounds. First, the literature review in the previous chapter suggested that political action *in direct response to chronic undernutrition as a priority concern* has been uncommon in recent historical experience. Where policy agendas have succeeded in reducing stunting, they have done so indirectly, through addressing the key determinants of undernutrition, especially rural income poverty, maternal knowledge, and access to safe water, sanitation, and basic maternal/child health services. Unlike the child survival revolution of the 1980s and 1990s, stunting reduction historically has been driven less by concerns about child welfare than by whether political economy factors are amenable to pro-poor, pro-rural, pro-woman policy action. This point is central to the narrative of Brazil developed in Part III. For now, it simply serves as a key argument for why reverse causality is not likely to bias parameter estimates in the final reduced-form equation.

There are also empirical grounds for this stance. As discussed at greater length below, the dependent variable of stunting prevalence represents the "mean nutritional experience" of the population over the five years preceding the actual observation, as stunting is an indicator of long-term nutritional status and the measured population is comprised of children under the age of five. Where possible, the independent variables are measured in lagged form – specifically, as an average of the five years preceding the stunting observation. Thus the determinants are measured as "prior" to the stunting observation and as contemporaneous with the nutritional experience in question. This approach would not adequately protect against the possibility of reverse causality if stunting observations for each country were highly correlated – that is, if there was not adequate variation in the dependent variable. However, as the table below shows, this does not appear to be a problem:

Table 7. Summary statistics for dependent variable, cross-country models.

Variable		Mean	Std. Dev.	Min	Max	Observations
st2sd	overall	30.66733	16.14072	1.3	71.1	N = 453
	between		16.20332	1.3	63.1	n = 143
	within		4.94055	14.91733	50.38733	T-bar = 3.16783

The standard deviation of stunting observations *within* countries is around 4.9, close to 16% of the overall sample mean prevalence of 30.7. This suggests that enough variation in stunting exists within countries to utilize lagged values as an adequate empirical approach against the threat of reverse causality biasing parameter estimates.

Measurement of the determinants listed in the above table, as well as a detailed discussion of the set of structural equations that lead to the reduced-form model, is taken up in Chapter 5.

C. Process-Tracing

The analysis of Brazil and India in Parts III and IV is based on a process-tracing approach. Process-tracing requires that hypotheses to be tested be divided into a series of necessary steps in a single causal chain. A hypothesis is confirmed if each of the causal steps is confirmed, and rejected if any of the causal steps is rejected. In the following two sections, the hypotheses and process-tracing causal steps driving the analysis of Brazil and India's reforms are presented in detail.

An introductory note about how the content of Parts III and IV was conceived and research, however, is required. The original intention of Part III was to explore the policy and political determinants of the drastic nutritional change in Northeast Brazil, which, as noted in Chapter 1, reduced stunting from 51.3% to 5.9% in the three decades leading up to 2006. In carrying out this research, however, I was forced to make two important modifications. First, although Northeast Brazil's nutritional experience is the topic of Part III, I learned that federal-level policy action and political change, more so than similar happenings at the regional level, was the primary driver of stunting reduction. For that reason, much of Part III is concerned with events occurring in Brazil as a whole and its impact on the Northeast region. Second, my analysis led me to conclude that the impressive stunting reduction in Northeast Brazil was *not* primarily due to an intentional policy focus on food and nutrition, but instead the side effect of other policy goals, especially inflation control and greater income equality; this is in fact the major conclusion of the Brazil chapters. Thus, in the imagery of the conceptual framework of Figure 8, I work "top to bottom" in Part III, making the case for how stunting was reduced and then examining the political economy of the policies responsible, instead of focusing on the political economy of nutrition as such.

The outcome of the Brazil case study influenced how I approached the India research. I sought in India to perform a more direct analysis of the political economy of food and nutrition policy linked to child welfare, to investigate more directly the processes by which political concern around undernutrition is generated and influences policy design and implementation. This method led me to concentrate on the major food and nutrition policy reforms that have occurred in the past decade in India, analyzing both the forces contributing to this recent change and the reasons why such change has been so long in arriving (as exemplified by the country's persistently high stunting rates, even in the face of rapid economic growth). I also look at past health and nutrition policy reforms in the states of Kerala and Tamil Nadu, where stunting levels are far below nearly all other Indian states.

Thus, in summary, the major questions examined by the study differ slightly for Brazil and India. In Brazil, I ask how stunting reduction happened, and study the political economy of this process, regardless of whether it involves food and nutrition policy directly. In India, I ask through a political economy lens how specific food, nutrition, and health policy reforms at the federal and state levels occurred.

1. Brazil

In the pages below, I present four political hypotheses for how stunting reduction occurred in Northeast Brazil. The first two hypotheses are linked to interest-based factors, in which the primary force responsible for creating a policy environment favorable to child stunting reduction is political pressure applied on policymakers. The latter two hypotheses rely on ideas-based factors, in which the primary force responsible for creating a policy environment favorable to child stunting reduction is the influence of ideational factors – personal experience, socio-cultural norms, the influence of epistemic communities, and/or organizational and bureaucratic culture – on policymaker values, beliefs, and action. The hypotheses are as follows:

- **H1**: Mass movements in which the rural poor directly participate, and thus exert political force, were the primary mechanism by which policymakers were pressured to take action against child undernutrition (either directly or through addressing its causes).
- **H2**: Alliances between politically powerful elites and the rural poor were the primary mechanism by which policymakers are pressured to take action against child undernutrition.
- **H3**: Personal values and beliefs constructed by ideational influences were the primary forces driving policymakers to take action against child undernutrition.
- **H4**: Party ideology constructed by ideational influences was the primary force driving policymakers to take action against child undernutrition.

Details of each hypothesis are discussed below.

Hypothesis 1: Mass Movements

The key sub–questions pertaining to hypothesis 1 – that poor people's mass movements had a direct impact on the formulation and implementation of effective policy that strongly impacts child undernutrition – are the following:

1. Did mass movements exist in Northeast Brazil that prioritized child nutrition or closely related concerns in their political agenda?

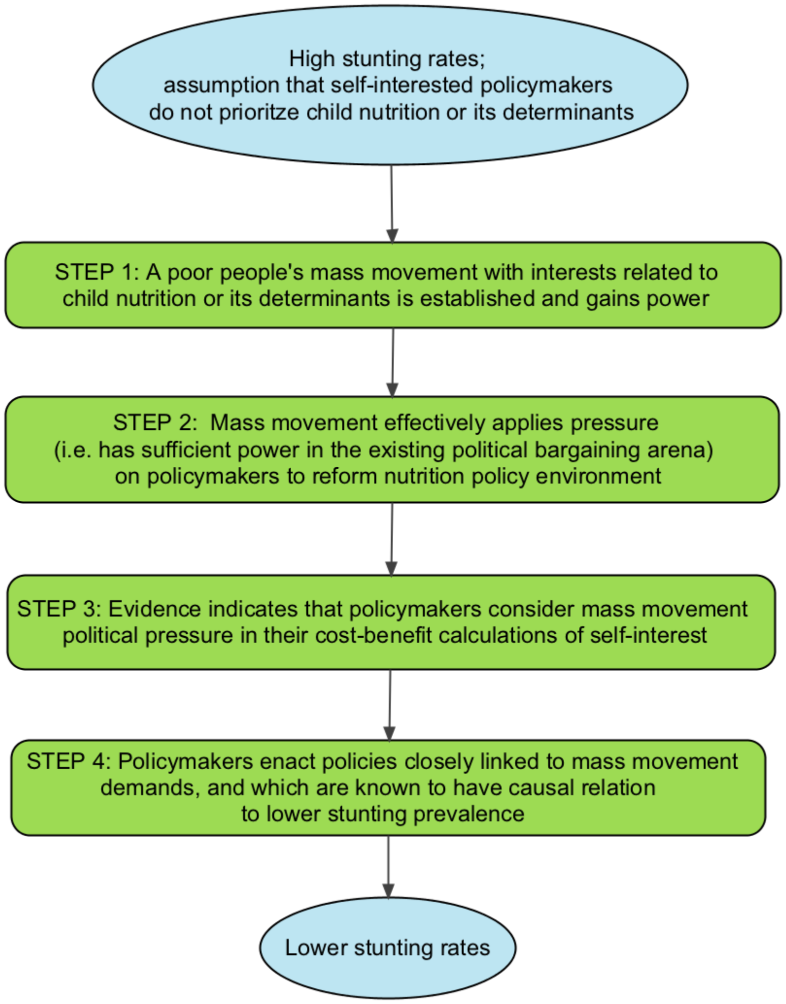
2. Did such mass movements wield political power, either through a potential to influence electoral processes or other means? Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such movements to wield power?

3. Were policymakers seen to react to mass movements' political power, not simply in discourse but also in substantive action?

4. Did this substantive action involve enacting and effectively implementing policies linked to mass movement demands, and which had a causal impact on stunting?

These questions can be diagrammed as a causal process as follows:

Figure 9. Hypothesis 1 causal process, Brazil.



Again, confirmation of the hypothesis as a whole depends on independent confirmation of each of the four steps portrayed above.

Hypothesis 2: Elite/Poor Alliances

The key sub–questions pertaining to hypothesis 2 – that alliances between the rural poor (or their representatives) and politically powerful groups had an impact on the formulation and implementation of effective policy that reduced stunting – are the following:

1. Did such alliances exist in Northeast Brazil, and did they prioritize child nutrition or closely related concerns?

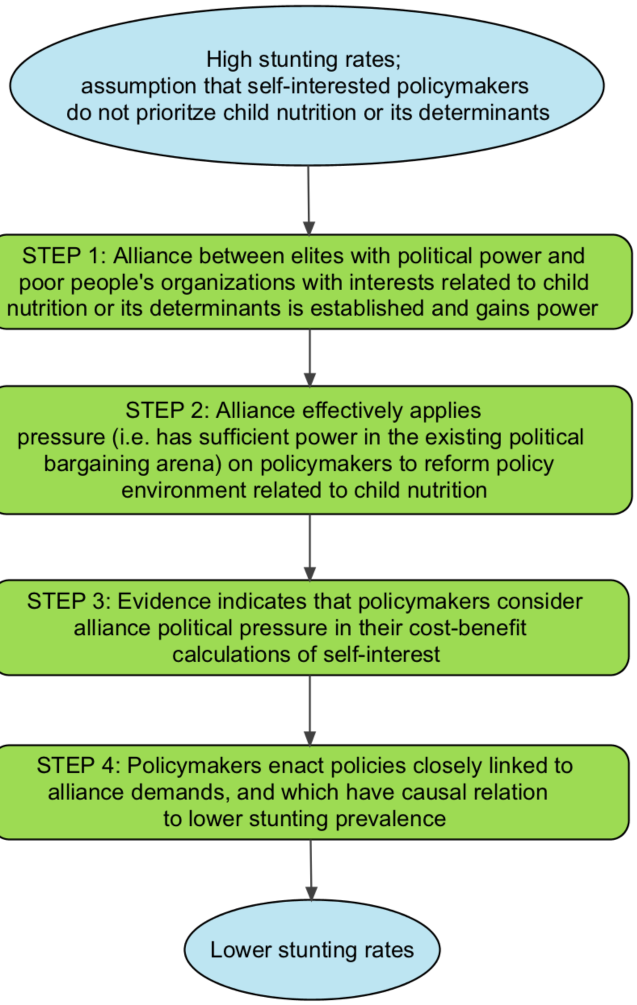
2. Did such alliances wield political power? Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such alliances to wield power?

3. Did policymakers respond to the demands of these alliances, not only in rhetoric but also in substantive political action?

4. Did this substantive action entail enacting and effectively implementing policies linked to alliance demands, and which had a causal impact on stunting?

These questions can be diagrammed as a causal process as follows:

Figure 10. Hypothesis 2 causal process, Brazil.



<u>Hypothesis 3: Personal Ideology</u>

The key sub-questions of hypothesis 3 – that policymakers chose policies based on personal ideas, beliefs, and values – are the following:

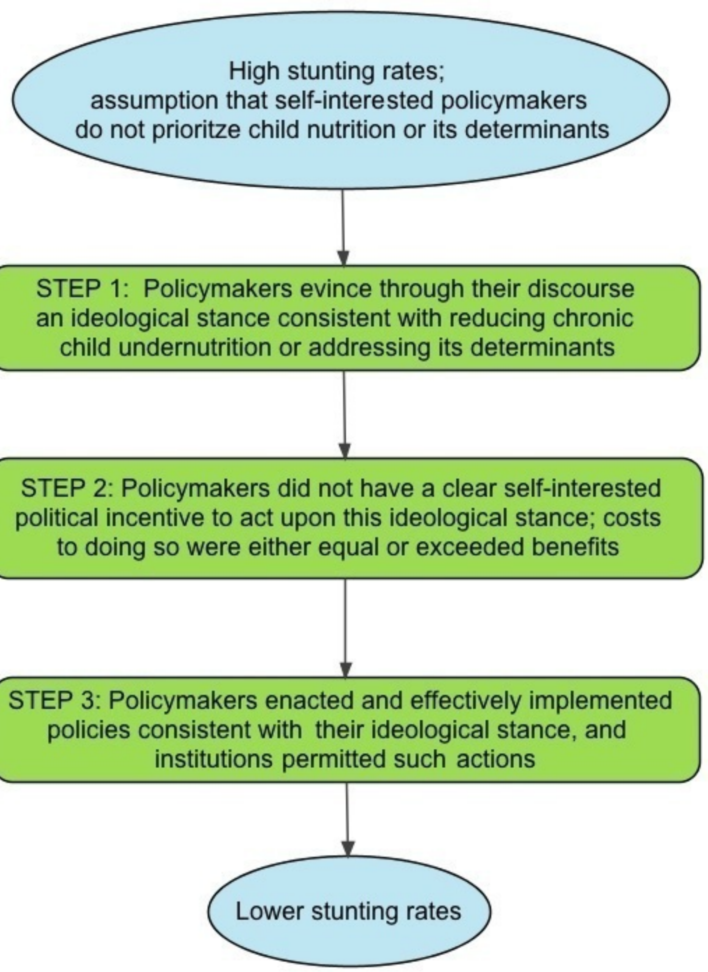
1. In their formal and informal discourse, did policymakers in Northeast Brazil evince ideas, beliefs, and values consistent with the goal of creating a policy environment favorable to child nutrition?

2. Did policymakers have a political incentive to state or act upon these ideas, beliefs, and values – was there political gain to be had by doing so?

3. Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such individual ideas, beliefs, and values to be translated into political action?

These questions can be diagrammed as a causal process as follows:

Figure 11. Hypothesis 3 causal process, Brazil.



This causal chain helps to illuminate the distinction between policymaker discourse and actual intentions – the latter gauged by the efforts taken to implement policies implied by previous discourse. It is worth noting also that, due to political opposition, genuine efforts do not always lead to the policy action originally envisaged; pragmatic consideration of what is politically possible may influence political behavior in ways that deviate from the originally expressed belief. Analysis of this causal chain thus demands the researcher to be broad in defining "ideological stance" – the expressed core concerns should be consistent, but the strategies taken to achieve them may evolve.

<u>Hypothesis 4: Party Ideology</u>

The key sub-questions related to hypothesis 4 – that policymakers chose policies based on party ideas and values – are the following:

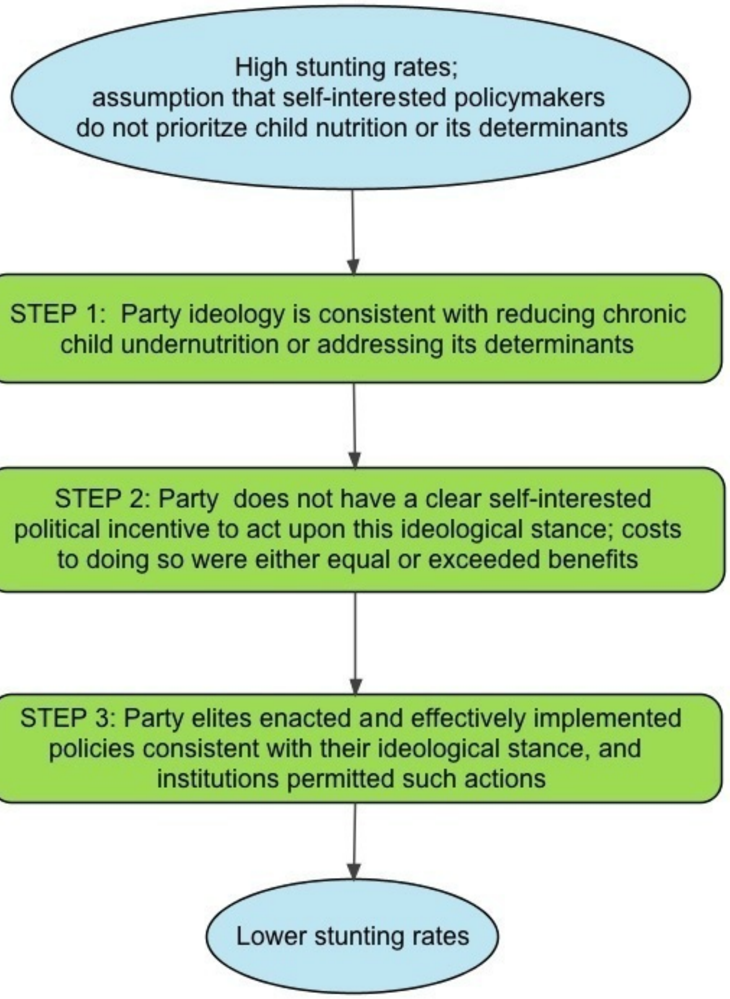
1. Were party ideas and values consistent with the goal of creating a policy environment favorable to child nutrition?

2. Did the party have a political incentive to express or act upon these ideas and values? How consistent over time was the party's expression of these ideas and values?

3. Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such party ideas and values to be translated into political action?

The causal process can be diagrammed as follows:

Figure 12. Hypothesis 4 causal process, Brazil.



Testing of all of the hypotheses above was based on review of published and unpublished secondary data, research in public archives, and interviews with key informants. In Northeast Brazil, the key informants include policymakers from the Ministries of Agrarian Development, Agriculture, Education, Health, and Social Development, program officers from the nutrition-focused NGO Pastoral da Criança, academic experts from various universities, and households from various high undernutrition-risk municipalities. It is expected that the triangulation of information from multiple sources will allow accurate process-tracing of the political forces driving variation in child stunting in each context.

Refuting all of the variants would lend support to the proposition that creation of a policy environment favorable to child stunting reduction is the unintended consequence of processes in which political pressure or ideational forces related to child nutrition or closely related issues (i.e., a pro-poor, pro-child policy agenda) are irrelevant to the explanation. It is important to note that outright rejection of any hypothesis variant may be unlikely in any given case; rather, the goal is to assess the importance of the various forces in generating the phenomenon of interest. In addition, the hypotheses are not mutually exclusive; several mechanisms together can lead to the outcome of interest.

I would like to make one final point on generalizability. The objective of this research is to test various general theories of the politics of undernutrition with reference to crucial cases. However, no matter the case selection criteria, two cases cannot decisively confirm or refute the universal generalizability of the hypothesis in question. In keeping with the mid-range nature of this study, the more modest objective of the fieldwork is to build the evidence base for one or more of the hypotheses and advance the state of existing research further towards a generalizable theory. Even if the results of this work lead to a conclusion that cross-country generalizations are not helpful, the study of multiple cases can, alternatively, assist to typological theorization: the interpretation that there are various "types" of political processes, each with their own sets of contingent generalizations, that lead to stunting reduction. Again, the type of "contingent generalization" sought is mid-range: universal enough to be applicable to multiple cases, but specific enough to avoid policy-irrelevant levels of abstraction.

2. India

As in the Brazil study, I start with four hypotheses explaining the recent wave of food and nutrition policy reforms at the federal level in India, as well as older health and nutrition policy reforms in the states of Kerala and Tamil Nadu:

- **H1**: Mass movements in which the rural poor directly participate, and thus exert political force, were the primary mechanism by which policymakers were pressured to enact food, nutrition, and health policy reforms.
- **H2**: Alliances between politically powerful elites and the rural poor (or their representatives) were the primary mechanism by which policymakers were pressured to enact food, nutrition, and health policy reforms.
- **H3**: Personal values and beliefs constructed by ideational influences were the primary forces driving policymakers to enact food, nutrition, and health policy reforms.
- **H4**: Party ideology constructed by ideational influences was the primary force driving policymakers to enact food, nutrition, and health policy reforms.

Hypothesis 1: Mass Movements

The key sub–questions pertaining to hypothesis 1 – that poor people's mass movements had a direct impact on the formulation and implementation of food, nutrition, and health policy reforms – are the following:

1. Did such mass movements exist at the federal in India over the past decade, and/or in Kerala and Tamil Nadu over previous decades, that prioritized food, nutrition, and health policy reforms in their political agenda?

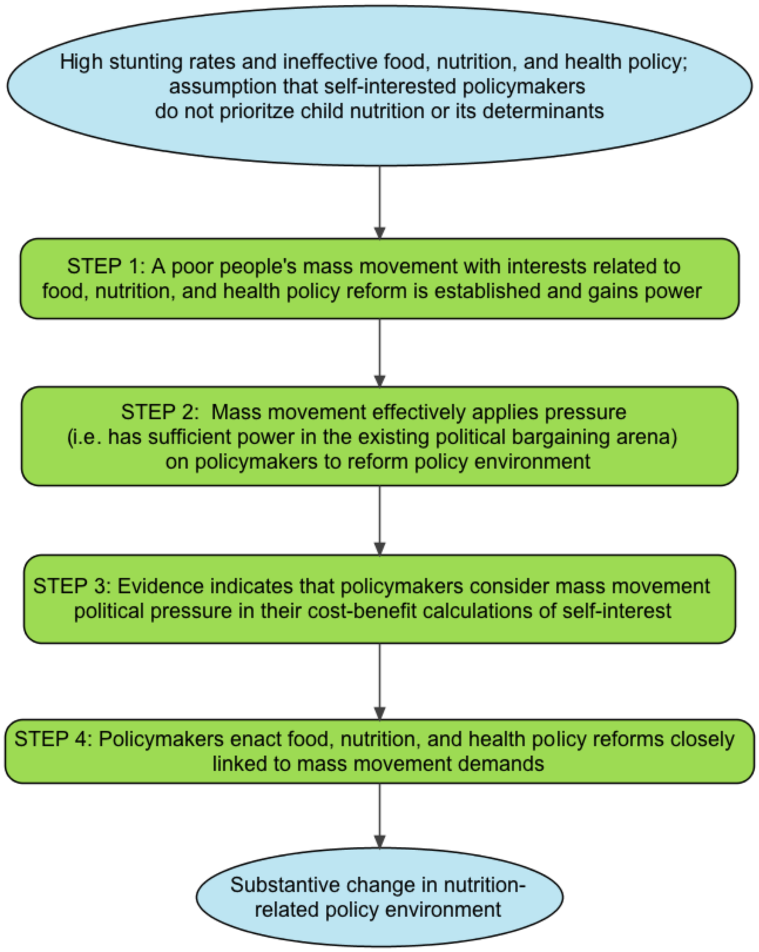
2. Did such mass movements wield political power, either through a potential to influence electoral processes or other means? Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such movements to wield power?

3. Were policymakers seen to react to mass movements' political power, not simply in discourse but also in substantive action?

4. Did this substantive action involve enacting and effectively implementing food, nutrition, and health policy reforms linked to mass movement demands?

These questions can be diagrammed as a causal process as follows:

Figure 13. Hypothesis 1 causal process, India.



Again, confirmation of the hypothesis as a whole depends on independent confirmation of each of the four steps portrayed above.

Hypothesis 2: Elite/Poor Alliances

The key sub–questions pertaining to hypothesis 2 – that alliances between the rural poor (or their representatives) and politically powerful groups had an impact on the formulation and implementation of food, nutrition policy reforms – are the following:

1. Did such alliances exist in India over the past decade, and did they prioritize food, nutrition, and health policy reforms?

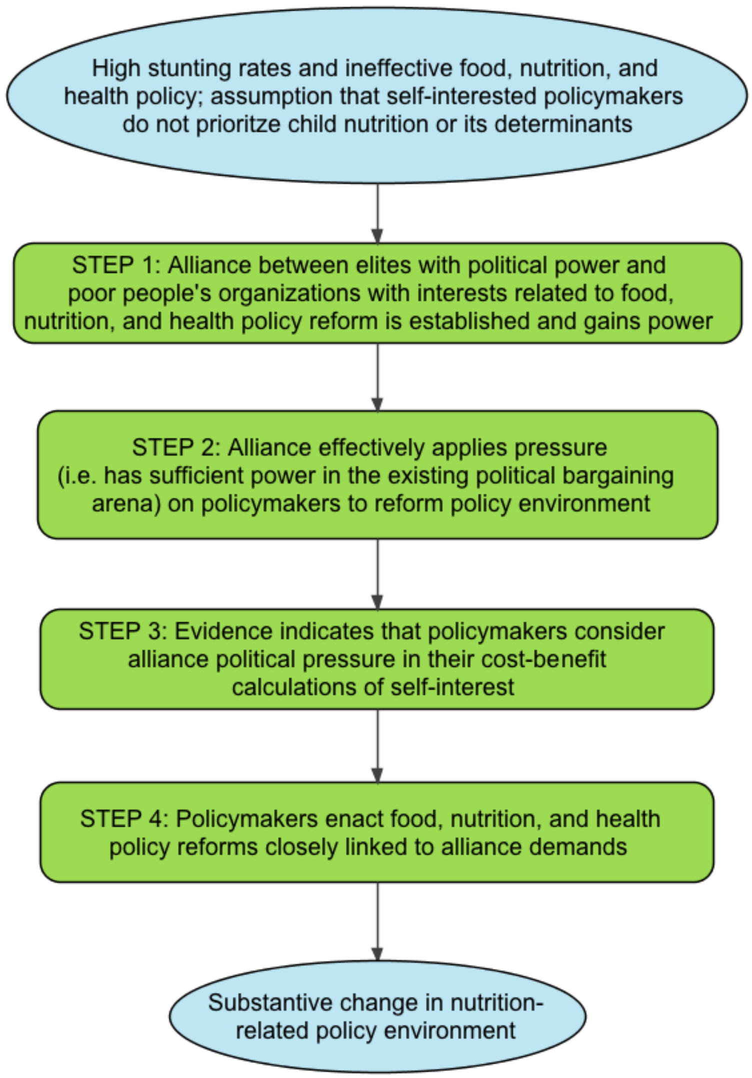
2. Did such alliances wield political power? Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such alliances to wield power?

3. Did policymakers respond to the demands of these alliances, not only in rhetoric but also in substantive political action?

4. Did this substantive action entail enacting and effectively implementing food, nutrition, and health policy reforms linked to alliance demands?

These questions can be diagrammed as a causal process as follows:

Figure 14. Hypothesis 2 causal process, India.



Hypothesis 3: Personal Ideology

The key sub-questions of hypothesis 3 – that policymakers pursued food and nutrition policy reforms based on personal ideas, beliefs, and values – are the following:

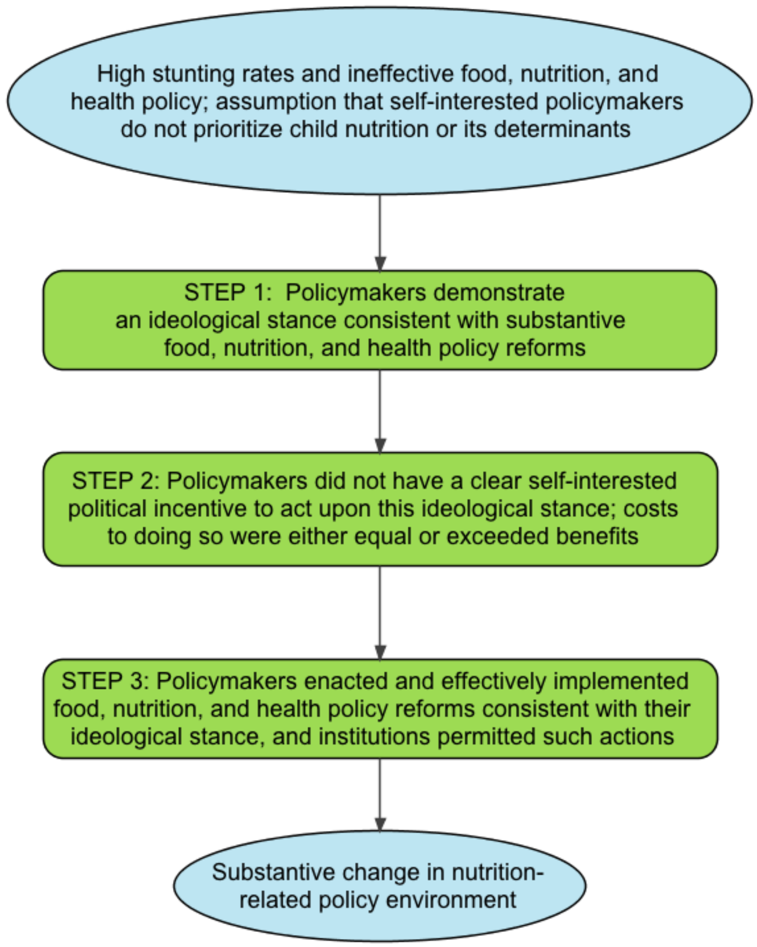
1. In their formal and informal discourse, did policymakers in India evince ideas, beliefs, and values consistent with the goal of enacting substantive food, nutrition, and health policy reforms?

2. Did policymakers have a political incentive to state or act upon these ideas, beliefs, and values – was there political gain to be had by doing so?

3. Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such individual ideas, beliefs, and values to be translated into political action?

These questions can be diagrammed as a causal process as follows:

Figure 15. Hypothesis 3 causal process, India.



<u>Hypothesis 4: Party Ideology</u>

The key sub-questions related to hypothesis 4 – that policymakers pursued food, nutrition, and health policy reforms based on party ideas and values – are the following:

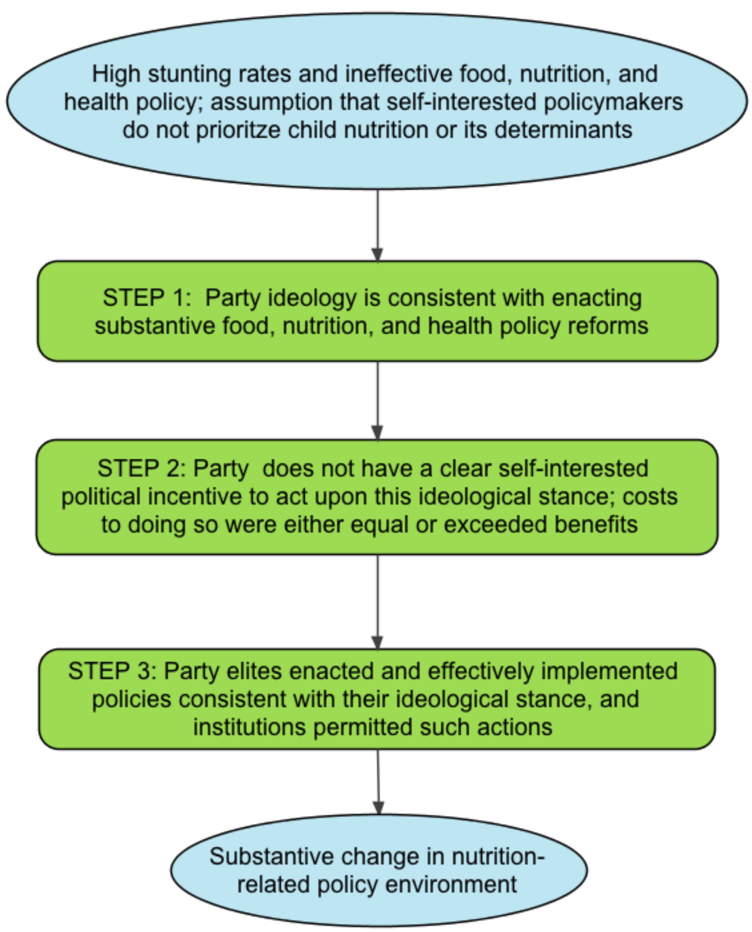
1. Were party ideas and values consistent with the goal of creating a policy environment favorable to food, nutrition, and health policy reforms?

2. Did the party have a political incentive to express or act upon these ideas and values? How consistent over time was the party's expression of these ideas and values?

3. Did the institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permit such party ideas and values to be translated into political action?

The causal process can be diagrammed as follows:

Figure 16. Hypothesis 4 causal process, India.



Testing of all of the hypotheses above is based on review of published and unpublished secondary data, research in public archives, and interviews with key informants. In India, the key informants include NGO and government officials in the fields of child nutrition, rural and agricultural economics, public health, social protection, and constitutional law.

Part II. Cross-Country Analysis of the Policy Determinants of Child Stunting

One key message of the econometric literature reviewed in Chapter 2 is that results are highly sensitive to model specification. With the exception of household income and caregiver knowledge, and to a lesser extent access to safe water and sanitation, few variables consistently appear as significant determinants of stunting. The strength of association between most tested variables and stunting is strongly affected by which controls are included, functional form and lag choices, and whether regional and country dummies are included, the last suggesting that unobserved cultural, economic, and political factors may be affecting undernutrition rates.

I contend that many of the models utilized in the literature suffer from serious endogeneity issues stemming from the complexity of undernutrition's causal web. The estimating equations in the studies reviewed are rarely reduced-form specifications; high multicollinearity, omitted variables, and reverse causality issues are likely biasing the parameter estimates of many included variables. High multicollinearity – strong correlation within the set of explanatory variables – may be obscuring the independent effect of any one given variable. The effects of omitted variables important in the causation of stunting, and correlated with included variables, are "picked up" instead by these included variables. The reverse causal impact of stunting over time on the independent variables, if not accounted for, would cause us to interpret the association between undernutrition and its determinants incorrectly.

In the next two chapters, I construct two models of the determinants of child nutritional status – one dealing with policy determinants and the other with political economy determinants – and confront the endogeneity issues plaguing previous models by using reduced-form specifications and lagged variable values. The first, more extensive model traces the outcome of child stunting through a system of equations back to a specification usefully conceptualized as comprised of only exogenous policy determinants – i.e., a reduced-form model. The second model then examines the key political factors that, through these policy determinants, are associated with stunting. Chapter 5 outlines the estimation strategy employed and describes the dataset used in detail. Chapter 6 then estimates the policy and political models and discusses the results of various specifications.

Chapter 5. Econometric Models, Data, and Estimation Strategy

A. The Policy Model

As mentioned previously, the policy and political economy models constructed in the following pages are based on the conceptual framework shown in Figure 8. The series of equations leading to the final reduced-form policy model are systematically presented in the following pages.

1. The Determinants of Child Nutritional Status

The dependent variable η_1 represents long-term nutritional status of children under the age of five. We start with the individual level determinants of child nutritional status: *dietary intake* (η_2) and *health status* (η_3), both shown to have strong influence on child growth (Becker, Black, and Brown 1991; Brown and others 2002; Shrimpton and others 2001; Scrimshaw and Suskind 1976; Rowland, Cole and Whitehead 1977; Rowland, Rowland and Cole 1988). With respect to stunting, a measure of accumulated undernourishment over the child's lifespan, the relevant time period in which dietary intake and health status have an impact is from the moment of conception to the date of measurement (as will be the case with many of the other determinants as well). For cross-sectional analysis, using dietary intake or health status information that is simply contemporaneous with the date of height-for-age measurement excludes the possibility that dietary or illness shocks occurring at some past point in the child's lifespan have affected present nutritional status. In other words, the correlation between present-day dietary intake or health status and stunting would be tested through the use of contemporaneous cross-sectional data, but the causal effect of these two determinants on height-for-age would not; their causal influence lies in the past, not the present.

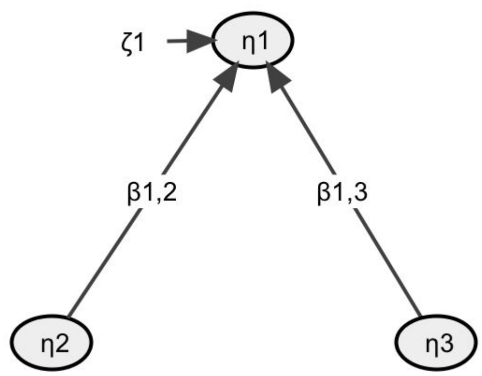
As described in the following section, this research employs a pooled cross-sectional dataset of countries. To deal with the temporal issue noted above with regards to cross-sectional analysis, I employ a lagged variable approach, using average values of the five year period preceding the year of the stunting observations whenever possible.

One can represent the individual-level determinants of stunting as follows:

$$\eta_1 = \alpha_1 + \beta_{1,2}\eta_2 + \beta_{1,3}\eta_3 + \zeta_1 \quad (1)$$

Where, again, η_1 is long-term child nutritional status; η_2 is the child's quality and quantity of dietary intake from conception to the date of measurement (which thus includes maternal dietary intake from conception to the termination of breastfeeding); and η_3 is the child's health status from conception to the date of measurement (which thus includes maternal health status from conception to the termination of breastfeeding, taking into account the impact of breastfeeding on the child's immunologic health); $\beta_{1,2}$ and $\beta_{1,3}$ are the structural parameters indicating the partial correlation of η_2 and η_3 with child nutritional status; α_1 is the structural intercept; and ζ_1 is the random error term.[18] The path diagram in Figure 17 below illustrates these relationships graphically.

Figure 17. Path diagram of relationships in equation (1).



As with all of the equations in this model, the expected value of the error term is zero and is assumed to be non-autocorrelated; heteroscedasticity-robust standard errors are used in the estimated models in the following chapter. Note that all endogenous variables in the policy model are denoted by η and all exogenous variables by ξ. All ζ are assumed to be uncorrelated with the exogenous variables. The structural parameter terms in the model are represented by $\beta_{i,j}$ where *i* represents the equation number and *j* represents the subscript of the associated variable; thus $\beta_{1,2}$ is the parameter for equation (1) and variable η_2.

[18] Note that the child's genetic endowment – i.e., inherent growth potential – is not included here. This is because the recent WHO Multicentre Growth Reference Study suggests that, broadly speaking, children across countries have similar growth potential (see WHO 2006b); because the final reduced-form policy equation (19) and political economy equation (20) measures child nutritional status at the country level, genetic variation is conceptualized to be within the error term.

2. The Determinants of Child Dietary Intake and Health Status

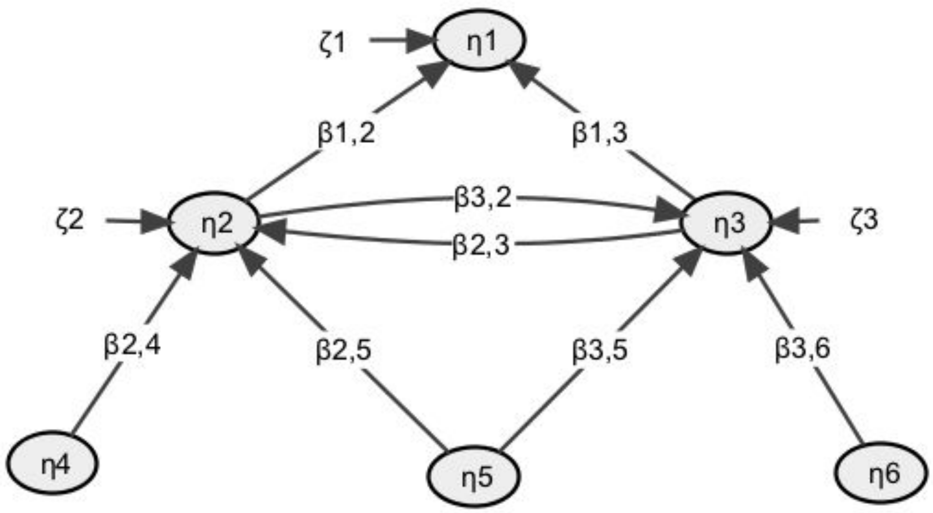
The determinants of the child's dietary intake and health status are shown in equations (2) and (3) below:

$$\eta_2 = \alpha_2 + \beta_{2,3}\eta_3 + \beta_{2,4}\eta_4 + \beta_{2,5}\eta_5 + \zeta_2 \qquad (2)$$

$$\eta_3 = \alpha_3 + \beta_{3,2}\eta_2 + \beta_{3,5}\eta_5 + \beta_{3,6}\eta_6 + \zeta_3 \qquad (3)$$

where η_4 is household food availability, in terms of both quantity and quality; η_5 is the quality of household caregiving practices; and η_6 is the quality of the household's health environment (for the importance of these, see Immink and Payongayong 1999; Bhutta and others 2008; Behrman and Hoddinott 2001; Monteiro and others 2009; Vella and others 1994; Esrey and others 1988; Alderman and Garcia 1994; Barber and Gertler 2009; Lavy and others 1996; Thomas, Lavy, and Strauss 1996). Figure 18 below shows the path diagram for Equations (2) and (3).

Figure 18. Path diagram of relationships in equations (2) and (3).



3. The Determinants of Household Food Availability, Caregiving Practices, and Health Environment

Equation (4) below shows the determinants of household food availability.

$$\eta_4 = \alpha_4 + \beta_{4,7}\eta_7 + \beta_{4,8}\eta_8 + \zeta_4 \qquad (4)$$

where η_7 is household income (including unearned income in the form of cash and food transfers, as shown in equation (7) below); and η_8 is local market prices of food (taking into account missing markets and impeded access to markets) (on the importance of income, see Immink and Payongayong 1999; Bhutta and others 2008; Heaton and others 2005; Boyle and others 2006; Heltberg 2008, and Behrman and Hoddinott 2001; on the importance of prices, see Lavy and others 1996; de Janvry and Subramaniam 1993; Thomas, Lavy, and Strauss 1996; and Christiaensen, and Alderman 2004). It is worth noting here that "local market prices" is conceptualized as an endogenous variable in the sense that it is partially determined by policy choice, as shown in Equation (8). Household own-production of food is left out of the equation is an explicit sense, but can be conceptualized of as a form of income, using shadow prices to assign values to the retained harvest.

Equation (5) shows the determinants of household care practices.

$$\eta_5 = \alpha_5 + \beta_{5,9}\eta_9 + \beta_{5,10}\eta_{10} + \beta_{5,11}\eta_{11} + \gamma_{5,1}\xi_1 + \zeta_5 \quad (5)$$

where η_9 represents the knowledge of the caregiver with respect to feeding and health behavior pertaining to child care[19]; η_{10} represents the physical and emotional health status of the caregiver herself; η_{11} represents intra-household equality (i.e., the distribution of decision-making power in the household, which affects how knowledge is converted into behavior; and ξ_1 is the household dependency ratio (the proportion of household members under age 15 and over 64 to household members between 15-64), which affects the allocation of time for care children and other dependents versus other household and outside work responsibilities (on the importance of caregiver knowledge, see Webb and Block 2004; Monteiro and others 2009; de Lima and others 2010; Thomas, Strauss, and Henriques 1991; Handa 1999; Glewwe 2004; Rubalcava and Teruel 2005; and Frost, Forste; and Haas 2005; on caregiver status, see Gragnolati 1999; Surkan and others 2007; and Butta and others 2008; on intra-household equality, see

[19] Note that the caregiver is assumed to be female in the system of equations below.

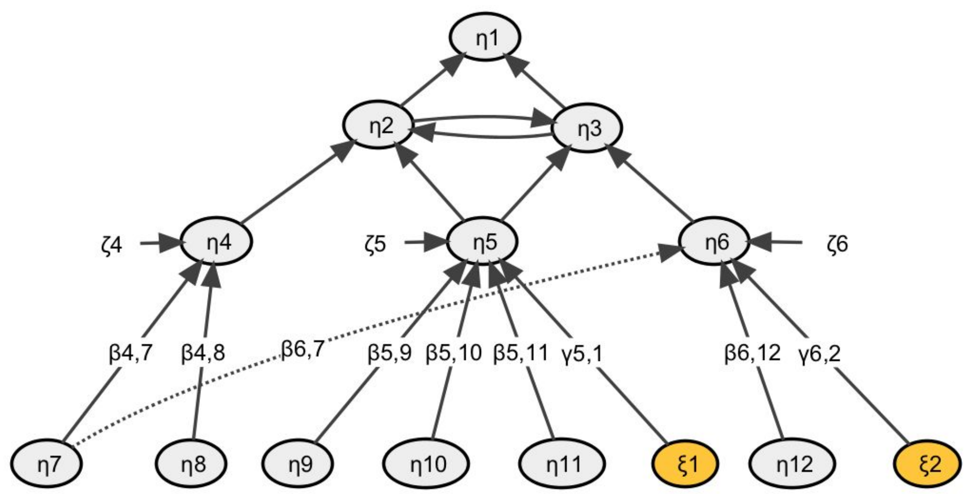
Smith and Haddad 2000 and Strauss 1990; on dependency ratio, see Bronte-Tinkew, and DeJong 2004; Haddad and Hoddinott 1994; and Ukwuani and Suchidran 2003).

Equation (6) shows the determinants of the quality of the household health environment.

$$\eta_6 = \alpha_6 + \beta_{6,7}\eta_7 + \beta_{6,12}\eta_{12} + \gamma_{6,2}\xi_2 + \zeta_6 \qquad (6)$$

where, as noted above, η_7 is household income, necessary to purchase health goods and services; η_{12} represents the safety of the household's environmental milieu with respect to disease threats; ξ_2 represents maternal/child health policies (on the importance of income, see Immink and Payongayong 1999; Bhutta and others 2008; Heaton and others 2005; Boyle and others 2006; Heltberg 2008; and Behrman and Hoddinott 2001; for environmental safety, see Milman and others 2005; Schrimshaw and Suskind 1976; Rowland and others 1977; Rowland and others 1988; Black and others 2008; and Fahrmeir and Khatab 2008; for maternal/child health policies see Wagstaff 2003; and Bhutta and others 2008). Figure 19 shows the path diagram associated with Equations (4) – (6). Parameters and error terms from earlier equations are left out for clarity purposes.

Figure 19. Path diagram of relationships in equations (4) – (6). Exogenous determinants shaded.



4. The Determinants of Income and Food Prices

Equation (7), showing the determinants of income, is analogous to a household production function:

$$\eta_7 = \alpha_7 + \beta_{7,13}\eta_{13} + \beta_{7,14}\eta_{14} + \beta_{7,15}\eta_{15} + \zeta_7 \quad (7)$$

where η_{13} represents the ratio of local agricultural input to agricultural output prices; η_{14} is the household stock of physical capital, including productive assets and natural capital; and η_{15} is the household stock of human capital, defined by the health status and educational background of household members (on the importance of prices, see Lavy and others 1996; de Janvry and Subramaniam 1993, Thomas, Lavy, and Strauss 1996; and Christiaensen and Alderman 2004; for importance of household capital stocks, see Thomas, Strauss, and Henriques

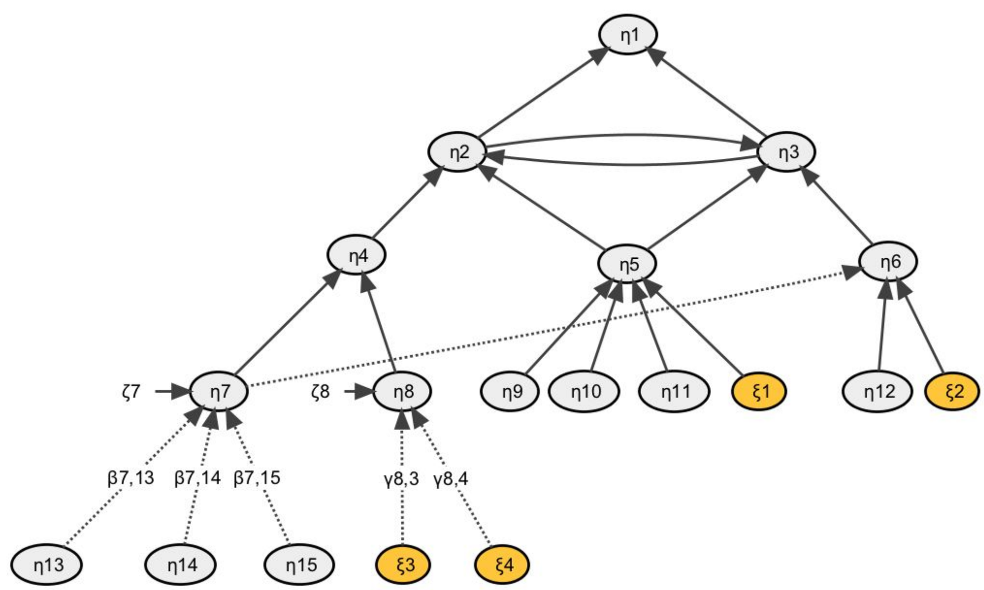
1991; Frost, Forste, and Haas 2005; Morales, Aguilar, and Calzadilla 2004; Harttgen and Misselhorn 2006; and Heaton and others 2005).

Equation (8) shows the determinants of food prices prevailing in local markets.

$$\eta_8 = \alpha_8 + \gamma_{8,3}\xi_3 + \gamma_{8,4}\xi_4 + \zeta_7 \quad (8)$$

where ξ_3 represents government policies to influence food consumer prices on domestic markets; and ξ_4 is the exogenously determined price of food goods on world markets (Lavy and others 1996; de Janvry and Subramaniam 1993; Thomas, Lavy, and Strauss 1996; and Christiaensen and Alderman 2004). Equations (7) and (8) are shown in the path diagram below.

Figure 20. Path diagram of relationships in equations (7) – (8). Exogenous determinants shaded.



5. The Determinants of Caregiver Knowledge and Health, Intrahousehold Equality, and Health Threats

Equation (9) shows the determinants of caregiver knowledge with respect to child care practices.

$$\eta_9 = \alpha_9 + \beta_{9,16}\eta_{16} + \beta_{9,17}\eta_{17} + \zeta_9 \tag{9}$$

where η_{16} is the educational background of the caregiver and η_{17} is caregiver access to media sources imparting information about child care practices (for importance of caregiver educational background, see Monteiro and others 2009; de Lima and others 2010; Handa 1999, Frost, Forste, and Haas 2005; Rubalcava and Teruel 2005; Vella and others 1994; Attanasio and others 2004; and Seerabutra and others 2006; for caregiver access to information, see Thomas, Strauss, and Henriques 1991; Handa 1999; Barrera 1990; and Webb and Block 2004).

Equation (10) shows the determinants of caregiver health status.

$$\eta_{10} = \alpha_{10} + \beta_{10,4}\eta_4 + \beta_{10,6}\eta_6 + \beta_{10,11}\eta_{11} + \zeta_{10} \tag{10}$$

where, as noted above, η_4, η_6, and η_{11} are household food availability, household health environment, and intra-household equality of decision-making (see Immink and Payongayong 1999; Bhutta and others 2008; Behrman and Hoddinott 2001; Monteiro and others 2009; Vella and others 1994; Glewwe, Koch, and Nyugen 2004; Esrey and others 1988; Alderman and Garcia 1994; Barber and Gertler

2009; Lavy and others 1996; Thomas, Lavy and Strauss 1996; Smith and Haddad 2000; and Strauss 1990).

Equation (11) shows the determinants of intra-household equality.

$$\eta_{11} = \alpha_{11} + \beta_{11,16}\eta_{16} + \beta_{11,18}\eta_{18} + \gamma_{11,5}\xi_5 + \zeta_{11} \qquad (11)$$

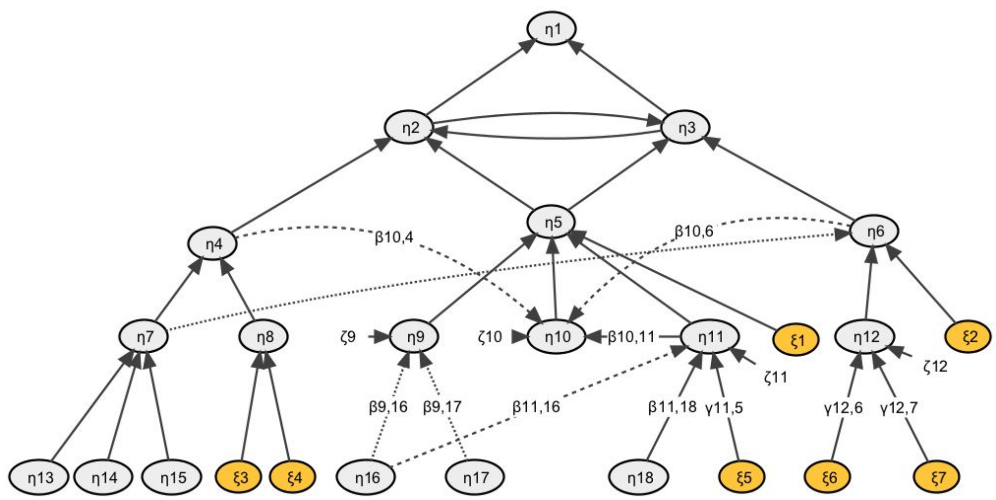
where, as noted above, η_{16} is the educational background of the caregiver; η_{18} is the caregiver's participation in paid work, as female participation in the labor force tends to increase intra-household equality of control over resources; ξ_5 represents cultural norms around gender equality (for importance of caregiver educational background, see Monteiro and others 2009; de Lima and others 2010; Handa 1999; Frost, Forste, and Haas 2005; Rubalcava and Teruel 2005; Vella and others 1994; Attanasio and others 2004; and Seerabutra and others 2006; for importance of caregiver participation in paid work, see Ukwuani and Suchindran 2003; and Haddad and Hoddinott 1994; the importance of cultural gender norms is inferred from the many studies showing links between women's status relative to men and child nutritional outcomes).

Equation (12) shows the determinants of the quality and safety of the household's environmental milieu, especially threats posed by diseases.

$$\eta_{12} = \alpha_{12} + \gamma_{12,6}\xi_6 + \gamma_{12,7}\xi_7 + \zeta_{12} \qquad (12)$$

where ξ_6 represents government policies pertaining to vector control protection; and ξ_7 represents the exogenously determined environmental context in which the household is located, specifically with respect to diseases and their vectors (on the importance of vector control, especially through water and sanitation improvement and malaria control measures, see Rowland and others 1977; Rowland and others 1988; Black and others 2008; Esrey and others 1988; and Bhutta and others 2008). The path diagram below in Figure 21 illustrates Equations (9) – (12).

Figure 21. Path diagram of relationships in equations (9) – (12). Exogenous determinants shaded.



6. The Determinants of Agricultural Prices and Household Capital Stocks

Equation (13) shows the determinants of the ratio of local agricultural input to output prices.

$$\eta_{13} = \alpha_{13} + \gamma_{13,8}\xi_8 + \gamma_{13,9}\xi_9 + \gamma_{13,10}\xi_{10} + \zeta_{13} \qquad (13)$$

where ξ_8 represents government policy interventions to influence agricultural input and output prices, for example due to taxes and subsidies; ξ_9 represents the exogenously determined (i.e., global market) output prices; and ξ_{10} represents the exogenously determined input prices, especially of fertilizer (for importance of agricultural prices, see Lavy and others 1996; de Janvry and Subramaniam 1993, Thomas, Lavy, and Strauss 1996; and Christiaensen and Alderman 2004; the importance of price policies is inferred from the importance of prices).

Equation (14) shows the determinants of household physical capital.

$$\eta_{14} = \alpha_{14} + \beta_{14,7}\eta_7 + \gamma_{14,11}\xi_{11} + \zeta_{14} \qquad (14)$$

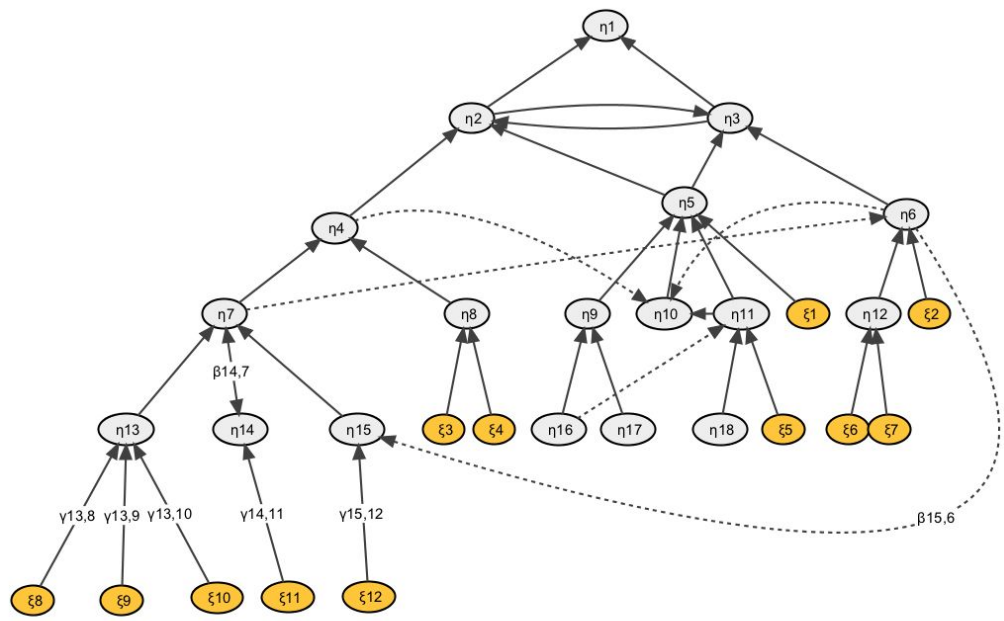
where, as noted above, η_7 is household income and ξ_{11} represents the environmental endowment with respect to the household production system (of particular relevance are soil type and nutrient status, water availability, climatic hazards, and prevalence of plant and livestock pests and diseases; the importance of these factors is inferred from the contribution of farm productivity to income of poor households). Although household decisions – e.g., cropping pattern choices – can have reverse causal effects on the quality of the ecological resources, this variable is seen to be exogenous in the short-run.

Equation (15) shows the determinants of the household's human capital stock.

$$\eta_{15} = \alpha_{15} + \beta_{15,6}\eta_6 + \gamma_{15,12}\xi_{12} + \zeta_{15} \qquad (15)$$

where, as noted above, η_6 is the quality of the household health environment; and ξ_{12} represents government educational policies. Figure 22 below illustrates equations (13) - (15).

Figure 22. Path diagram of relationships in equations (13) – (15). Exogenous determinants shaded.



7. The Determinants of Caregiver Education, Access to Media, and Participation in Paid Work

Equation (16) shows the determinants of educational background of the caregiver.

$$\eta_{16} = \alpha_{16} + \beta_{16,7}\eta_7 + \beta_{16,11}\eta_{11} + \gamma_{16,12}\xi_{12} + \zeta_{16} \quad (16)$$

where, as noted above, η_7 is household income; η_{11} is intra-household equality; and ξ_{12} represents government educational policies.

Equation (17) shows the determinants of caregiver access to media.

$$\eta_{17} = \alpha_{17} + \beta_{16,7}\eta_7 + \beta_{17,11}\eta_{11} + \beta_{17,16}\eta_{16} + \zeta_{17} \qquad (17)$$

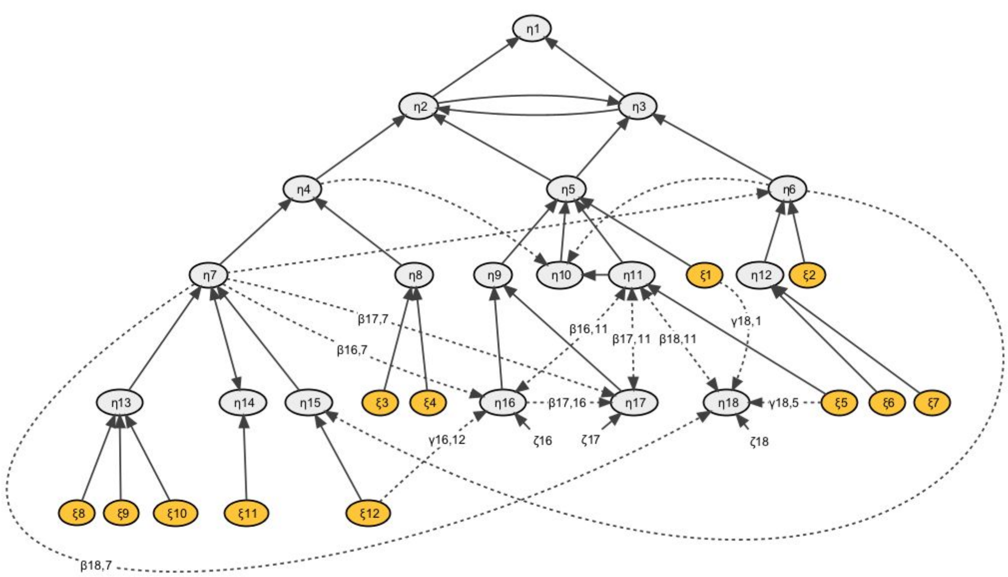
Where, as noted above, η_7 is household income; η_{11} is intra-household equality; and η_{17} is the educational background of the caregiver.

Equation (18) shows the determinants of caregiver participation in wage work.

$$\eta_{18} = \alpha_{18} + \beta_{18,7}\eta_7 + \beta_{18,11}\eta_{11} + \gamma_{18,1}\xi_1 + \gamma_{18,5}\xi_5 + \zeta_{18} \qquad (18)$$

Where, as noted above, η_7 is household income; η_{11} is intra-household equality; ξ_1 is the time budget of the caregiver; and ξ_5 is cultural gender norms. Figure 23 illustrates the relationships in equations (16) - (18).

Figure 23. Path diagram of relationships in equations (16) – (18). Exogenous determinants shaded.



In addition to the 12 exogenous determinants of stunting listed in the system of equations above, the conceptual framework in the previous section suggests that it is important to control for country's macroeconomic circumstances when assessing the impact of policy choices on child stunting. The macroeconomic circumstances variables are represented by ξ_{13}.

The reduced-form model of the determinants of child stunting implied by equations (1) - (18) is thus the following:

$$\eta_1 = \alpha_{19} + \gamma_{19,1}\xi_1 + \gamma_{19,2}\xi_2 + \gamma_{19,3}\xi_3 + \gamma_{19,4}\xi_4 + \gamma_{19,5}\xi_5 + \gamma_{19,6}\xi_6 + \gamma_{19,7}\xi_7 + \gamma_{19,8}\xi_8 + \gamma_{19,9}\xi_9 + \gamma_{19,10}\xi_{10} + \gamma_{19,11}\xi_{11} + \gamma_{19,12}\xi_{12} + \gamma_{19,13}\xi_{13} + \zeta_{19} \quad (19)$$

In other words, in this policy model, child stunting is a function of:

- **Government policies** pertaining to maternal/child health (ξ_2), consumer food prices (ξ_3), environmental threats (ξ_6), agricultural prices (ξ_8), and education (ξ_{12});
- **Global market prices** of food (i.e., consumer prices; ξ_4), agricultural outputs (i.e., producer prices; ξ_9), and agricultural inputs (ξ_{10});
- **The environmental context** with respect to disease vectors (ξ_7) and the household production system (ξ_{11});
- Household dependency ratio (ξ_1);
- Cultural gender norms (ξ_5); and
- A country's macroeconomic circumstances (ξ_{13}).

For reference purposes, the list of endogenous and exogenous variables used in the system of structural equations is reprinted below (originally from Table 6).

Endogenous Variables		Exogenous Variables	
η_1	Child long-term nutritional status	ξ_1	Household dependency ratio
η_2	Child dietary intake	ξ_2	Maternal/child health policies
η_3	Child health status	ξ_3	Consumer food price policies
η_4	Household food availability	ξ_4	World market food prices
η_5	Household caregiving practices	ξ_5	Cultural gender equality norms
η_6	Household health environment	ξ_6	Environmental threat policies
η_7	Household income	ξ_7	Environmental context: vectors
η_8	Food prices on national markets	ξ_8	Agricultural producer price policies
η_9	Caregiver knowledge	ξ_9	Global agricultural output prices
η_{10}	Caregiver physical/mental health	ξ_{10}	Global agricultural input prices
η_{11}	Intra-household equality	ξ_{11}	Environmental context: household production system
η_{12}	Disease threats	ξ_{12}	Educational policies
η_{13}	Agricultural input/output price ratio	ξ_{13}	Macroeconomic circumstances
η_{14}	Household physical capital		
η_{15}	Household natural capital		
η_{16}	Caregiver educational background		
η_{17}	Caregiver access to media		
η_{18}	Caregiver participation in paid work		

It should be noted that none of these variables are "exogenous" over extended time frames; a country's policymakers do indeed have control over policy choices, for example – and the political determinants of policy choice are indeed explored in the political economy model described below, as well as in Parts III and IV in the context of Brazil and India. However, I argue that these variables are indeed exogenous determinants *with respect to the production of stunting within the time frame of measurement*. That is, these variables: 1) are not determined by stunting itself within the time frame of measurement (lack of reverse causality, as argued earlier); and 2) are not determined by other variables correlated to stunting within the time frame of measurement, except insofar as these other unobserved variables work through the included variables themselves. For example, policy choices may be determined by, say, the degree of democratization in a country, but within the time frame of measurement the effect of democratization is theorized to work only through the observed variables (of policy choice and perhaps others).

B. The Political Economy Model

The policy model established the causal chain from outcomes at the child and household level to their determinants at the policy level. The political economy model replaces the policy variables in the final reduced-form model with their political economy determinants, as explained below.

Equation (20) lays out the structure of the model, based on the key "ideas vs. interests" dichotomy laid out in the conceptual framework (Figure 8):

$$\eta_1 = \alpha_{20} + \gamma_{20,1}\xi_1 + \gamma_{20,4}\xi_4 + \gamma_{,20}\xi_5 + \gamma_{20,7}\xi_7 + \gamma_{20,9}\xi_9 + \gamma_{20,10}\xi_{10} + \gamma_{20,11}\xi_{11} + \gamma_{20,13}\xi_{13} + \gamma_{20,14}\xi_{14} + \gamma_{20,15}\xi_{15} + \gamma_{20,16}\xi_{16} + \zeta_{20} \tag{20}$$

where:

- η_i is, once again, long-term child nutritional status;

- as in the policy model, ξ_4 represents household dependency ratio; ξ_4 represents world market food prices; ξ_5 represents cultural gender equality norms; ξ_7 represents the environmental context with respect to disease vectors; ξ_9 represents global agricultural output prices; ξ_{10} represents global agricultural input prices; ξ_{11} represents the environmental context with respect to the household production system; and ξ_{13} represents prevailing macroeconomic circumstances, particularly indicators of economic stability and wealth which determine the feasibility of a given policy choice;

- ξ_{14} represents "ideas", that is, the existing ideology and beliefs of the executive, legislature, and bureaucrats responsible for policy formulation and implementation;

- ξ_{15} represents "interests", that is, the distribution of power determined by political institutions. These institutions are seen as providing or restricting opportunities for key political players involved in policy formulation and implementation, including societal groups, to pursue their self-interested agendas;

- and ξ_{16} represents prevailing macro-political circumstances, particularly indicators of political stability, which influence whether ideas and interests are able to impact policy choice.

These variables are the key determinants of policy choice emphasized by the political economy literature. Note, again, that the political variables ξ_{14}, ξ_{15}, and ξ_{16} in equation (20) replace the policy variables in the reduced-form equation (19), the logic being that these policies are ultimately the result of the political economy factors (however, a specification with both policy and political economy variables included is also tested to assess robustness of the explanatories). The further contention is that, for the purposes of this model, the political variables are exogenous to the production of child stunting. Again, the argument for exogeneity rests on the argument that these variables are neither determined by stunting itself nor by other unobserved variables correlated to stunting within the time frame of measurement.

The next section discusses the data utilized and the estimation strategy employed for both the policy and the political models.

C. Variables and Data Sources

The direct or proxy variables used for measurement of the determinants appearing in Equation (19)'s policy model and Equation (20)'s political model are summarized in Table 8 below. The rest of the section describes each of these measures in greater detail. Note that the key variables of interest are the five policy variables pertaining to maternal/child health, consumer food prices, environmental threats, agricultural producer prices, and education for the policy model, as well as the three political variables pertaining to ideas, interests, and macro-political circumstances for the political economy model; the measurement variables for these are highlighted in bold below.

Table 8. Measurement variables used to estimate the policy and political economy models.

Variables from Model		Associated Measurement Variables		Label
η_1	Child long-term nutritional status	Y_1	Total stunting prevalence	st2sd
ξ_1	Household dependency ratio	X_1	Household dependency ratio	depend5
ξ_2	Maternal/child health policies	$\mathbf{X_2}$	**Measles-containing vaccine (MCV) coverage**	**mvacc5**
ξ_3	Consumer food price policies	$\mathbf{X_3}$	**Consumer tax equivalent for agricultural goods**	**cte5**
ξ_4	Global food prices	X_4	Global cereal prices	cprice5
ξ_5	Cultural gender norms	X_5	Sex ratio in the population	sexrt5
ξ_6	Environmental threat policies	$\mathbf{X_6}$	**Population with access to safe water**	**water**
ξ_7	Environmental context: diseases and vectors	X_7	Malaria ecology	maleco
ξ_8	Agricultural producer price policies	$\mathbf{X_8}$	**Nominal rate of assistance to agriculture**	**nra5**
ξ_9	Global agricultural output prices	(X_4)	(Global cereal prices)	(cprice5)
ξ_{10}	Global agricultural input prices	X_9	Fertilizer price index	ftprice5
ξ_{11}	Environmental context: household production system	X_{10}	Inherent land quality index	lqi
ξ_{12}	Educational policies	$\mathbf{X_{11}}$	**Educational attainment of population (yrs)**	**educ5**
ξ_{13}	Macroeconomic circumstances	X_{12}	Change in consumer price index	inflat5
		X_{13}	GDP per capita growth rate	incgr5
		X_{14}	Log GDP per capita	loginc5

Variables from Model		Associated Measurement Variables		Label
ξ_{14}	Ideology/beliefs of policymakers	**X_{15}**	**Executive/party stated ideological orientation, average of last 10 years**	**exid10**
		X_{16}	**Executive/party stated ideological orientation, average of last 20 years**	**exid20**
ξ_{15}	Distribution of power as determined by political institutions	**X_{17}**	**Polity IV index (level of democracy/autocracy), average of last 10 years**	**polity10**
		X_{18}	**Polity IV index (level of democracy/autocracy), average of last 20 years**	**polity20**
		X_{19}	**Executive index of electoral competitiveness, average of last 10 years**	**eiec10**
		X_{20}	**Executive index of electoral competitiveness, average of last 20 years**	**eiec20**
ξ_{16}	Macro-political circumstances	**X_{21}**	**Conflict intensity, average of last 5 years**	**conflict5**
		X_{22}	**Ethno-linguistic fractionalization**	**elfviii**

1. Child Long-Term Nutritional Status

The dependent variable *child long-term nutritional status* is measured by *total stunting prevalence* (Y_1). In the regressions that follow, total stunting prevalence is labeled as *st2sd* (proportion of children under two standard deviations from the reference population median).

The data source for all observations of both nutritional status variables is the WHO Global Database on Child Growth and Malnutrition. The *st2sd* variable has

453 national-level observations on total stunting among children under age five from 143 countries between the years 1963-2009, with 390 (86%) of those observations coming from 1990 or later. All developing countries with an under age five population of at least 2 million are represented for this variable. The WHO Database is generally judged to be a high-quality source; de Onis and Blössner (2003) discuss the procedure for collection, inspection, and standardization utilized by the WHO for inclusion of surveys into the database.

2. Household Dependency Ratio

The *household dependency ratio* is measured directly (X_1). The age dependency ratio is calculated as the ratio of the number of people under age 15 and over age 64 to the number of people ages 15-64, with the former group classified as dependents and the latter as working-age non-dependents. The household dependency ratio used in this dataset is a simple average of the dependency ratio in the five years preceding the year of the *st2sd* observation. This choice stems from the fact that currently measured child long-term nutritional status for children under age five is a result of factors operating throughout the child's lifespan, starting from conception and continuing to the time of measurement. Where data is available, most of the variables in this dataset take similar 5-year averages to account for these lagged effects.

Age dependency ratio data comes from the World Bank's *World Development Indicators* database (World Bank 2011), supplemented with information as needed from the U.S. Census Bureau's *International Data Base* (United States

Census Bureau 2011). Data is available for 450 of the 453 observations of *st2sd*. The age dependency ratio variable is labeled in the regressions below as *depend5*. The data is expressed as the proportion of dependents per 100 non-dependents.

3. Maternal/Child Health Policies

The first of five key policy variables, *maternal/child health policies,* is proxied by *measles-containing vaccination* (MCV) *coverage* (X_2). This is an admittedly imperfect proxy. One could convincingly argue that a variety of maternal and child health interventions – antenatal services, breastfeeding and hygiene promotion, and so on – have a more direct association with stunting than does vaccination. Indeed, national health spending on the entire set of maternal/child health programs would be the most comprehensive measurement variable. However, disaggregated national health accounts data for maternal/child health interventions is available for only a small subset of countries, and data on specific interventions is lacking, especially when compared to vaccination coverage. Though the link to stunting itself may be weaker than other interventions, given the importance of measles prevention to child survival and health generally, measles vaccination is the best indicator available of commitment to basic maternal/child health services. Along with DTP vaccine coverage (for which less data is available), MCV coverage is considered by funding agencies as a reliable indicator of overall health system performance. MCV campaigns are a fairly straightforward logistical exercise and are cost-effective in terms of DALYs saved; donor funding is consequently generally more available for vaccination than for other more complex, expensive health interventions (GAVI Alliance

2009; Bos and Batson 2000; MCC 2000; Becker and others 2006). Thus, controlling for a country's per capita GDP and the presence of conflict[20] (on the supply side) and gender equality differences (on the demand side) that may also affect MCV coverage, I argue that this variable is the best measure available of political commitment to maternal/child health policies.

Annual post-1980 data for MCV coverage is available for nearly all countries; within this dataset, information is available for 421 of the 453 observations of *st2sd*. The MCV variable is expressed as the percentage of children aged between 12 and 23 months who received the measles-containing vaccine at any point before the survey. Again, the average value of the 5 years preceding the associated *st2sd* observation is taken; for the less than 10% of observations for which the full five-year time series is unavailable, as many years as were available were used. The data is sourced from WHO/UNICEF, who compile information reported by national health systems; see Burton and others (2009) for an overview of data collection and verification processes. The MCV variable is labeled in the regressions below as *mvacc5*.

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[20] The presence of conflict has not been discussed previously as a control variable in the policy model, as it was not included in the previous section's system of equations. This exclusion was due to the fact that conflict was theorized to work through the listed exogenous determinants in the reduced form equation (19) to affect stunting. However, controlling for conflict is necessary in a measurement sense, for the reason given above: it can disrupt the link between commitment to maternal/child health (and other policies) and actually observed policy outcomes such as MCV coverage. For that reason, *presence of conflict* is included in all regressions and is measured by the variable *conflict intensity* (X_{15}); note that the political model <u>does</u> contain this conflict variable explicitly, as described in more detail below.

4. Consumer Food Price Policies

The *consumer food price policies* variable, the second of five key policy variables listed here, is measured by *consumer tax equivalent* (X_3), included in the University of Adelaide's Database of Distortions to Agricultural Incentives, 1955 to 2007. Consumer tax equivalent (CTE) is defined as "the percentage by which domestic consumer prices are above (or below if negative) international prices. This measure is an estimate of direct government policy intervention affecting consumers of covered farm products". The consumer tax equivalent variable is labeled as *cte5* in the regressions below; again, it is expressed as an average of the 5 years preceding the *st2sd* observation.

Unfortunately, CTE data is only available for 154 of the 453 observations of *st2sd*. For this reason, models with and without the CTE variable are attempted in the estimation exercise below.

5. Food Prices on Global Markets

The variable *food prices on global markets* is measured by a weighted average of wheat, maize, and rice prices, called here *global cereal prices* (X_4). Together, in 2007 wheat, maize, and rice supplied 49% of the calories in the group of low-income food deficit countries[21], and for this reason are chosen as the principal

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[21] The current list of low-income food deficit countries includes Afghanistan, Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Congo, Cote d'Ivoire, Democratic People's Republic of Korea, Democratic Republic of the Congo, Djibouti, Egypt, Eritrea, Ethiopia, Gambia, Georgia, Ghana, Guinea, Guinea-Bissau, Haiti,

food commodities of interest (FAOSTAT 2011). The relative importance of each cereal varies by region, however, with wheat presently the primary cereal staple in Northern Africa, South America, Central Asia, and Western Asia; maize the primary cereal staple in Eastern Africa, Middle Africa, Southern Africa, and Central America; and rice the primary cereal staple in Western Africa, the Caribbean, Eastern Asia, Southern Asia, and South-Eastern Asia.

Cereal prices are obtained from the UNCTAD-STAT commodity price database, and are measured in current US dollars per metric ton (UNCTAD 2011). The average cereal price variable is calculated by taking the average of rice, wheat, and maize prices, weighted by consumption share of each grain in the total caloric intake of low-income food deficit countries in each given year.[22] Again, the average of the five years preceding the *st2sd* observation is the figure used. The aggregate price variable is labeled *cprice5* in the regressions below. The *cprice5* variable is available for 452 of the 453 *st2sd* observations.

Honduras, India, Indonesia, Iraq, Kenya, Kiribati, Kyrgyzstan, Laos, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Moldova, Mongolia, Mozambique, Nicaragua, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Philippines, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, Sri Lanka, Sudan, Syria, Tajikistan, Tanzania, Timor-Leste, Togo, Turkmenistan, Tuvalu, Uganda, Uzbekistan, Vanuatu, Yemen, Zambia, and Zimbabwe (FAO 2011).

[22] For the 1963-1985 period, only the weighted average of rice and wheat prices was used. However, the 1963-1985 and 1986-2009 aggregate price series are treated as equivalent, and measured as the same variable. This is justified by noting that the exclusion of maize in the latter time period only reduces average weighted cereal price by 5%, and this 5% figure remains consistent for each year in this latter period.

6. Cultural Gender Norms

The variable *cultural gender norms* is measured by *sex ratio in the population* (X_5). The logic is that gender bias is manifested in varying mortality rates across sexes, the result of sex-selective abortions, infanticide, and differential access to health and nutritional resources that influence survival outcomes (Sen 2003). The presence of multiple intervening mechanisms, some of which may be unrelated to cultural norms, makes sex ratio an imperfect measure of cultural gender bias, but it appears to be the best choice given available data, and one commonly employed in the econometric literature. It should be noted that there is no consensus on what a society's "expected" sex ratio would be given a society with gender-equal cultural norms and access to resources (Klasen and Wink 2003). However, the ability to measure the relative degree of differences between countries serves the purposes of this study.

The sex ratio variable is labeled as *sexrt5* in the regressions below. Again, it is the average sex ratio of the five years preceding the associated *st2sd* observation. Following convention, it is measured as the number of males per female. Sex ratio data comes the United Nations Population Division; 450 of the 453 *st2sd* country-year observations have associated *sexrt5* values (UNPD 2009).

7. Environmental Threat Policies

The third key policy variable, *environmental threat policies,* is measured by *proportion of population with access to safe water* (X_6). Diarrheal diseases kill about 1.5 million children under the age of five every year, and are important contributors to the total burden of childhood morbidity (WHO 2009). By reducing nutrient retention, diarrheal diseases play a major role in stunting. Consumption of unsafe water is arguably the single greatest environmental threat faced by poor households in the developing world, and for this reason is chosen as the proxy indicator for the wider set of policies designed to combat environmental threats. Although the variable itself measures a policy outcome, not policy commitment or quality, I argue that the proportion of the population with access to safe water is an adequate proxy when controlling for GDP per capita and conflict, which the regressions in the next section do.

Data on the proportion of population with access to safe water, labeled as *water* in the regressions below, is available for most developing countries only for the years 1990, 1995, 2000, 2005, and 2008. However, with almost no exceptions, the trend for any given country is linearly increasing or remaining constant; there are few instances of severe, sudden year-to-year decline of coverage. This to be expected given that safe water infrastructure generally deteriorates only slowly (except in situations of conflict, which are explicitly controlled for), and is from a technical standpoint easily maintained. For these reasons, safe water access data for any year in between the years noted above is extrapolated as a linear trend in this study's dataset. This allows us to have reliable *water* data points for 385 of the 453 *st2sd* observations.

The (non-extrapolated) data comes from the WHO/UNICEF Joint Measurement Program (WHO/UNICEF 2011). Access to safe water is defined as "the percentage of the population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 liters a person a day from a source within one kilometer of the dwelling" (WHO/UNICEF 2011). Note that, in contrast to other indicators, the *water* data is contemporaneous with the *st2sd* observation instead of being an average of the five years previous, due to data constraints. However, because of the generally slow rate of change of the safe water access variable, this decision may be less problematic than in the case of other variables.

8. Environmental Context: Diseases and Vectors

Measuring the *environmental context with respect to diseases and vectors* variable is a particular challenge. Many potential cross-country health indicators (e.g., HIV infection rate, diarrheal disease morbidity, mortality from disasters, etc.) contain problems of endogeneity: they frequently measure a combination of health threats and health system performance, not simply the "exogenous" environmental threats that exist in a location.

One promising indicator, however, is the *malaria ecology* variable (X_7) constructed by Kiszewski and others (2004). This measure considers temperature, abundance of the various malaria-causing species of the *Plasmodium* genus, and abundance of the key vectors, mosquitos of the *Anopheles* genus. The variable is a alternative to relying on data of malaria cases reported or suspected, which is problematic from a reliability standpoint as well as being endogenously determined by health interventions (Sachs 2003). The malaria ecology variable is calculated at sub-national levels and then averaged at the national level. At present, data is not available for multiple time periods, although past vector control measures, especially drainage programs, and climate change have likely altered habitat conditions for *Anopheles*. Thus each country in the dataset has one malaria ecology value. The variable is labeled as *maleco* in the regressions below.

Relying solely on a malaria ecology indicator for exogenously determined environmental health hazards is certainly an oversimplification, but perhaps not a dangerously misleading one. In 2008, malaria killed nearly one million people and caused nearly 250 million cases of illness. The disease caused one in five deaths of preschool children in Sub-Saharan Africa in the same year (WHO 2012). Although various other diseases and risk factors – especially perinatal conditions, lower respiratory infections, HIV/AIDS, and diarrheal diseases – contribute to a larger share of the burden of disease in developing countries than does malaria, no others are as directly and clearly tied to exogenously determined environmental factors. For these reasons, I argue that *maleco* is an adequate measure of the environmental context with respect to diseases and their vectors.

The *maleco* data was obtained from the Earth Institute at Columbia University's malaria ecology database. Values are available for 431 of the 453 *st2sd* observations in the database (128 of 143 countries).

9. Agricultural Producer Price Policies

The fourth of the five policy variables, *agricultural price policies*, is measured by *nominal rate of assistance to agriculture* (X_8), collected by the University of Adelaide's Database of Distortions to Agricultural Incentives, 1955 to 2007. Nominal rate of assistance (NRA) is defined as "the percentage by which domestic producer prices are above (or below if negative) border prices of like products…net of transportation and trade margins". It takes into account "product-specific input subsidies and non-product-specific assistance", and is constructed as the production-weighted average of agricultural commodities for each country. It thus represents the net impact of government policy intervention to influence agricultural producer prices.[23] The NRA variable is labeled as *nra5* in the regressions below; once again, it is the average of the five years preceding the *st2sd* observation.

Unfortunately, NRA data is only available for 152 of the 453 observations of *st2sd*. For this reason, models with and without the NRA variable are attempted in the estimation exercise below.

[23] Note that the Consumer Tax Equivalent (CTE) and NRA measures are closely related. Differences between the two are due to policies that cause consumer and producer prices to diverge, especially taxes and subsidies. If information is lacking about such policies, CTE and NRA are assumed to be equivalent (Anderson and others 2009).

10. Global Agricultural Output Prices

The agricultural smallholder populations of different countries depend on different mixes of outputs for their income; indeed, considerable variation in product mix exists at the subnational level as well. For this reason, calculating a single measure of the variable *global agricultural output price* that is applicable across country-year observations is difficult. This study suggests that the variable *cprice5* (X_4; consumer food prices on global markets), described earlier as a measure of food prices on global markets and constructed using a weighted average of wheat, rice, and maize prices, is an adequate proxy for global agricultural output prices. The parameter estimate on *cprice5* would then take on the interpretation of being the *net* consumption/production effect of a change in cereal prices. For example, a positive correlation between *cprice5* and *st2sd* – an increase in prices associated with higher stunting – might suggest that, in terms of nutritional outcomes, the cost to consumers of higher cereal prices outweighs the benefit to farming families. Again, *cprice5* data is available for 452 of the 453 *st2sd* observations.

11. Global Agricultural Input Prices

The variable *agricultural input prices on global markets* will be measured with the *global fertilizer price index* indicator (X_9). Synthetic fertilizers are, along with improved seeds, one of the two most important agricultural inputs traded on global markets. Because fertilizer types are more homogenous than seed varieties, adjustments for type of cropping system are less necessary with the former. This study utilizes a fertilizer price index calculated by the United States Department of Agriculture Economic Research Service. The index sets prices in relation to a 1990-92 base value of 100. Although this data pertains to prices paid by United States farmers, the general lack of fertilizer subsidies in the U.S. allows the index to serve as an adequate proxy indicator for global fertilizer price trends.

The data utilized in this study averages the fertilizer price index over the five years preceding the year of the *st2sd* observation. The variable is labeled as *ftprice5* in the regressions below and is available for all 453 *st2sd* country-year observations.

12. Environmental Context: The Production System

The *environmental context with respect to the production system* variable is measured by the *inherent land quality index* (X_{10}), which focuses on the potential agricultural and livestock productivity of land, a key variable for the rural households that are the focus of this study. Beinroth, Eswaran, and Reich (2001) construct this Inherent Land Quality Index (LQI) based on the two dimensions of soil resilience and soil performance, which together gauge the ability of a given land area to sustain grain production at high yields. The authors do not consider land degradation in their assessment, and instead focus on intrinsic factors – soil characteristics and various climatic and geophysical stresses, including the effects of temperature and precipitation – to classify land into nine quality classes. Countries are then given a single land quality value based on their average land quality class, weighted by the surface area belonging to each class. The methodology of constructing the land quality index captures more dimensions of inherent environmental productivity than do (say) latitude, temperature, or precipitation measures alone.

Unfortunately, the LQI is only available for 91 of the 143 countries examined in this study, 315 of the 453 observations (70%). However, the missing values can be generated with multiple imputation techniques using average annual precipitation and temperature data as predictors; both variables are significant determinants of land quality. The results of regressing the original land quality index data (*lqiorg*) against the logged version of these two variables, *logpre* and *logtemp*, are given below in Table 9; nearly 63% of the variation in *lqi* is explained by the two variables.[24]

Table 9. *Lqiorg* as predicted by *precip* and *temp*.

Source	SS	df	MS
Model	354.534009	2	177.267004
Residual	206.170062	307	.671563719
Total	560.704071	309	1.81457628

Number of obs	= 310
F(2, 307)	= 263.96
Prob > F	= 0.0000
R-squared	= 0.6323
Adj R-squared	= 0.6299
Root MSE	= .81949

lqiorg	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
logpre	1.16275	.0508178	22.88	0.000	1.062755	1.262745
logtemp	-.889261	.1480147	-6.01	0.000	-1.180513	-.5980093
_cons	1.196688	.5232119	2.29	0.023	.1671528	2.226223

24 Average annual temperature and average annual precipitation comes from the Tyndall Centre for Climate Change Research databases. These measures are calculated by taking the 1961-1990 monthly means from within-country grid box values weighted by surface area, resulting in a single value for each country (Tyndall Centre for Climate Change Research 2010).

The variable *lqi*, with 142 values imputed is this manner, is thus used as the indicator of the productivity of the environmental context.

13. Educational Policies

The variable *educational policies* poses some problems for measurement. Preferred indicators – for example, government spending on primary and secondary education, either in per-student terms, as a percentage of government expenditures, or as a percentage of GDP – is generally only available for a limited set of countries in the post-1998 period.

Rather, the indicator used in this study is *educational attainment* of the population (X_{11}), expressed in terms of the years of total schooling completed by the above-age 15 population. I argue that educational attainment of the population can be conceptualized as an outcome of government educational policies, controlling for per-capita income (i.e., macroeconomic circumstances; see below) and cultural gender norms, both of which the regressions below include as additional independent variables.[25] The educational attainment figures represent investment into primary, secondary, and tertiary levels of education. Since the figures are averaged over the entire population, however, investment at lower levels of the educational system is effectively weighted more heavily, since per-capita

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[25] This assumption was tested using a subsample of 68 country-years for which data on expenditure per primary school student, as a percentage of GDP, is available. *Educ5* was regressed against this primary education expenditure variable, labeled *preduc*, controlling for *loginc5* and *sexrt5*, the operational measures of income and gender equality. *Preduc* was found to have a significant association with *educ5* at the 95% level. This result comes from a small sample, and data does not exist for lagged values of *preduc* to be used, and so must be seen as only suggestive.

expenditure needed to increase schooling attainment by (say) one year is much greater at higher levels of education (UNESCO 2007; Welsch 2009).

The Barro-Lee Educational Attainment Dataset has data for 146 countries over the 1950-2010 period, with data points at each 5-year interval (Barro and Lee 2011). As with the access to safe water variable, the trend is linear and slowly increasing or stagnant for all countries; for no country does the data suggest a drastic collapse or increase in educational attainment over a short time frame. Thus I linearly extrapolate data for between-interval years as needed. As with other variables, averages of the five-year period preceding the *st2sd* observation are generated. It is worth noting, however, that these educational attainment figures represent not just the outcome of the last five years of educational policy, but also the outcome of previous government commitment to education (again, critically, controlling for income levels and cultural gender norms). However, this is appropriate for the purposes of this study: as the system of equations in the previous section details, government educational policies affect household stunting outcomes through increasing caregiver knowledge and bolstering the household human capital stock, both of which are processes which extend farther back into the past than the last five years.

The educational attainment indicator is available for 368 of the 453 *st2sd* observations in the database.

14. Macroeconomic Circumstances

The *macroeconomic circumstances* variable has three potential measurement variables in this model: *change in consumer price index* (X_{12}), *GDP per capita growth rate* (X_{13}), and *level of log GDP per capita* (X_{14}). The focus here is on identifying indicators of macroeconomic insecurity that influence policy choices.

Changes in the consumer price index are a measure of inflation, and are calculated with reference to a CPI value of 100 in 2005. The measure as it appears in this dataset is a simple calculation of change in the CPI between the year of the *st2sd* observation and five years before this observation. The data comes from the *World Development Indicators* database, obtained originally from the International Monetary Fund's *International Financial Statistics*. The Laspeyres formula using base-year prices was used in calculation of the CPI. The variable is labeled as *inflat5* in the regressions below. However, because data for only 363 of the 453 *st2sd* observations is available, the sample is considerably reduced when including *inflat5*.

The growth rate in GDP per capita, calculated as the compound annual growth rate over the five years preceding the *st2sd* observation, also provides a snapshot of recent economic volatility and stability. The growth rates used in this study are calculated from real GDP per capita figures in the Penn World Tables 7.0 (Heston and others 2011). The PWT variable derives GDP per capita from growth rates of consumption, government expenditure, and investment, using constant 2005 dollars and the Laspeyres formula. Growth rate is measured as the compound annual growth rate over the period between the *st2sd* observation and five years before this observation. The growth rate variable is labeled *incgr5* in the regression below. Data for *incgr5* is available for 436 of the 453 *st2sd* observations.

Although both *inflat5* and *incgr5* are adequate measures of recent economic volatility and performance, policy choices are influenced as much by *level* of economic resources as by recent trends in growth of these resources. Thus the level of GDP per capita, in logged form and averaged over the five-year period preceding the *st2sd* observation, is also included; the source is the Penn World Tables 7.0 (Heston et al. 2011). The variable is labeled as *loginc5* in the regressions below. Data for *loginc5* is available for 443 of the 453 *st2sd* observations.

15. Ideology/Beliefs of Policymakers

The variable *ideology/beliefs of policymakers* is measured by the variables *stated ideological orientation of executive/party over the last 10 years* (X_{15}) and *stated ideological orientation of executive/party over the last 20 years* (X_{16}). This indicator is a recoded version of the variable EXECRLC in the World Bank's Database of Political Institutions (DPI). The DPI codes the executive's affiliated party as "Right", "Left", "Center", or "No Information" based on party name, stated economic policy platform, and cross-checking with other sources. In cases where the executive's policy platform differed from his/her party, the executive's orientation gained precedence (Beck and others 2001).

The DPI variable has been slightly recoded in this study. Parties with a leftist orientation were coded "-1", those with the rightist orientation "1", and centrist and parties for which no clear information existed were both coded "0". This deviates from the DPI practice of coding centrist parties and "no information" situations differently. The reason for this change is because the purpose of including this variable in this study is to determine how explicit right/left ideological orientation – that is, deviation from centrist *or* non-ideological policy positioning – is correlated with stunting outcomes.

In this study, the executive/party ideology for a given *st2sd* country-year is taken as the average of both the last 10 years (labeled as *exid10* in the regressions below) and the last 20 years (labeled as *exid20*). These longer time frames are chosen because major policy initiatives – such as in the environmental health and educational sectors – usually require political commitment over an extended period; reversals in ideological positioning across political administrations can negate policies pursued by any given administration, and these shifts will not be captured over short time frames. Note that this 10-20 year retrospective time frame varies from the 5-year frame used for many variables in this study.

The *exid10* variable has values for 425 country-year observations, and the *exid20* variable for 405 observations.

16. Distribution of Power, as determined by political institutions

The variable *distribution of power* is measured by two different sets of variables. The first set is based on the Polity IV democratization index, and includes both a *democratization level over the last 10 years* variable (X_{17}) and a *democratization level over the last 20 years* variable (X_{18}). The Polity IV index, constructed by investigators at the Center for Systemic Peace, incorporates measures of executive recruitment, constraints on executive authority, and political competition into an aggregate measure of government authority spanning the spectrum from hereditary monarchy (scored as -10) to consolidated democracy (scored as +10) (CSP 2012).

In this study, the Polity IV value for a given *st2sd* country-year was taken as both an average of the 10 years preceding the observation (labeled as *polity10*) and 20 years preceding the observation (labeled as *polity20*). Again, this is because impacts of democratization on stunting are expected to unfold over a long-term time frame. Of the 453 *st2sd* country-years in the dataset, 420 have associated *polity10* values and 407 have *polity20* values.

The second set of variables is based on the "Executive Index of Electoral Competitiveness" (EIEC) variable used in the World Bank's Database of Political Institutions. The EIEC variable codes executives on a scale of 1 to 7 based on the competitiveness of the electoral process by which they were elected. If there is no executive position, the country-year is coded "1"; if the executive is unelected, the code is "2"; if the executive is elected without other candidates in competition, the code is "3"; if elected in a one-party competition with multiple candidates, the code is "4"; if elected in a multi-party competition in which only one party won seats, the code is "5"; if elected if a multi-party competition in which the largest party won more than 75% of seats, the code is "6"; and if elected in a competition in which the largest party won less than 75% of seats, the code is “7” (Beck and others 2001).

As with the Polity IV index, two variables are constructed from EIEC: *executive index of electoral competitiveness over the last 10 years* (X_{19}) and *executive index of electoral competitiveness over the last 20 years* (X_{20}). The former is labeled as *eiec10* and the latter as *eiec20* in the regressions below. 422 observations are available for *eiec10*, and 351 for *eiec20*.

17. Macro-Political Circumstances

The *macro-political circumstances* variable is measured by the variables *conflict intensity* (X_{21}) and *ethno-linguistic fractionalization* (X_{22}). Country-year observations are scored “0” if the country experienced less than 25 battle-related deaths in the past year, “1” if the country experienced between 25 and 999 battle-related deaths in the past year (classified as “minor conflict”), and “2” if the country experienced more than 999 battle-related deaths in the past year (classified as “war”). The information used comes from the Uppasala Conflict Data Program/International Peace Research Institute, Oslo (UCDP/PRIO) Armed Conflict Dataset, Version 4, 2009 (Gleditsch and others 2002; Harbom 2009). The definition of battle-related deaths is as follows: “The deaths must come as a result of armed conflict, defined as “a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of the state, results in at least 25 battle-related deaths” (Harbom 2009, p.1). In this study, the conflict variable takes on the sum value of the five years preceding the st2sd observation, and is labeled *conflict5* in the regressions below. The sum value, and not the average value, is chosen because conflict is hypothesized to have a cumulative impact on political stability. Data on *conflict5* exists for 453 country-year observations.

The ethno-linguistic fractionalization variable is included to test the possibility that the degree of ethnic, linguistic, and/or religious heterogeneity in a country influences economic and political outcomes, and thus eventually political outcomes. Alesina and others (2002) review the literature looking at the impact of fractionalization of political and economic stability, and conclude that especially ethnic and linguistic fractionalization are likely to have important impacts on the quality of policies and institutions, although the size of the effects are highly sensitive to model specification. Desmet and others (2011) also point out that the level of aggregation at which fractionalization is defined influences the degree of correlation with political economy outcomes. The authors construct 15 different measures of ethno-linguistic fractionalization, ranging from ELF(1) at the highest level of aggregation to ELF(15) and the highest level of disaggregation. In this study, I use Desmet and others' ELF(8) indicator, the variable with the median level of aggregation. The variable is labeled as *elfviii* in the regressions below, and values are available for 450 country-year observations. The actual *elfvii* value is interpreted as the probability that two randomly chosen people in a population belong to different ethno-linguistic groups.

D. Estimation Strategy

This section discusses the estimation of the policy and political models in Equations (19) and (20).

The basic estimation model, suggested by both Equations (19) and (20) and utilizing the measurement variables described in the previous section, can be expressed in general form as follows:

$$\eta_1 = \alpha + \sum_{k=1}^{K} \beta_k X_{k,cy} + \zeta; c = 1,\ldots n; y = 1\ldots T \tag{21}$$

where stunting is determined by some linear combination of variables, each denoted by X_k, where k takes on values between k=1,…K; α is the scalar intercept term; c denotes countries; y denotes year of the observation; β is a vector of the parameters of all included X variables; and ζ is the error term, which is assumed to be normally distributed with mean zero and constant variance σ^2.

The dataset is used to estimate both pooled ordinary least squares (OLS) cross-section models and random effects (RE) specifications. It should be noted that estimating a RE model removes degrees of freedom and diminishes the power of the statistical tests attempted; for this reason, the OLS specifications are preferred. However, random effects specifications are indeed estimated to assess the robustness of association between variables in the OLS specifications and stunting.

Chapter 6. Estimation Results

A. Descriptive Statistics

Basic descriptive statistics for the dependent variable *st2sd* and the 22 independent variables are given below in Table 10 and Table 11. Table 10 presents results that are not population-weighted or year-weighted, and so do not represent developing world mean values over the time period of the data. This follows the general approach of this study, to treat each country-year data point as an equivalent observation. Table 11 then presents results weighted by child population under age five, by way of comparison. Population weights are not used in the regressions that follow, as results would be heavily biased by very large countries, especially India and China.

Table 10. Basic descriptive statistics, cross-country models, not weighted by child population.

Variable	Obs	Mean	Std. Dev.	Min	Max
st2sd	453	30.66733	16.14072	1.3	71.1
depend5	450	77.46806	17.54079	34.2802	116.0779
mvacc5	421	72.82969	21.69449	1	99
cte5	154	.0258729	.2301092	-.7672057	1.095209
cprice5	452	318.7668	173.7932	183.8912	1081.413
sexrt5	450	1.007041	.0969762	.8564242	1.54775
water	385	76.30629	19.05671	10.2	100
maleco	431	4.930456	7.254778	0	31.5479
nra5	152	.0063539	.1794582	-.4842439	.8887407
ftprice5	453	111.0478	22.73852	36.4	217.6
lqi	453	6.409803	1.299029	3.04	9.01
educ5	368	5.616839	2.364095	.71654	12.33936
inflat5	363	22.55149	17.95694	-10.12	99.71
incgr5	436	2.205418	4.988629	-18.71579	50.52648
loginc5	443	7.859778	1.090609	5.331101	10.82011
exid10	425	-.1351699	.5455977	-1	1
exid20	405	-.162886	.4799274	-1	1
polity10	420	-.1039048	6.314643	-10	10
polity20	407	-1.126044	5.957462	-10	10
eiec10	422	4.967164	1.914088	1	7
eiec20	351	4.499801	1.714514	1.25	7
conflict5	453	1.238411	2.386472	0	10
elfviii	450	.3968947	.3023457	0	.9841

A quick summary of some of the most important figures in the table above:

- The mean country-year has nearly one-third of children (30.7%) under the age of five stunted.
- The mean dependency ratio is a little above 3 dependents for every 4 non-dependents (77.5).
- The mean measles-containing vaccination coverage rate is just under three-quarters of the population (72.8%). The mean safe water coverage rate is just over three-quarters of the population (76.3%).

- In the average-country year, food consumers are taxed slightly (2.6% above border price levels) and food producers are subsidized very slightly (0.6% above border price).

- In the average country-year, the sex ratio is skewed towards males, with about 1007 males for every 1000 females.

- In the average country-year, years of educational attainment equal about 5.6.

- The mean increase in CPI over the five years preceding country-year observations is about 22.6 points.

- The mean rate of economic growth per capita over the five years preceding country-year observations is about 2.2%.

- The mean GDP per capita value in the dataset is around $4907 in constant 2005 international dollars (not shown in the table above; only log GDP per capita shown).

- The mean executive ideology for both the ten- and the twenty-year periods preceding the country-year observation is slightly left-of-center (-0.14 and -0.16, respectively).

- The mean democratization value for the 10 years preceding the country-year observation is slightly below zero (-0.1, with zero representing the median value between hereditary monarchy at -10 and consolidated democracy at +10). The mean value for the last 20 years leans more in the direction of autocracy (-1.1).

- The mean country-year value for executive index of electoral competitiveness averaged over the last 10 years is about at the level of a "multiparty competition in which one party wins all seats" (5.0); for the last 20 years, between this level and the level of "elected without competition"(4.5).

- The mean country-year value for conflict intensity is slightly above the level of "minor conflict" (1.2).

- For the mean country-year, there is about a 40% probability that two randomly chosen individuals in a population will belong to different ethno-linguistic groups.

These statistics are discussed further in the bivariate results section below.

The descriptive statistics, weighted by size of child population, are shown below.

Table 11. Basic descriptive statistics, cross-country models, weighted by size of child population.

Variable	Mean	Std. Dev.	Min	Max
st2sd	34.88707	15.41276	1.8	71.1
depend5	69.72821	18.26215	34.2802	116.0779
mvacc5	74.01377	22.90265	1	99
cte5	-.0057107	.2132352	-.7672057	1.095209
cprice5	282.9593	139.7937	183.8912	1081.413
sexrt5	1.026334	.046118	.8564242	1.54775
water	76.19213	15.71125	10.2	100
maleco	4.140393	6.693487	0	31.5479
nra5	-.0001781	.1776498	-.4842439	.8887407
ftprice5	113.4847	17.59869	36.4	217.6
lqi	6.331049	1.192444	3.04	9.01
educ5	5.261599	1.759468	.90058	11.63612
inflat5	21.78238	16.89948	-10.12	99.71
incgr5	3.425308	3.662914	-11.41147	50.52648
loginc5	7.638636	.8278399	5.331101	10.82011
exid10	-.2271654	.5868151	-1	1
exid20	-.3085438	.5271267	-1	1
polity10	-.7685674	6.223516	-10	10
polity20	-1.897779	5.678407	-10	10
eiec10	4.706944	1.859097	1	7
eiec20	4.308905	1.666196	1.25	7
conflict5	1.915727	2.527201	0	10
elfviii	.518274	.2741486	0	.9841

The most important differences are found in *st2sd*, *depend5*, *sexrt5, maleco,* and *incgr5*. Stunting is more than four percentage points higher in the weighted table. Dependency ratio is reduced significantly, from 77.5 to 69.7. The sex ratio is much higher, driven especially by the disproportionally high number of males in China and India. Malaria transmission risk is reduced, and income growth is over 1.2 percentage points higher. Executive ideology moves slightly to the left and the political system more towards autocracy over both the ten and twenty year time frame. Conflict increases significantly to 1.9, meaning that the average population-weighted observation was nearly in a state of war over the five years preceding the stunting observation. Ethno-linguistic fractionalization increases; there is now a greater than 50% chance that two randomly chosen individuals in a population will be from different groups.

B. Bivariate Results

1. Correlation Matrix and Collinearity Diagnostics

A correlation matrix of *st2sd* with all independent variables is provided in Table 12 below.

Table 12. Correlation matrix of all variables, cross-country models.

	st2sd	mvacc5	water	educ5	cte5	nra5	depend5
mvacc5	-0.5083*	1					
water	-0.6934*	0.6279*	1				
educ5	-0.6612*	0.5292*	0.5452*	1			
cte5	-0.3663*	0.1197	0.3224*	0.2566*	1		
nra5	-0.4172*	0.2031*	0.3456*	0.4210*	0.8225*	1	
depend5	0.6576*	-0.5746*	-0.6420*	-0.6114*	-0.2728*	-0.4022*	1
cprice5	0.0933*	-0.4781*	-0.0413	-0.2541*	0.0439	0.0565	0.2495*
sexrt5	-0.2274*	0.1534*	0.1905*	0.0200	-0.0092	-0.0899	-0.2779*
maleco	0.3437*	-0.4034*	-0.4645*	-0.4657*	-0.135	-0.2148*	0.3951*
ftprice5	-0.0895	0.3510*	0.0563	0.2287*	-0.0599	-0.1032	-0.2633*
lqi	-0.0503	0.0382	0.1455*	0.2184*	-0.0263	0.0685	-0.1038*
inflat5	-0.008	0.2097*	0.0359	0.2240*	0.0171	0.0172	-0.1379*
incgr5	-0.0766	0.1881*	0.0520	0.2168*	0.1501	0.0774	-0.1873*
loginc5	-0.7748*	0.4324*	0.7225*	0.5443*	0.4423*	0.5238*	-0.6726*
exid10	-0.0651	0.0056	0.1192*	-0.0089	0.2306*	0.2680*	0.0234
exid20	-0.1086*	0.0067	0.1890*	0.0507	0.2284*	0.2437*	-0.0025
polity10	-0.3181*	0.1711*	0.2962*	0.4046*	0.2798*	0.3402*	-0.2180*
polity20	-0.3783*	0.1702*	0.3440*	0.4326*	0.2963*	0.3460*	-0.2414*
eiec10	-0.2477*	0.2111*	0.2584*	0.3791*	0.2547*	0.2267*	-0.1641*
eiec20	-0.3783*	0.1940*	0.3717*	0.3575*	0.3357*	0.2967*	-0.1777*
conflict5	0.2332	-0.2040*	-0.1436*	0.1706*	0.0648	0.0466	0.1332*
elfviii	0.2430	-0.1689*	-0.2137*	-0.2435*	0.0664	-0.0012	0.0988*

	cprice5	sexrt5	maleco	ftprice5	lqi	inflat5	incgr5	loginc5
cprice5	1							
sexrt5	-0.0791	1						
maleco	-0.0225	-	1					
ftprice5	-	0.1139*	0.0938	1				
lqi	0.036	-	-0.0202	-0.0413	1			
inflat5	-	-	-0.0650	0.3807*	0.1119*	1		
incgr5	-	-0.0176	-0.0388	0.1517*	0.0335	0.0393	1	
loginc5	0.006	0.4289*	-	-0.0274	-0.0519	-	0.0602	1

	exid10	exid20	polity10	polity20	eiec10	eiec20	conflict5	elfviii
exid10	1							
exid20	0.8894*	1						
polity10	0.2174*	0.2143*	1					
polity20	0.1758*	0.2150*	0.9353*	1				
eiec10	0.1427*	0.1625*	0.7846*	0.7512*	1			
eiec20	0.1549*	0.1633*	0.7862*	0.8272*	0.9260*	1		
conflict5	0.0478	0.0449	-0.0552	-0.0655	-0.0813	-0.0695	1	
elfviii	0.0375	0.0114	-	-0.2646	-0.1682	-0.2252	0.1862*	1

** Starred correlation coefficients are significant at the 95% level.*

Stunting exhibits a strong correlation in the expected direction with many of the listed variables, especially the household dependency ratio *depend5*, the three policy variables *mvacc5* (measles vaccination), *water* (access to safe water), *educ5* (educational attainment), and the macroeconomic control variable *loginc5* (log GDP per capita). The agricultural consumer and producer price policy variables *cte5* (food consumer tax) and *nra5* (assistance to agriculture) are also significant, although (as noted above) within a smaller sample of 154 and 152 observations, respectively. The environmental variable *maleco* (malaria ecology) also has a strong correlation with *st2sd*, while the cultural gender norms variable *sexrt5, lqi* (inherent land quality), and the cereal price variable *cprice5* have somewhat weaker but still significant correlations. Again, all of these correlations are in the expected direction. The fertilizer price variable *ftprice5* and the two macroeconomic circumstances variables *inflat5* and *incgr5* do not have significant bivariate correlations with *st2sd*.

Among political factors, the executive ideology variable *exid10* does not have a significant association with stunting, although its longer-term counterpart *exid20* is weakly but significantly correlated. The other political variables show a stronger relationship with child nutrition. The democratization variables *polity10* and *polity20* have associations of moderate strength, particularly the longer-term variable. The executive index of electoral competitiveness variables *eiec10* and *eiec20* are also moderately correlated with stunting, with the longer-term variable again showing a stronger relationship. The political stability variable *conflict5* and the fractionalization variable *elfviii* also have a moderate association with nutritional outcomes. The correlations for democratization, electoral competitiveness, conflict, and ethno-linguistic fractionalization are all in the expected direction.

Strong correlations between four potential explanatory variables – *loginc5, depend5, water,* and *educ5* – are of special concern in terms of multicollinearity biasing parameter estimates in the multivariate analysis that follows. To test for potential problems, collinearity diagnostics were performed on these variables, using a subset of 306 observations containing values for all four variables. The results are given below in Table 13.

Table 13. Collinearity diagnostics for *loginc5, depend5, water, educ5*.

(obs=306)

Collinearity Diagnostics

Variable	VIF	SQRT VIF	Tolerance	R-Squared
loginc5	2.57	1.60	0.3892	0.6108
depend5	2.29	1.51	0.4362	0.5638
water	2.39	1.55	0.4186	0.5814
educ5	1.66	1.29	0.6029	0.3971
Mean VIF	2.23			

The table above shows that multicollinearity is not likely to be a major issue with this set of variables: each has a variance inflation factor (VIF) of less than 10 and a tolerance above 0.1, the thresholds which would indicate that the variable could be interpreted as a linear function of the other variables.

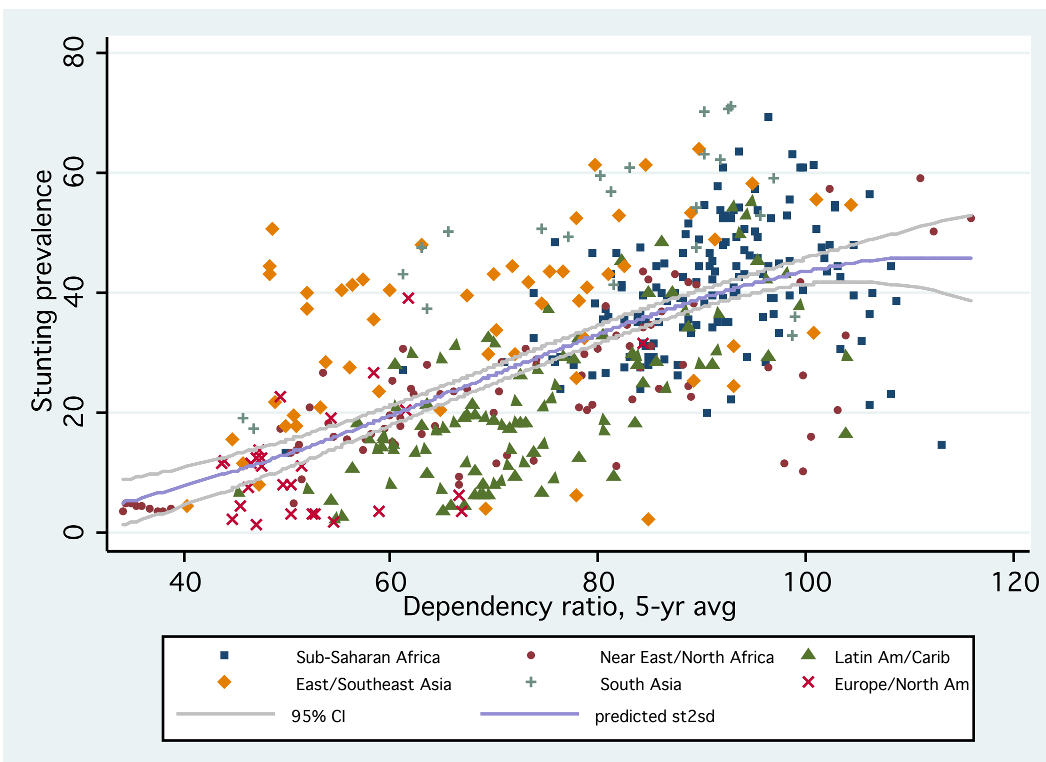
The following sections examine the bivariate relationships between total stunting prevalence (*st2sd*) and each of the 22 independent variables listed above, and extend the simple correlation analysis of this section by identifying potential non-linearities in the relationships.

2. Household Dependency Ratio

Household dependency ratio has a strong bivariate relationship with *st2sd*. The relationship is as expected: increasing household dependency ratios are associated with higher stunting rates. Again, because *depend5* uses lagged values, the potential for reverse causation of stunting is reduced. Additionally, because the within-country variation (i.e., variation over time) in *st2sd* is adequate (see Table 7), the correlation between past values of *st2sd* and *depend5* is less problematic.

Figure 24 shows a scatterplot of *depend5* against *st2sd*, with observations classified by macro-region. With the exception of East/Southeast Asia, there is a distinct clustering of observations by region. The plot is fitted using a fractional polynomial trend line; the trend indicated is generally linear. It is worth noting that this two-dimensional graph, and all the bivariate graphs that follow, do not take into account for conditioning factors that may alter the observed relationship; the multivariate models in the next section include controls.

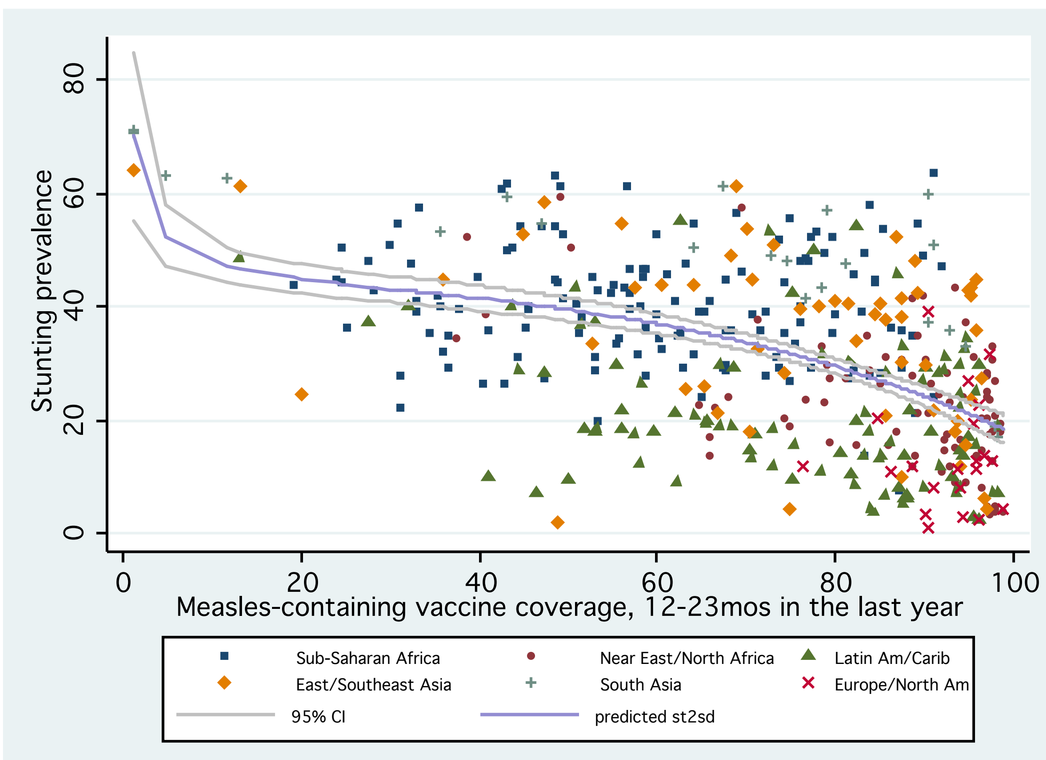
Figure 24. Household dependency ratio vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



3. Measles Vaccination Coverage

Measles vaccination coverage has a strong bivariate relationship with *st2sd*. The relationship is as expected: greater coverage of measles-containing vaccine interventions over the preceding five years – a proxy for government maternal/child health policy – is associated with better stunting outcomes. Figure 25 shows a scatterplot of *mvacc5* against *st2sd*, with observations classified by macro-region. The trend indicated is generally linear except for the few observations with MCV coverage below 20 percent.

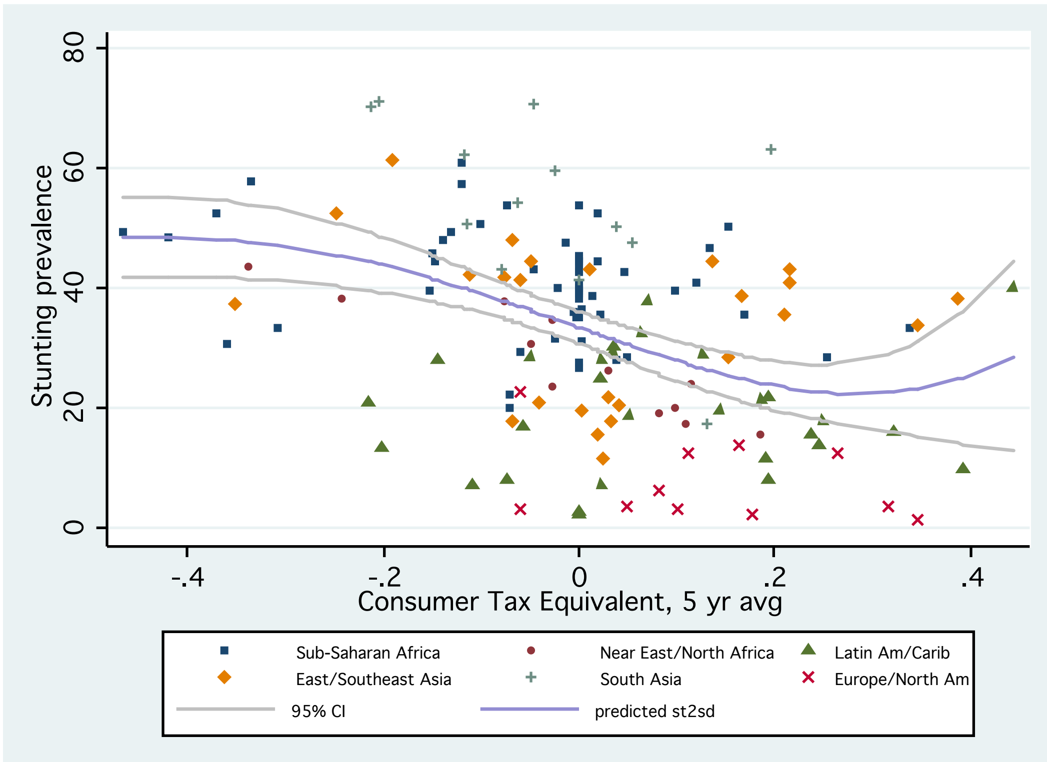
Figure 25. Measles vaccination coverage vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



4. Consumer Tax Equivalent

Consumer tax equivalent (CTE) has a moderately strong bivariate relationship with *st2sd*. Figure 26 below shows a scatterplot of *cte5* against *st2sd*, with observations classified by macro-region. The trend indicated is generally linear between the CTE values of -0.5 (indicating a consumer subsidy equaling 50% of grain price) and +0.5 (indicating a consumer tax equaling 50% of grain price), where 96% of the 154 *cte5* observations lie; data points outside this range are excluded. The relationship, however, is not in the expected direction: greater taxation of consumers is associated with lower stunting. However, there does appear to be high variation of *st2sd* in country-years where the degree of government consumer price interventions is relatively mild (that is, around zero).

Figure 26. Consumer tax equivalent vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



5. Cereal Prices

Cereal prices – i.e., the average aggregate price of wheat, rice, and maize, weighted by consumption share of each cereal in low-income food deficit countries – have a significant but weak bivariate relationship with *st2sd*. Figure 27 and Figure 28 show scatterplots of *cprice5* against *st2sd*, with observations classified by decade; the first graph is for all data points, and the second is for the 1990s and 2000s only, in which 86% of the observations fall. The trend indicated is generally linear but the association is clearly weak.

Figure 27. Cereal prices vs. stunting prevalence scatterplot with fractional polynomial trend line, all decades, and 95% confidence intervals.

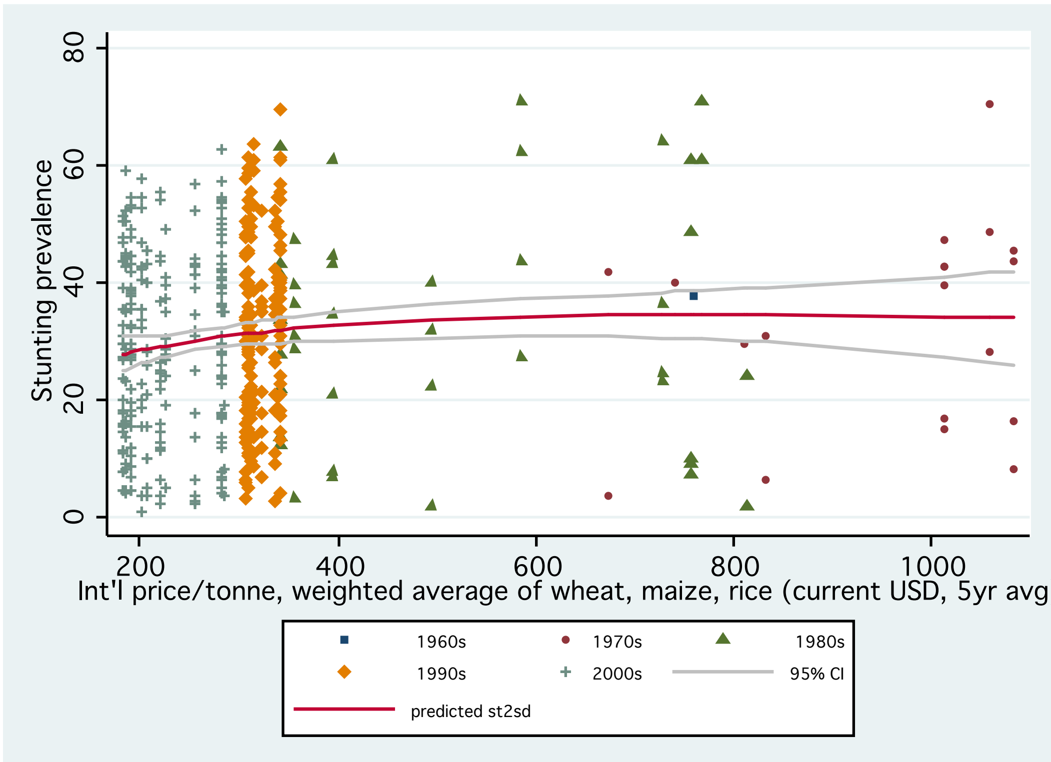
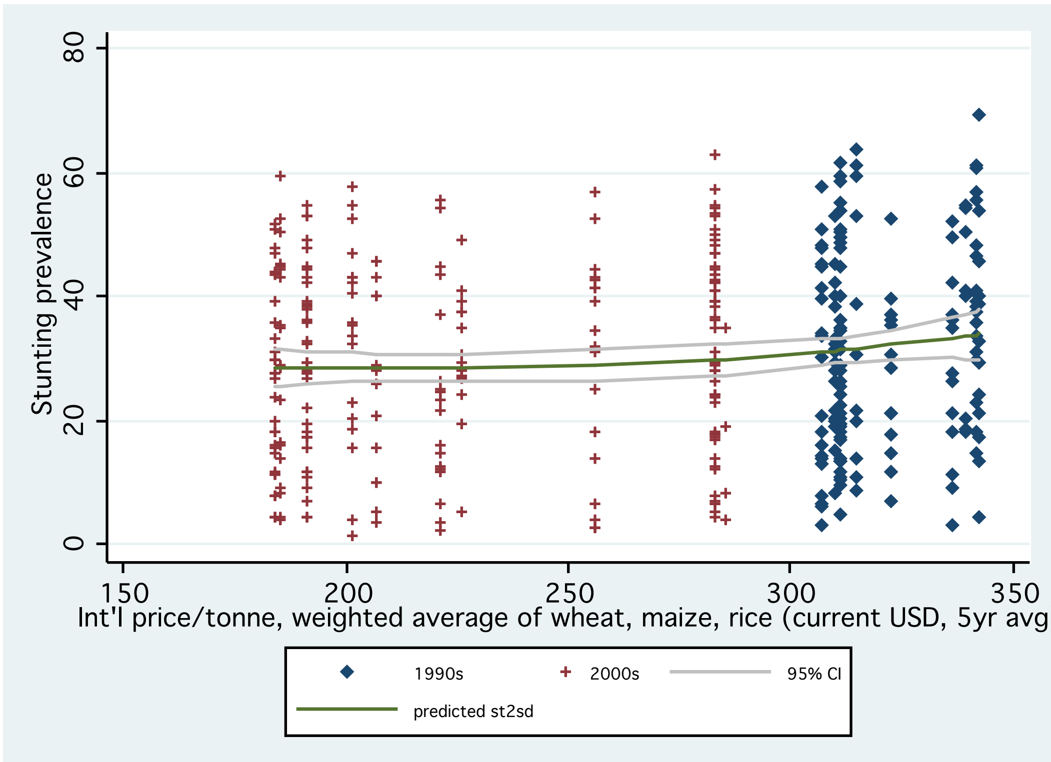


Figure 28. Cereal prices vs. stunting prevalence scatterplot with fractional polynomial trend line, 1990s and 2000s only, with 95% confidence intervals.



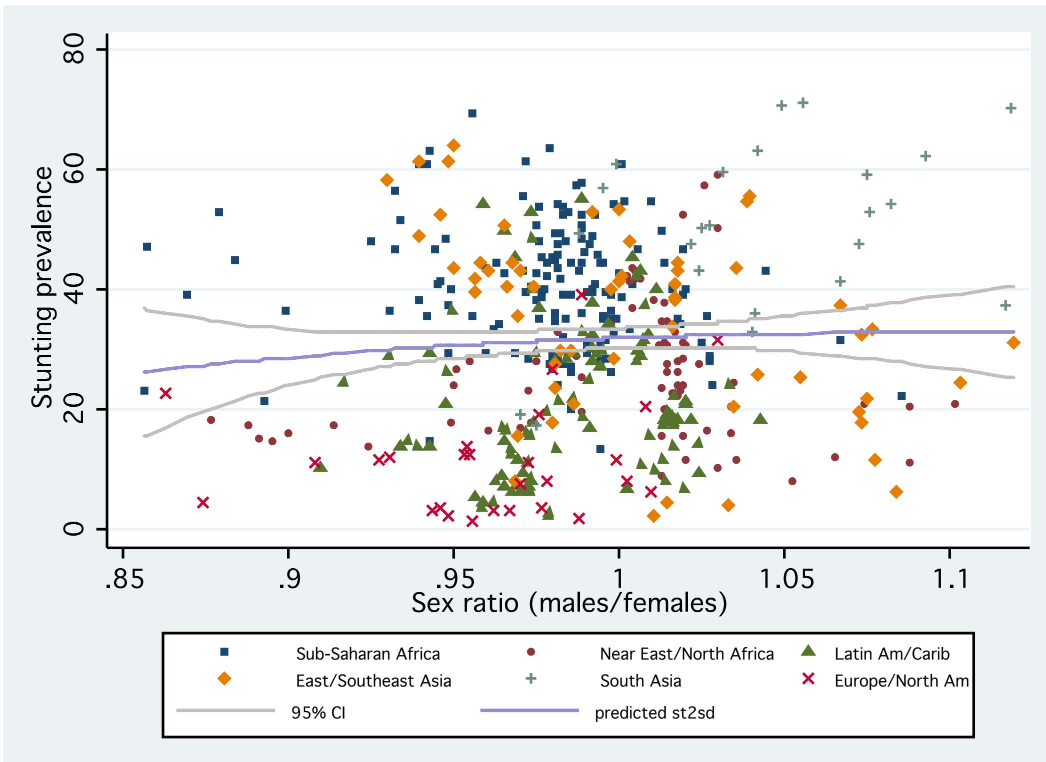
6. Sex Ratio

Sex ratio has a weak but significant bivariate relationship with *st2sd*. Figure 29 below shows a scatterplot of *sexrt5* against *st2sd*, with observations classified by macro-region; 16 outlier Gulf State observations, in which sex ratios are strongly inflated by migrant worker populations, are excluded.[26] The generally flat fractional polynomial trend line indicates the weak relationship between the

[26] The following observations are excluded: Kuwait (1994, 1996, 2001-2009); Bahrain (1989, 1995); Oman (1999); Saudi Arabia (1994, 2004). Each of these countries have sex ratios above 1.2, my chosen cutoff for exclusion, and Kuwait has sex ratios between 1.46 and 1.55; no other country in the dataset has a sex ratio above 1.12.

variables, although higher sex ratios – that is, a greater bias against females in the population – are indeed significantly associated with higher stunting rates.

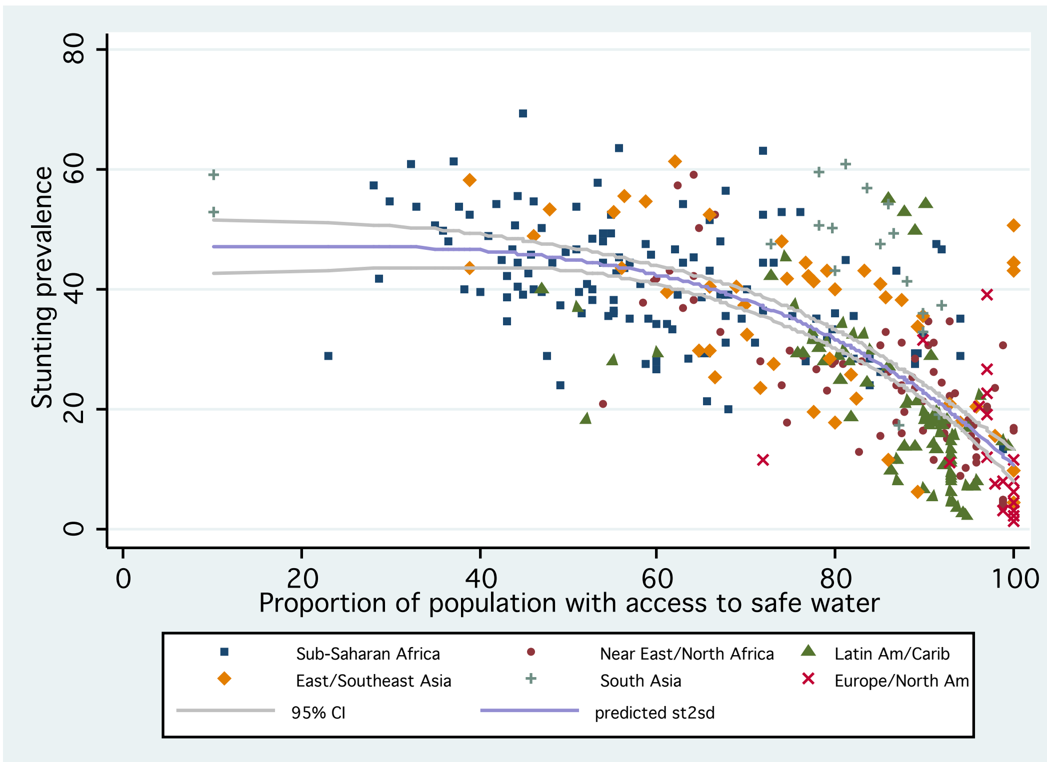
Figure 29. Sex ratio in population vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



7. Access to Safe Water

The proportion of population with access to safe water variable has a strong bivariate relationship with *st2sd*. Figure 30 below shows a scatterplot of *water* against *st2sd*, with observations classified by macro-region. The trend appears to nonlinear, with an accelerating drop in stunting as safe water access nears universal coverage. There is less regional clustering than with most of the other dependent variables, especially in the Sub-Saharan Africa, East/Southeast Asia, and Near East/North Africa regions.

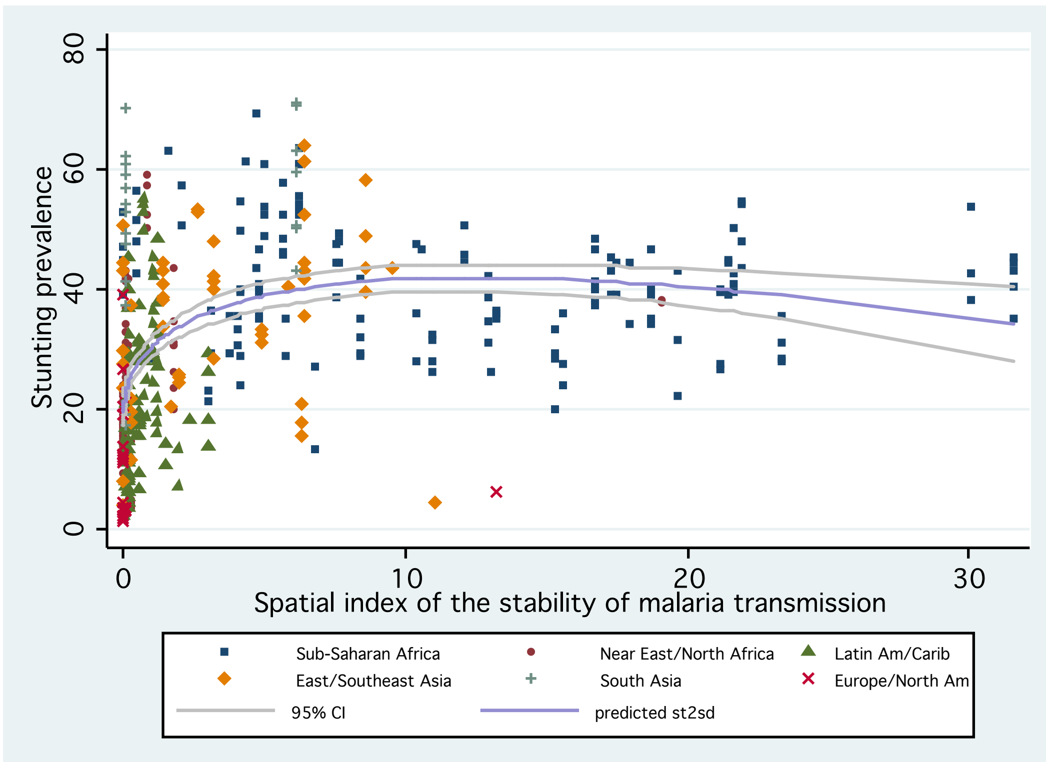
Figure 30. Access to safe water vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



8. Malaria Ecology

The malaria ecology variable has a moderately strong bivariate relationship with *st2sd*. Figure 31 below shows a scatterplot of *maleco* against *st2sd*, with observations classified by macro-region. The trend indicated is nonlinear, rapidly increasing as levels of malaria risk go from zero to moderate, but remaining constant as risk goes from moderate to high. The initially increasing trend appears to largely be a regional effect, with Sub-Saharan countries having both high stunting prevalence and a higher malaria risk.

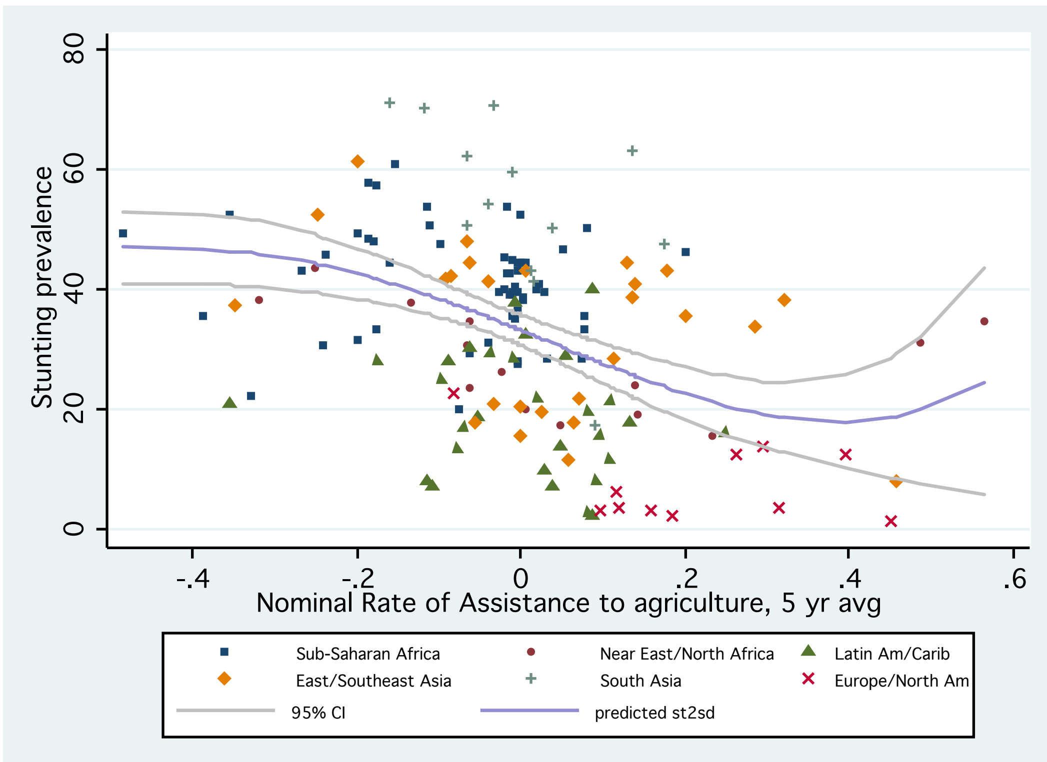
Figure 31. Malaria ecology vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



9. Nominal Rate of Assistance to Agriculture

The nominal rate of assistance to agriculture has a strong bivariate relationship with *st2sd*. Figure 32 below shows a scatterplot of *nra5* against *st2sd*, with observations classified by macro-region. One extreme outlier has been excluded: the Netherlands in 1980, which had an *nra5* value of 0.89, over 35% higher than the next highest value of 0.57. The trend indicated is generally linear with most of the range of observations, and in the expected direction: greater assistance to agriculture is associated with lower stunting.

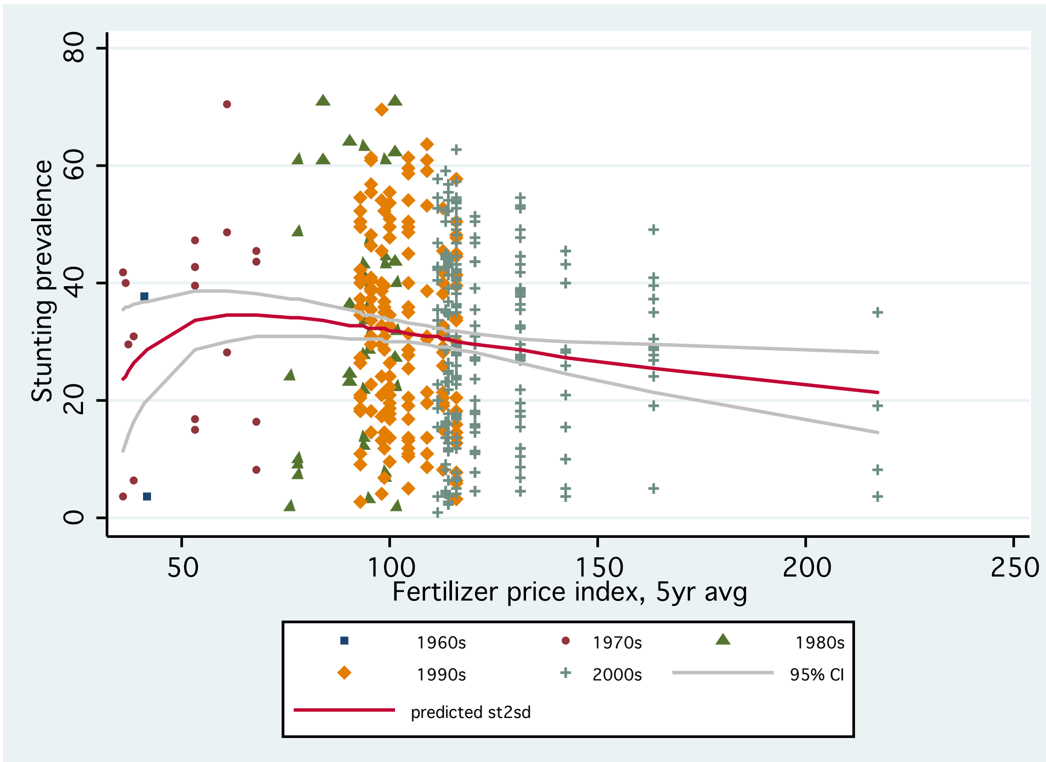
Figure 32. Nominal rate of assistance to agriculture vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



10. Fertilizer Prices

Fertilizer price has an insignificant bivariate relationship with *st2sd*. Figure 33 shows a scatterplot of *ftprice5* against *st2sd*, with observations classified by decade. The scatterplot and fit line confirm the lack of strong association between the variables.

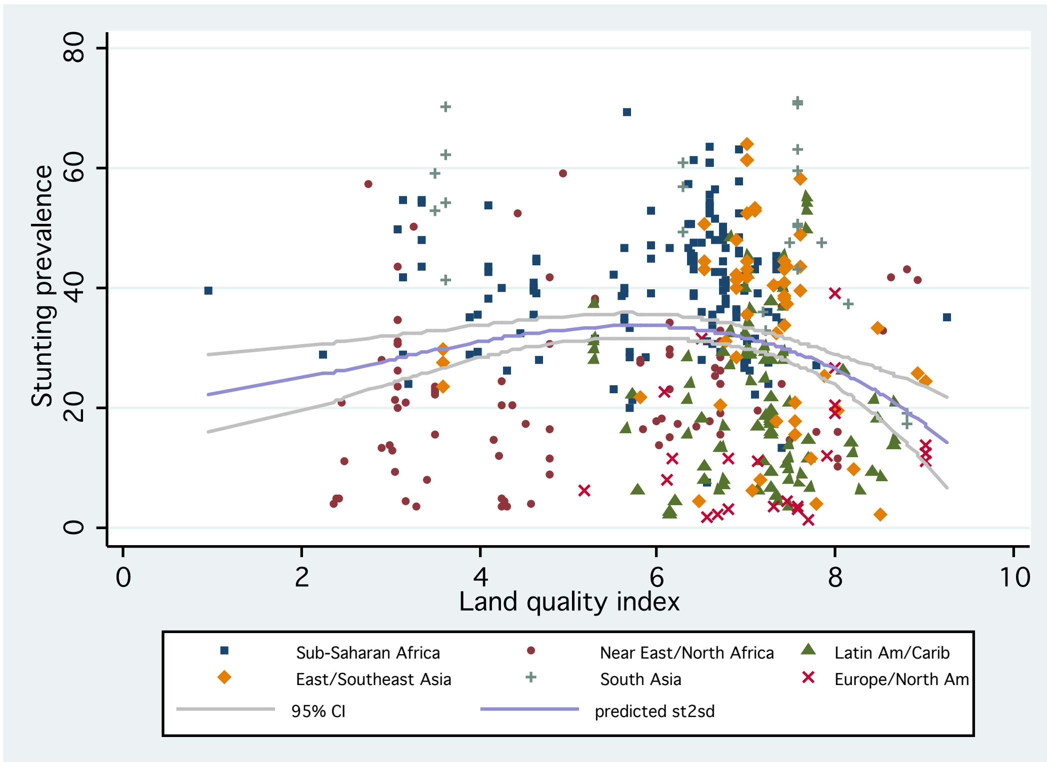
Figure 33. Fertilizer prices vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



11. Inherent Land Quality

Inherent land quality has a weak but significant bivariate relationship with *st2sd*. Figure 34 below shows a scatterplot of *lqi* against *st2sd*, with observations classified by macro-region. The relationship appears to be nonlinear: the index appears to have little correlation with stunting at low and moderate levels of land quality, but at high levels of land quality increasing values are associated with improvements in nutrition.

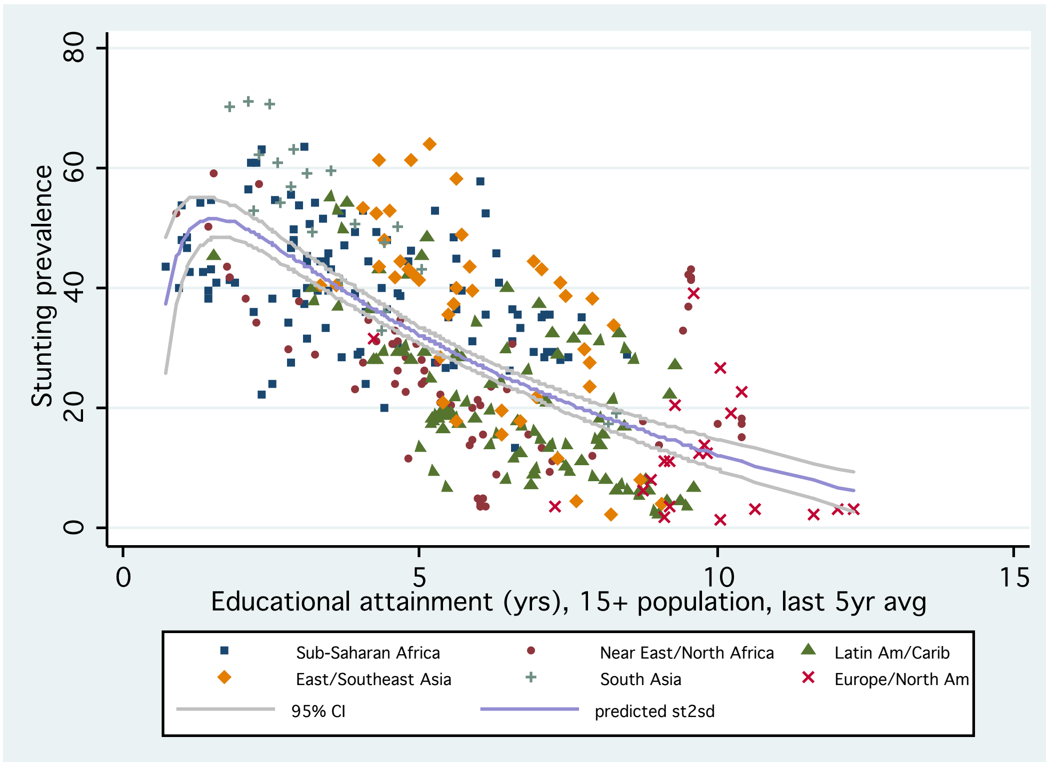
Figure 34. Inherent land quality index vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



12. Educational Attainment

Educational attainment has a strong bivariate relationship with *st2sd*. Figure 35 shows a scatterplot of *educ5* against *st2sd*, with observations classified by macro-region. With the exception of a cluster of observations at very low levels of educational attainment, the trend indicated is generally linear, with increasing levels of educational attainment associated with lower levels of stunting.

Figure 35. Educational attainment vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



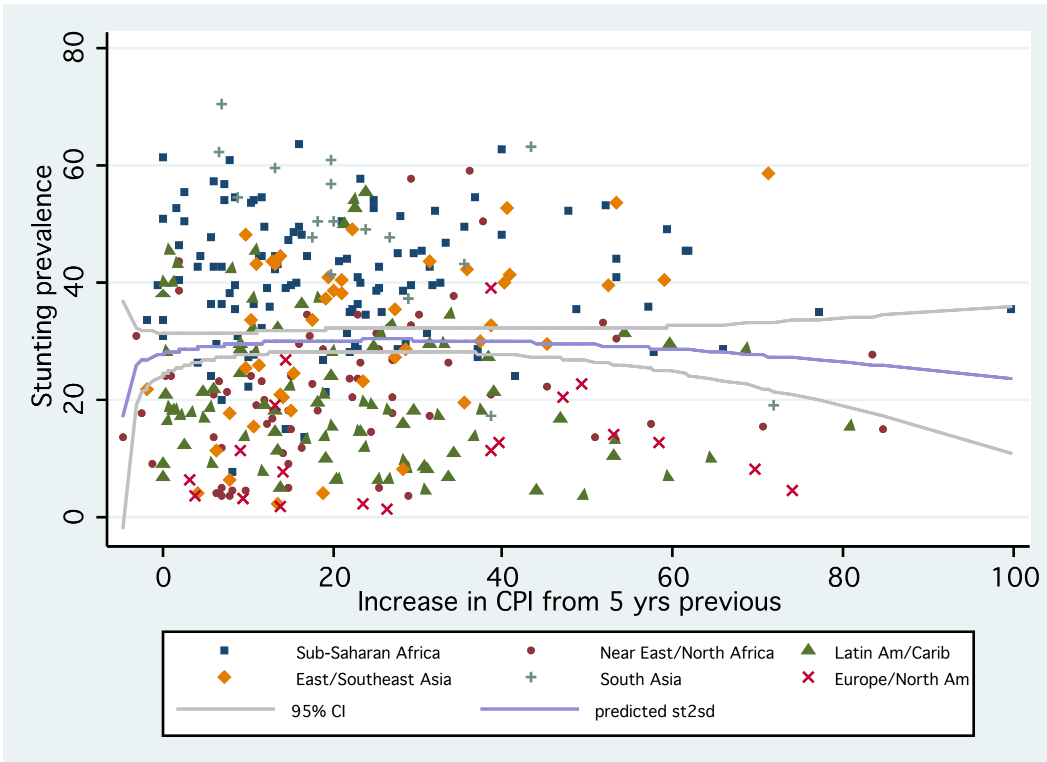
13. Change in Consumer Price Index

Recent trends in inflation have an insignificant bivariate relationship with *st2sd*. Figure 36 shows a scatterplot of *inflat5* (change in consumer price index over the latest five years) against *st2sd*, with observations classified by macro-region.[27] The scatterplot and fit line illustrate the lack of strong relationship between the two variables.

---

[27] One extreme outlier observation with respect to inflation – Niger 1992 – has been excluded. In this year, Niger had an inflation rate of -10.52; the next lowest inflation observation in the dataset is -4.53, and only 8 of the 363 observations with inflation values are negative.

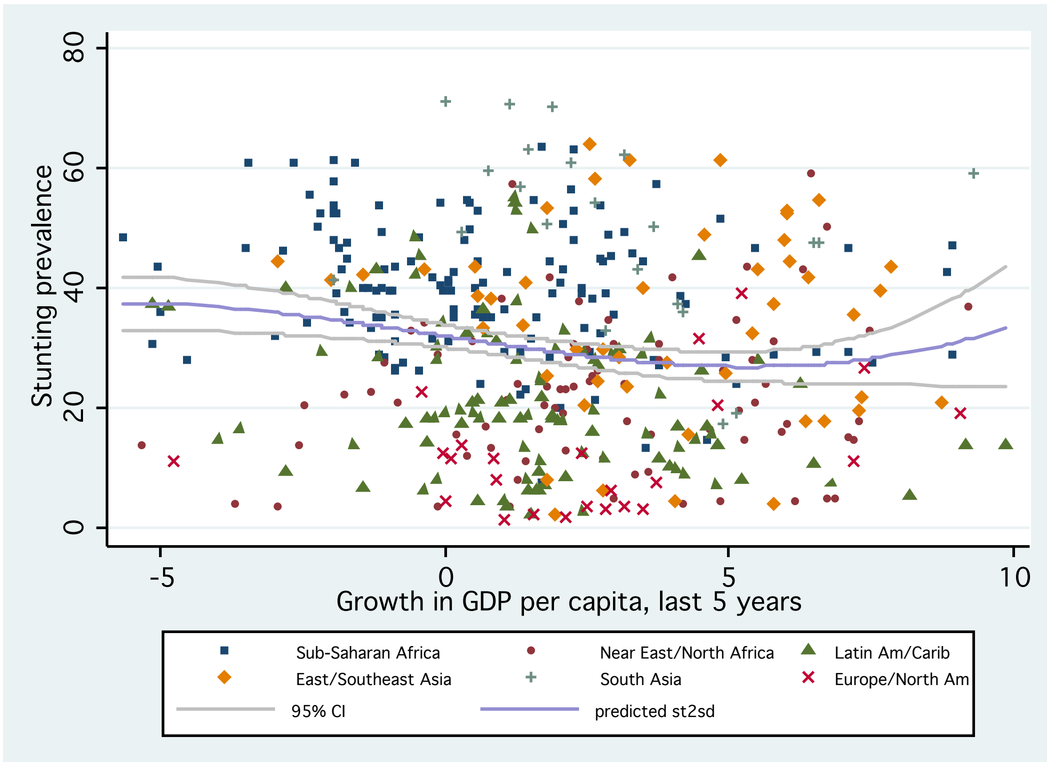
Figure 36. Inflation vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



14. Economic Growth

Recent economic growth has an insignificant bivariate relationship with *st2sd*. Figure 37 below shows the scatterplot of *incgr5* against *st2sd*, with observations classified by macro-region. The graph eliminates outliers, the 31 country-year observations with annual economic growth rates of less than -5% or greater than 10%, most of which are associated with conflict or recovery from conflict. The scatterplot and fit line suggest an ambiguous relationship between recent economic growth and stunting outcomes.

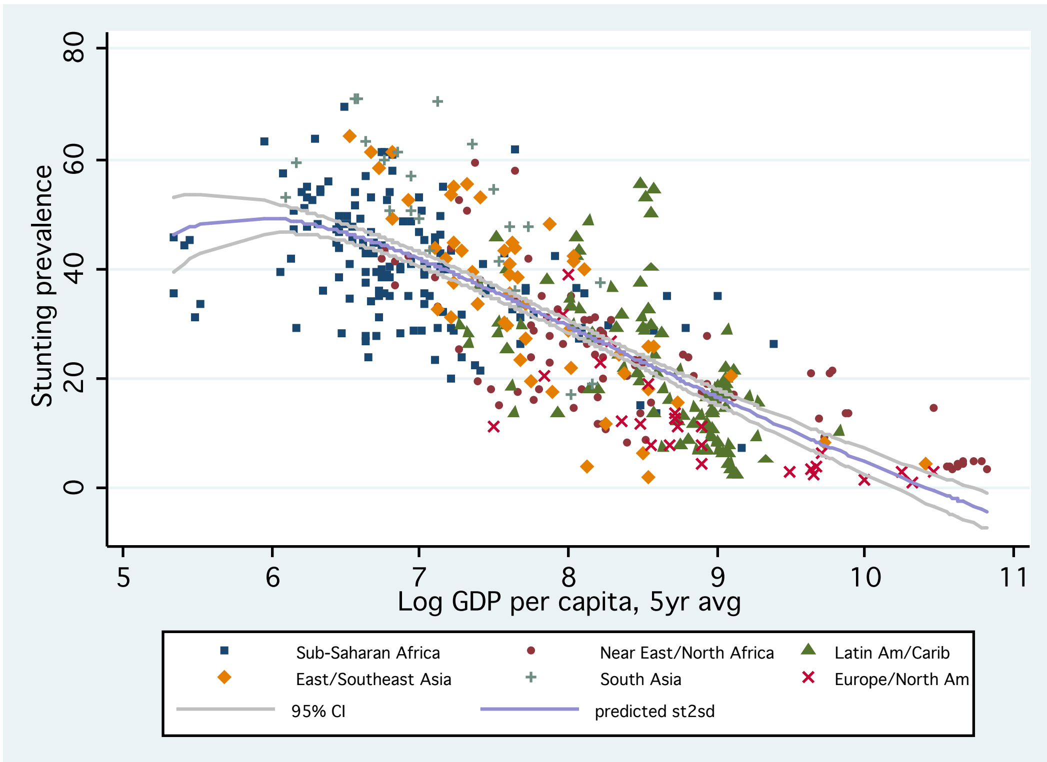
Figure 37. Recent economic growth vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, outliers excluded.



15. GDP per Capita

Log GDP per capita has a strong bivariate relationship with *st2sd*. Figure 38 shows a scatterplot of *loginc5* against *st2sd*, with observations classified by macro-region. The relationship is clear and in the expected direction, with increases in income associated with lower stunting rates.

Figure 38. Log GDP per capita vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals.



16. Executive Ideology

Executive ideology, measured both in terms of a 10-year and a 20-year retrospective timeframe, has a very weak bivariate relationship with child stunting, and is only significant over the longer time frame. Figure 39 and Figure 40 below show scatterplots of both *exid10* and *exid20* against *st2sd*, with observations classified by macro-region.

Figure 39. Executive ideology (10-year retrospective) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.

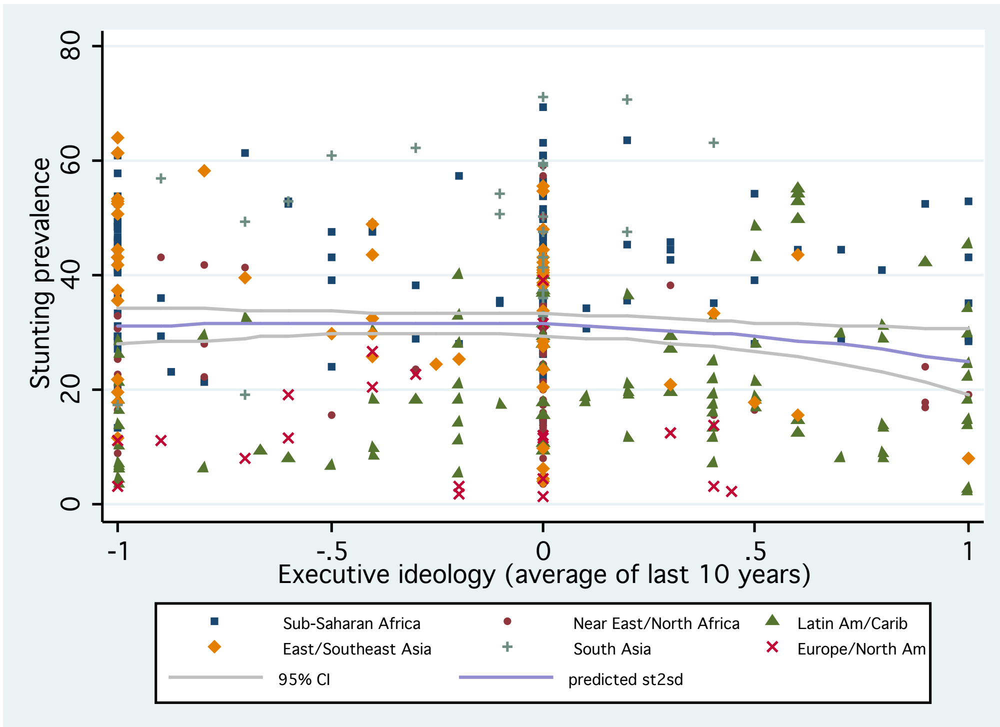
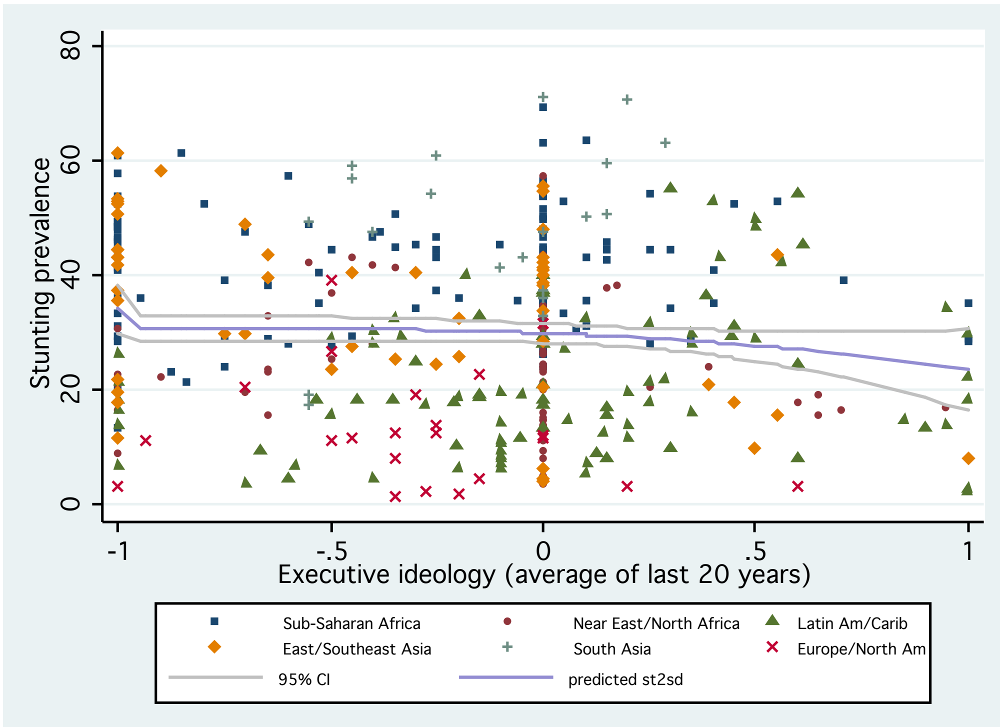


Figure 40. Executive ideology (20-year retrospective) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.



17. Democratization

Democratization, measured both in terms of a 10-year and a 20-year retrospective timeframe, has a moderately strong bivariate relationship with *st2sd*; the longer time frame variable *polity20* is more strongly correlated. Figure 41 and Figure 42 below show scatterplots of both *polity10* and *polity20* against *st2sd*, with observations classified by macro-region. The fractional polynomial trend line appears to show a non-linear relationship, with a negative association between democratization and stunting appearing only at higher levels of democratization.

Figure 41. Democratization (10-year retrospective) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.

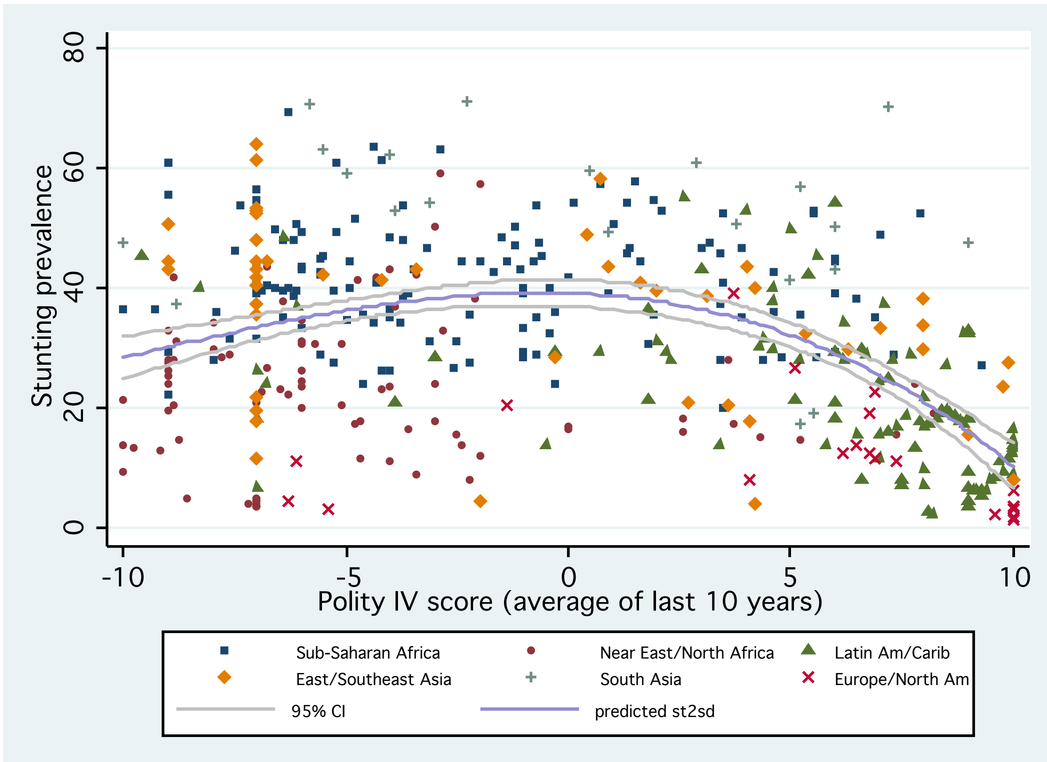
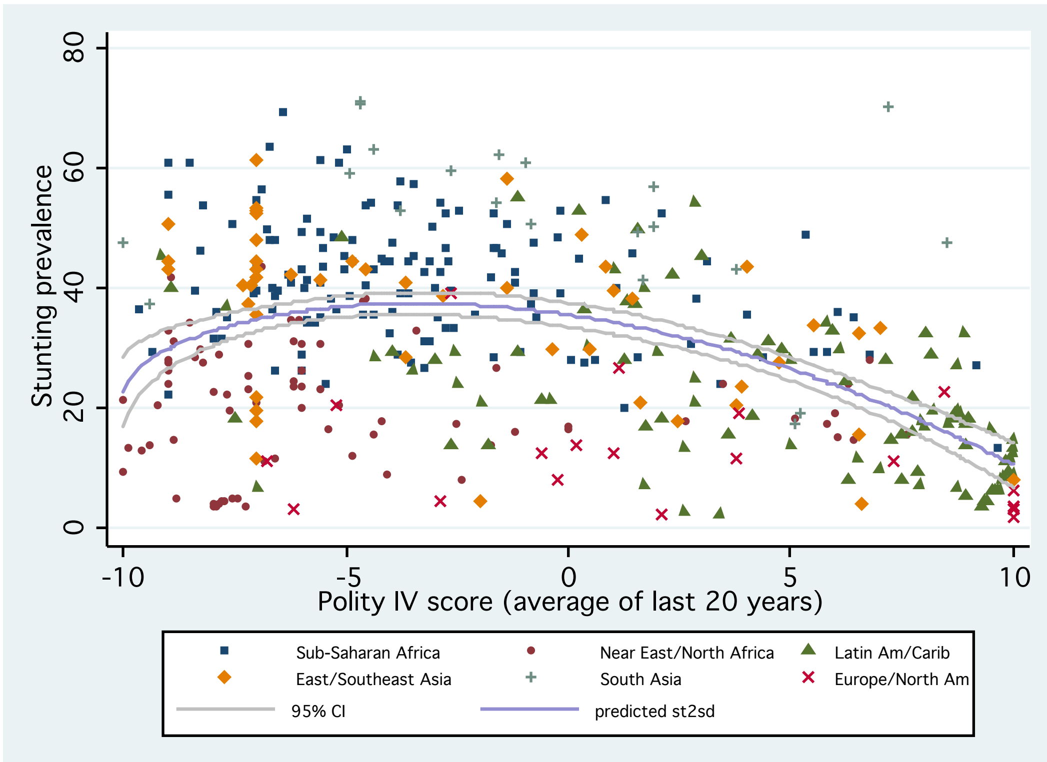


Figure 42. Democratization (20-year retrospective) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.



18. Electoral Competitiveness

Electoral competitiveness has a similar relationship as democratization with child nutrition. Measured both in terms of a 10-year and a 20-year retrospective timeframe, electoral competitiveness has a moderately strong bivariate association with *st2sd*, with the longer time frame variable *eiec20* more strongly correlated (Figure 43 and Figure 44). Again, the trend lines appear to show a non-linear relationship between the electoral competitiveness variables and stunting, with greater competition leading to falls in stunting only at higher levels of competition.

Figure 43. Executive index of electoral competitiveness (10-year retrospective) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.

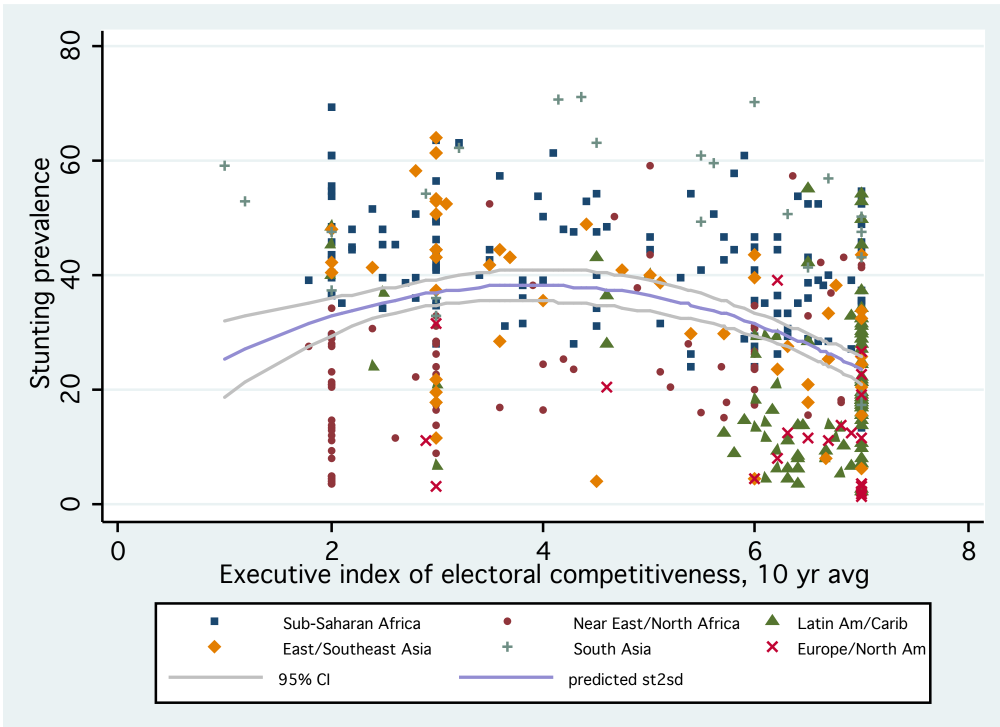
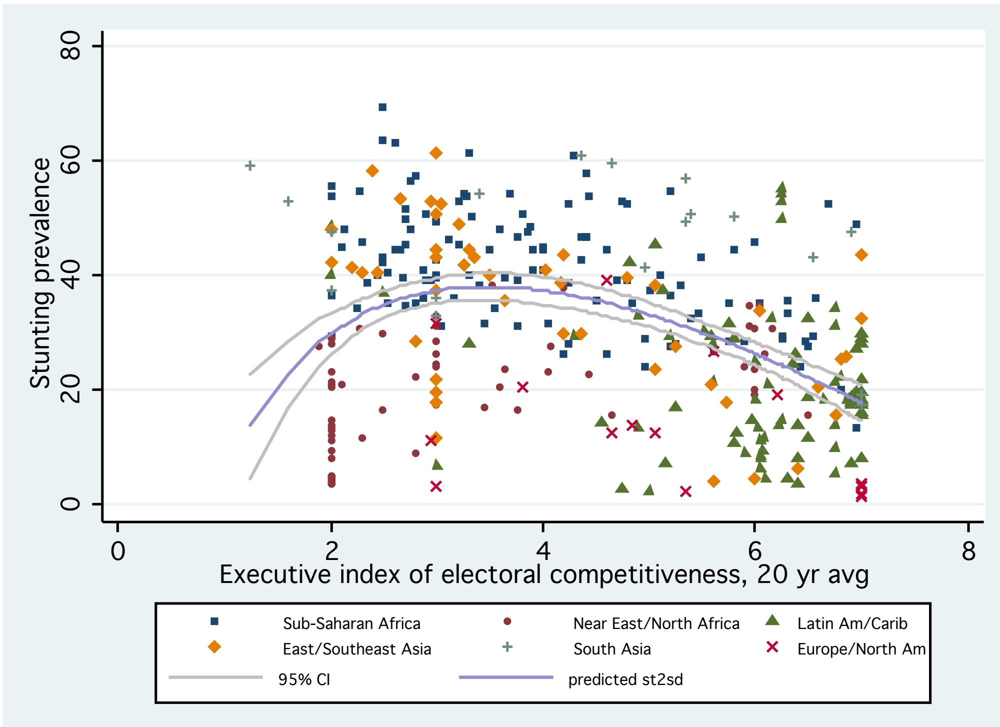


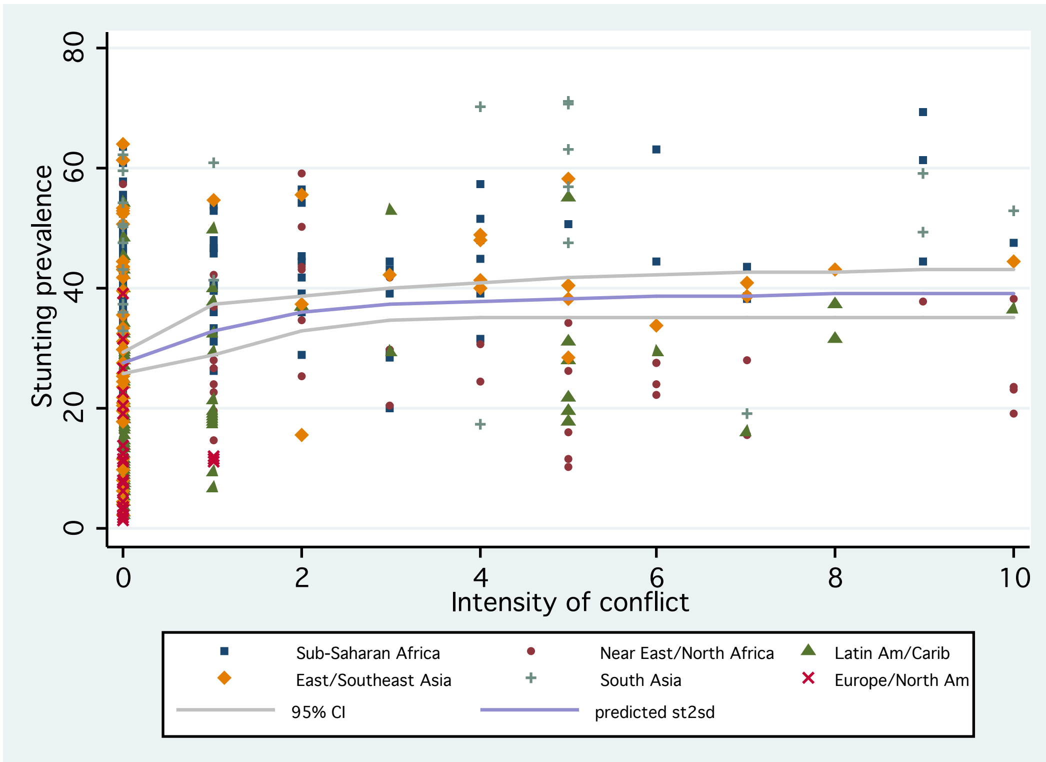
Figure 44. Executive index of electoral competitiveness (20-year retrospective) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.



19. Conflict

Presence of conflict has a significant bivariate relationship with *st2sd*, but the association is largely at the lower levels of violence (the range between 0 and 999 battle-related deaths in the past year, averaged over the previous five years). Figure 45 below shows a scatterplot of *conflict5* against *st2sd*, with observations classified by macro-region. The relationship is in the expected direction, with increases in conflict intensity associated with high stunting.

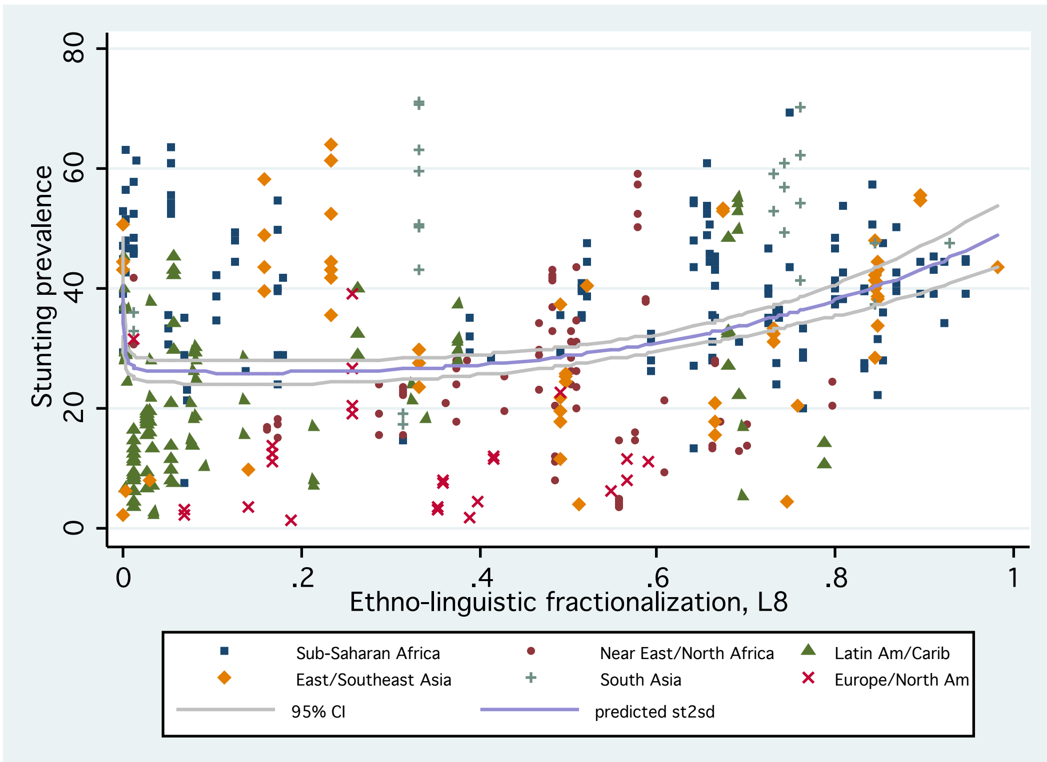
Figure 45. Conflict intensity (averaged over five years before stunting observation) vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.



20. Ethno-linguistic Fractionalization

Ethno-linguistic fractionalization, a measure of political stability, has a moderately strong bivariate relationship with *st2sd*. Figure 46 below shows a scatterplot of *elfviii* against stunting, with observations classified by macro-region. The relationship is roughly linear, though little correlation between the two variables exists until ethno-linguistic fractionalization reaches moderate levels, after which the variable has a positive correlation with *st2sd*: as fractionalization increases, stunting worsens.

Figure 46. Ethno-linguistic fractionalization vs. stunting prevalence scatterplot with fractional polynomial trendline and 95% confidence intervals.



C. Multivariate Results

The following section estimates parameters for each of the independent variables discussed above. Eleven different specifications, the first six based on the Equation (19) policy model and the next five on the Equation (20) political economy model, are estimated:

1) **Policy Model I, complete pooled OLS.** In this specification, all 14 independent variables are included. Because of the data limitations of the *cte5* and *nra5* variables, only 100 observations are available in this specification. The

results are provided here for the purpose of comprehensiveness, but the small sample size greatly reduces the reliability of the parameter estimates.

2) **Policy Model II, reduced pooled OLS (without *cte5* and *nra5*).** Because *cte5* and *nra5* are found to be insignificant predictors of *st2sd* even at the 90% level, and because exclusion of these variables allows expansion of the dataset from 100 to 267 observations, a smaller second model is estimated. However, to assess the robustness of this smaller model, it is also estimated with the same "small sample" set of 100 observations as Policy Model I.

3) **Policy Model III, reduced pooled OLS with nonlinear terms.** In this specification, nonlinear terms for the three variables hypothesized on the basis of the bivariate analysis to have a nonlinear relationship with *st2sd – water, maleco,* and *lqi* – are included in addition to the 14 independent variables.

4) **Policy Model IV, reduced with random effects.** The first three specifications are based on pooled OLS estimation; Policy Model IV is a random effects model. The choice of a random effects model over a fixed effects model is justified within this section.

5) **Policy Model V, reduced Pooled OLS, dependent variable for <u>male children only</u>.** This model repeats the specification in Policy Model IV, but uses stunting prevalence data for male children only. Note that Pooled OLS Policy Models I, II, and III were attempted for gender-disaggregated stunting rates, but no significant differences were found between male stunting and female stunting as a dependent variable.

6) **Policy Model VI, reduced Pooled OLS, dependent variable for <u>female children only</u>.** This model is identical to Policy Model V with the exception that stunting prevalence data for female children only is used.

7) **Political Economy Model I, pooled OLS.** In this specification, all 13 independent variables in Equation (20) are included, including the political variables. The results for only the longer-term 20-year political variables *exid20, polity20,* and *eiec20* are presented in this and the following models; the shorter-term 10-year variables were tested, but had weaker associations with stunting in every model attempted. 290 observations were available for this model, as well as for Political Economy Model II below.

8) **Political Economy Model II, pooled OLS with nonlinear terms.** In this specification, quadratic terms for the two variables hypothesized on the basis of the bivariate analysis to have a nonlinear relationship with *st2sd* – *polity20* and *eiec20* – are included in addition to the 13 independent variables. These are labeled, respectively, *pol20sq* and *eiec20sq*.

9) **Political Economy Model III, random effects.** The first two political model specifications are based on pooled OLS estimation. Political Model III is a random effects model; 94 countries (a total of 292 observations) are used for this model.

10) **Political Economy Model IV, Pooled OLS, male children only.** This model repeats the specification of Political Model II with the dependent variable as male stunting only.

11) **Political Economy Model V, Pooled OLS, female children only.** This model is identical to Political Model IV with female stunting as the dependent variable.

In all models, a *year* variable is included to control for unobserved time-trend effects. In all models, the key policy or political economy variables of interest appear first in the dependent variable list. Heteroscedasticity-robust standard errors are used in all models. Unit-specific and standardized coefficients are shown for the first three models. Comparative results of the models are given at the end of the Policy Model and Political Economy Model sections.

1. Policy Model I, Complete Pooled OLS

The pooled OLS estimation results for Policy Model I are discussed below.

Due to the inclusion of *cte5* and *nra5*, for which a limited set of data points is available, the number of observations in the sample is 100. In the model, *educ5* is the only policy variable that is statistically significant at the 95% level; the coefficient estimate suggests that a one-year increase in educational attainment is associated with a nearly two-percentage point drop in stunting (95% CI: -2.98, -0.65). Among the control variables, *maleco* and *loginc5* are the only significant variables, and *maleco* in the "wrong" direction, as discussed at greater length in the Model II section below. *Cte5* and *nra5* are insignificant. The overall explanatory power of the model is strong; nearly 74% of the variation in *st2sd* is explained by the included variables. The time trend variable is insignificant, suggesting that the included variables are picking up most of time-related influences on stunting prevalence.

Table 14 below shows the standardized coefficients for the variables included in Policy Model I. Standardized coefficients are generated by converting the variances of all included variables to a common value of one. This changes the interpretation of the coefficient estimate, which now represents the change in *st2sd* associated with a one standard deviation increase in each independent variable. Using standardized coefficients allows comparison of the relative strength of association between each variable and *st2sd*, since the coefficient estimates are no longer represented in different units of measurement.

Table 14. Standardized coefficients of all variables in Policy Model I, cross-country.

```
Linear regression                                      Number of obs =     100
                                                       F( 16,    83) =   19.21
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.7374
                                                       Root MSE      =  7.7753
```

st2sd	Coef.	Robust Std. Err.	t	P>|t|	Beta
mvacc5	.1062369	.0757347	1.40	0.164	.1293186
water	-.148288	.1022514	-1.45	0.151	-.1738428
educ5	-1.819203	.5872403	-3.10	0.003	-.2734378
cte5	-5.060422	5.698731	-0.89	0.377	-.0878002
nra5	8.767394	7.45872	1.18	0.243	.1063001
depend5	.0611859	.1021157	0.60	0.551	.0746768
cprice5	-.0392857	.053605	-0.73	0.466	-.1716207
sexrt5	26.43238	29.77746	0.89	0.377	.0662241
maleco	-.3426455	.1380733	-2.48	0.015	-.1922297
ftprice5	.2597454	.2264882	1.15	0.255	.2296651
lqi	.6743112	.632983	1.07	0.290	.063759
inflat5	-.0064409	.0643464	-0.10	0.921	-.008032
incgr5	-.3754074	.3451385	-1.09	0.280	-.0926756
loginc5	-8.638036	2.01696	-4.28	0.000	-.5976561
conflict5	.1866968	.2577315	0.72	0.471	.0375561
year	-1.253744	1.035045	-1.21	0.229	-.4623469
_cons	2567.488	2052.811	1.25	0.215	.

The standardized ("beta") coefficients are given in the right-most column. The table shows that, of the three variables found to be significant at the 95% level, a one standard deviation increase in *loginc5* has an effect about twice as strong as a similar increase in *educ5*, the next strongest variable, and three times as strong as *maleco*.

2. Policy Model II, Reduced

I now discuss the estimation results for the second model, which is equivalent to Policy Model I except for the exclusion of *cte5* and *nra5*.

The expansion of the sample from 100 to 267 observations, and the exclusion of *cte5* and *nra5*, changes the estimation results considerably. The *water* policy variable is now significant at the 95% level, although the effect appears moderate; a 10-percentage point increase in safe water coverage is associated with a 1.5 percentage point decrease in stunting (95% CI: -2.5, -0.4). *Educ5* retains its strong impact. The health policy variable *mvacc5* remains insignificant.

Several control variables show strong associations. The coefficient estimate on *depend5*, household dependency ratio, increases to 0.23, suggesting that a 1-unit increase in dependency ratio is associated with about a quarter-percentage point higher stunting prevalence (95% CI: 0.11, 0.36). It should be noted that the bivariate correlation matrix (Table 12) shows that *depend5* has a relatively strong correlation with *nra5*, and to a lesser extent with *cte5*, which suggests that some of the "effect" of these latter two variables – if there would indeed be a significant effect in a large sample size than that tested by Policy Model I – may be picked up by *depend5*. A doubling of income per capita is associated with a seven-percentage point decline in stunting, a strong effect at lower levels of GDP per capita. Sex ratio and land quality are also significant predictors of stunting, although their effects are weak. The *sexrt5* coefficient suggests that for every 10 additional males per 1000 females, stunting declines by just under 0.1 percentage point. The sign of the land quality index variable is not in the expected direction; a one-point increase in *lqi*, which is equivalent to about 14% of its range, is associated with a 0.8 percentage point higher stunting prevalence. As discussed below in Policy Model III's section, this "wrong" sign is likely due to the fact that *lqi* has a non-linear relationship with *st2sd*.

The *maleco* variable is also strongly significant, but not in the expected direction. Unlike the bivariate relationship between *maleco* and *st2sd*, in this multivariate model an increase in *maleco* – that is, a worsening of malaria risk – is associated with <u>lower</u> stunting, controlling for the other key determinants. It may be that *maleco* is proxying for other ecological variables that increase agricultural productivity, but the inclusion of *lqi* in the regression reduces this possibility. The same regression as in Model II with temperature, precipitation, and latitude variables included does reduce the parameter estimate on *maleco* considerably, suggesting that this proxy effect is occurring, but the variable remains significant in the "wrong" direction even in this expanded model. A more plausible explanation, explored below in the discussion of Policy Model III, is that the relationship between *maleco* and *st2sd* is, as in the case of *lqi*, non-linear. Conflict is significantly associated with stunting in the expected direction, but the effect is weak.

Table 15 shows standardized coefficients for Model II. *Loginc5* has the most powerful standardized effect, again about twice as strong as *educ5* and *depend5*, three times as strong as *water,* and seven times as strong as *lqi* and *sexrt5*.

Table 15. Standardized coefficients of all variables in Model II, cross-country.

```
Linear regression                                      Number of obs =     267
                                                       F( 14,   252) =   92.88
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.7466
                                                       Root MSE      =  8.0173
```

st2sd	Coef.	Robust Std. Err.	t	P>|t|	Beta
mvacc5	.0336878	.0453241	0.74	0.458	.0383675
water	-.1464053	.0524029	-2.79	0.006	-.1647269
educ5	-1.772087	.3925743	-4.51	0.000	-.2492624
depend5	.2291766	.0591769	3.87	0.000	.2524506
cprice5	.0310813	.0346468	0.90	0.371	.1152859
sexrt5	9.852469	5.037635	1.96	0.052	.0706375
maleco	-.4180225	.0940163	-4.45	0.000	-.1775683
ftprice5	-.0835217	.0698924	-1.20	0.233	-.1015923
lqi	.7655856	.4044417	1.89	0.060	.0660521
inflat5	-.0081079	.0315888	-0.26	0.798	-.0091365
incgr5	.1947409	.164034	1.19	0.236	.0418171
loginc5	-7.063536	1.055116	-6.69	0.000	-.5018478
conflict5	.59563	.2125294	2.80	0.005	.0940563
year	.6453201	.56008	1.15	0.250	.2175301
_cons	-1215.39	1122.042	-1.08	0.280	.

Overall, Policy Model II has similar explanatory power to Policy Model I, with the included variables explaining nearly 75% of the variation in *st2sd*.

Does the exclusion of *cte5* and *nra5* introduce bias into the parameter estimates? One way to test this is to run Policy Model II with the same small sample used in Policy Model I, and compare the parameter estimates.

The results vary in some respects. *Loginc5* and the policy variable *educ5* retain their strong significance, as does *maleco*. The *water* variable remains significant at the 90% level (though not at the 95% level), and the magnitude of its coefficient increases slightly. *Lqi* and *sexrt5*, both of which had weak (if significant) associations with stunting in Policy Model II, lose their explanatory power in this small sample. The more troubling change is the loss of significance of the *depend5* variable, which had been strongly significant in the full version of Policy Model II.

Exclusion of *cte5* and *nra5* – that is, relegating them to the error term – will cause problems in the presence of either of two conditions: if these two variables are significantly associated with *st2sd* (in which case the explanatory power of the model is reduced) or if they are strongly correlated with the included variables (in which case parameter estimates will be biased). We found in Model I that *cte5* and *nra5* are individually not significant; we can also evaluate their joint significance by performing a Wald test. The second condition – extent of correlation with included variables – can be evaluated by running collinearity diagnostics on the variables in Policy Model I. The results of both exercises are shown below in Table 16 and Table 17.

Table 16. Wald test for joint significant of *cte5* and *nra5*.

```
 ( 1)  cte5 = 0
 ( 2)  nra5 = 0

       F(  2,    83) =    0.71
            Prob > F =    0.4935
```

Table 17. Collinearity diagnostics for Model I, cross-country.

Variable	VIF	1/VIF
year	52.99	0.018871
cprice5	19.89	0.050269
ftprice5	13.54	0.073871
depend5	4.11	0.243124
water	3.61	0.277019
cte5	3.44	0.290953
loginc5	3.35	0.298274
nra5	3.31	0.301676
mvacc5	2.88	0.347539
educ5	2.70	0.369879
maleco	2.62	0.382383
incgr5	1.55	0.645954
lqi	1.37	0.732342
inflat5	1.32	0.756057
sexrt5	1.32	0.759185
conflict5	1.24	0.809434
Mean VIF	7.45	

The Wald test indicates that we cannot reject the null hypothesis that the joint significance of *cte5* and *nra5* is equal to zero. The two variables appear not to be associated with *st2sd*. The collinearity diagnostics indicate that the only strong collinearity appears to be between the year variable and the cereal and fertilizer price variables, which is to be expected given the linear price trend over the time frame of the dataset; this issue is discussed further in Policy Model III below. There appear to be no collinearity problems with either *cte5* or *nra5*, or with other variables; the variance inflation factors are below 10 (i.e., tolerance is above 0.1).

The tests above thus suggest that exclusion of *cte5* and *nra5* in the following models is not likely to be problematic.

3. Policy Model III, Reduced Non-Linear

Policy Model III contains all variables in Policy Model II, but tests for quadratic non-linearities with respect to three variables: *water, maleco,* and *lqi*. The bivariate scatterplots suggest that these variables have nonlinear relationships with *st2sd*. The model below tests this hypothesis in the presence of other strong determinants.

The *water* and *lqi* relationships are modeled as quadratic (see Figure 30 and Figure 34), with the expectation that the *water* and *lqi* coefficients are of ambiguous sign (that is, at low levels of safe water coverage and land quality, increases in safe water coverage and land quality have little effect on stunting) but the water squared and lqi squared coefficients (*watersq* and *lqisq*) are expected to be negative, as increasing safe water coverage at high levels of safe water coverage, and increasing land quality at high levels of land quality, appear to (in the bivariate correlation matrix) have a strong association with lower stunting.

The *maleco* variable is modeled as cubic (see Figure 31). The expectation is that the coefficient on *maleco* is positive (at low levels of malaria transmission, increasing malaria risk is correlated with higher stunting); the coefficient on the squared variable (*malecosq*) is negative (the association weakens as malaria risk increases); and the coefficient on the cubed variable is expected to be ambiguous (as the bivariate graph suggests that the malaria risk-stunting relationship is weak or even negatively correlated at high levels of malaria transmission).

The *water* variable is not significant, but *watersq* is at the 90% level, and the sign of the squared term is negative as expected. All *maleco* variables are significant. As expected, the coefficient signs suggest that increases in malaria transmission are initially (i.e., at low levels of risk) associated with higher stunting, but the relationship then reverses among countries that have very high risk of malaria transmission. The *lqi* variables are significant, although the sign of association is different than expected. *Lqi* is strongly negative, implying that at low levels of land quality, improvements are associated with lower stunting. *Lqisq* is, unexpectedly, negative, although the coefficient on the quadratic term is much weaker than on *lqisq.* At the mean value of land quality (6.4), a one-point increase (or about 17% of the variable's range) is associated with a greater than six point decline in stunting, a very strong effect.

Controlling for the "appropriate" functional form of the three variables above changes the parameter estimates of other variables. *Sexrt5* becomes significant, although weakly so. A coefficient suggests that a 0.01 increase in *sexrt5* – that is, an increase in a country's sex ratio from an equal ratio to (say) 1010 males per 1000 females – is associated with a 0.14 percentage point increase in *st2sd* (95% CI: 0.04, 0.25). The conflict variable becomes significant, although again the strength of association is negligible. The magnitude of the coefficients on *educ5, depend5,* and *loginc5* are largely unchanged, though the association between income and stunting is slightly weakened. The rest of the included variables – *mvacc5, cprice5, ftprice5, inflat5, incgr5,* and *year* – remain insignificant. The persistent lack of association between *mvacc5* and *st2sd*, given their strong observed bivariate correlation, requires explanation. The probable reason for the lack of association is that the bivariate correlation observed earlier is a result of *mvacc5*'s strong correlation with other, more powerful explanatories; as seen in the correlation matrix (Table 12), *mvacc5* is correlated with nearly every other variable, and many of them very strongly, including *depend5, water, maleco, educ5,* and *loginc5.* Once these variables are included in the regression, *mvacc5* loses its explanatory power.

The standardized coefficient estimates of the variables in Model III are given in Table 18 below.

Table 18. Standardized coefficients of all variables in Model III, cross-country.

```
Linear regression                                      Number of obs =     267
                                                       F( 18,   248) =   81.88
                                                       Prob > F      =  0.0000
                                                       R-squared     =  0.7700
                                                       Root MSE      =   7.699
```

st2sd	Coef.	Robust Std. Err.	t	P>|t|	Beta
mvacc5	.0063873	.0422604	0.15	0.880	.0072746
water	.4774972	.3121874	1.53	0.127	.5372524
watersq	-.0042557	.0022163	-1.92	0.056	-.6891326
educ5	-1.623408	.3767047	-4.31	0.000	-.2283492
depend5	.2310605	.0576808	4.01	0.000	.2545258
cprice5	.0323307	.0342873	0.94	0.347	.1199204
sexrt5	14.4432	5.511354	2.62	0.009	.1035509
maleco	1.560612	.4896246	3.19	0.002	.6629192
malecosq	-.2020404	.0456001	-4.43	0.000	-1.935621
malecocb	.0049612	.0011635	4.26	0.000	1.191777
ftprice5	-.0835863	.0676105	-1.24	0.218	-.1016709
lqi	-6.441048	2.907133	-2.22	0.028	-.5557112
lqisq	.6269995	.2657517	2.36	0.019	.6228227
inflat5	-.0067931	.0317523	-0.21	0.831	-.007655
incgr5	.1231338	.1609724	0.76	0.445	.0264408
loginc5	-6.390151	1.137673	-5.62	0.000	-.4540054
conflict5	.5692182	.2112503	2.69	0.008	.0898856
year	.6670724	.5519105	1.21	0.228	.2248625
_cons	-1271.876	1103.904	-1.15	0.250	.

Of the variables significant at the 95% level, the malaria indicators now have the strongest beta coefficients, followed by *lqi, loginc5, depend5,* and the much weaker *sexrt5* and *conflict5*. Overall, Policy Model III slightly improves on the explanatory power of Policy Model II; 77% of the variation in *st2sd* is explained by the included variables.

4. Policy Model IV, Reduced Random Effects

Model IV estimates the reduced model as a random effects specification. A random effects approach is selected following a Hausman test, which finds that the null hypothesis that the coefficients in the fixed and random effects models are not significantly different is not rejected at the 99% level, as shown in Table 19 below. The first two columns indicate the parameter estimates in the fixed versus random effects models; the last line shows the results of the hypothesis test.

Table 19. Hausman test for fixed vs. random effects specification, cross-country.

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
mvacc5	-.0013471	-.0022326	.0008855	.0336487
water	-.9475197	-.4659714	-.4815482	.2927349
watersq	.0059479	.0027091	.0032387	.0020301
educ5	-2.564626	-1.720616	-.8440103	1.128306
depend5	.1069014	.1895241	-.0826227	.0627521
cprice5	-.0115568	-.0081201	-.0034367	.0117669
sexrt5	-9.67099	-4.284733	-5.386256	33.29137
ftprice5	.0387644	.0268202	.0119443	.0285263
inflat5	-.0104768	-.0080364	-.0024404	.0100048
incgr5	-.0300385	-.010378	-.0196605	.0323166
loginc5	-6.874875	-5.53547	-1.339405	3.760617
conflict5	-.0215765	.1592793	-.1808557	.1252106
year	-.2566772	-.2184252	-.038252	.2718791

```
                      b = consistent under Ho and Ha; obtained from xtreg
       B = inconsistent under Ha, efficient under Ho; obtained from xtreg

   Test:  Ho:  difference in coefficients not systematic

                chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                         =        4.94
               Prob>chi2 =      0.8955
               (V_b-V_B is not positive definite)
```

This suggests that parameter estimates in the random effects model are not biased. *Water* is modeled as a non-linear determinant of *st2sd*, as in Policy Model III. The results of the random effects specification are discussed below.

The results are somewhat similar to the earlier models: *loginc5, educ5,* and the *depend5* variables are significant. A doubling of income is associated with a six-percentage point drop in stunting (95% CI: -8.5, -3.5), and a one-unit increase in dependency ratio leads to a 0.2 percentage point fall in stunting (95% CI: 0.08, 0.31). It should also be noted that the explanatory power of the model with respect to within-country variation over time (R^2=0.4005) is considerably lower than with respect to across-country variation (R^2=0.7726).

5. Policy Models V and VI, Pooled OLS with Dependent Variable Disaggregated by Gender

I discuss below the estimation results for models identical to Policy Model III above, but with the dependent variable measuring stunting prevalence disaggregated by gender. The sample size of the gender-disaggregated models is smaller than in Policy Models II-IV, dropped from 267 to 206 observations, due to decreased data availability. The models are generally similar. Again, the *educ5, depend5, maleco* and *loginc5* are strongly significant; the water and land quality are also moderately associated with stunting. The magnitudes of the coefficients suggest that *educ5* is more strongly associated with stunting in the female model, while the same is true for *depend5*, *maleco*, *lqi* and *loginc5* in the male model; however, these coefficients are not statistically significantly different from each other at the 90% level. Thus the results indicate that the policy determinants of male and female stunting are generally the same.

Table 20 below summarizes the estimation results of Policy Models I-VI. The policy variables of interest are in bold.

Table 20. Summary of Policy Models I-VI, cross-country.

VARIABLES	(I) OLS-full	(II) OLS-red	(III) OLS-red NL	(IV) RE	(V) Male	(VI) Female
mvacc5	0.106	0.0337	0.00639	-0.02616	-0.0397	-0.0390
	(0.0757)	(0.0453)	(0.0423)	(0.0459)	(0.0513)	(0.0520)
water	-0.148	-0.146***	0.477	-0.434	0.545	0.624*
	(0.102)	(0.0524)	(0.312)	(0.322)	(0.366)	(0.372)
watersq			-0.00426*	0.00239	-0.00453*	-0.00481*
			(0.00222)	(0.00236)	(0.00258)	(0.00265)
educ5	-1.819***	-1.772***	-1.623***	-2.008***	-1.858***	-2.183***
	(0.587)	(0.393)	(0.377)	(0.456)	(0.452)	(0.465)
depend5	0.0612	0.229***	0.231***	0.198***	0.234***	0.182**
	(0.102)	(0.0592)	(0.0577)	(0.0593)	(0.0688)	(0.0718)
cprice5	-0.0393	0.0311	0.0323	-0.00279	0.0345	0.0341
	(0.0536)	(0.0346)	(0.0343)	(0.0213)	(0.0430)	(0.0430)
sexrt5	26.43	9.852*	14.44***	-0.634	10.45	6.668

	(I)	(II)	(III)	(IV)	(V)	(VI)
VARIABLES	OLS-full	OLS-red	OLS-red NL	RE	Male	Female
	(29.78)	(5.038)	(5.511)	(9.040)	(6.562)	(6.734)
maleco	-0.343**	-0.418***	1.561***	-0.5826	1.311**	1.190**
	(0.138)	(0.0940)	(0.490)	(0.713)	(0.512)	(0.553)
malecosq			-0.202***	-0.1074	-0.162***	-0.161***
			(0.0456)	(0.0700)	(0.0464)	(0.0498)
malecocb			0.00496***	0.0027	0.00376***	0.00383***
			(0.00116)	(0.0018)	(0.00116)	(0.00123)
ftprice5	0.260	-0.0835	-0.0836	0.0192	-0.0961	-0.0605
	(0.226)	(0.0699)	(0.0676)	(0.0427)	(0.0815)	(0.0826)
lqi	0.674	0.766*	-6.441**	-3.091	-6.728**	-5.758*
	(0.633)	(0.404)	(2.907)	(4.061)	(3.154)	(3.204)
lqisq			0.627**	0.3206	0.631**	0.541*
			(0.266)	(0.349)	(0.289)	(0.295)
inflat5	-0.00644	-0.00811	-0.00679	-0.01228	0.00874	-0.00597
	(0.0643)	(0.0316)	(0.0318)	(0.01996)	(0.0361)	(0.0355)
incgr5	-0.375	0.195	0.123	-0.017	0.227	0.244

	(I)	(II)	(III)	(IV)	(V)	(VI)
VARIABLES	OLS-full	OLS-red	OLS-red NL	RE	Male	Female
	(0.345)	(0.164)	(0.161)	(0.109)	(0.187)	(0.195)
loginc5	-8.638***	-7.064***	-6.390***	-6.056***	-5.987***	-5.913***
	(2.017)	(1.055)	(1.138)	(1.122)	(1.244)	(1.277)
conflict5	0.187	0.596***	0.569***	0.117	0.294	0.254
	(0.258)	(0.213)	(0.211)	(0.203)	(0.239)	(0.241)
year	-1.254	0.645	0.667	-0.516	0.700	0.675
	(1.035)	(0.560)	(0.552)	(0.361)	(0.701)	(0.701)
cte5	-5.060					
	(5.699)					
nra5	8.767					
	(7.459)					
Constant	2,567	-1,215	-1,272	205.68	-1,331	-1,286
	(2,053)	(1,122)	(1,104)	(719.5)	(1,402)	(1,403)
Observations	100	267	267	267 (86)	206	206
R-squared	0.737	0.747	0.770	0.738	0.780	0.743

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

What are the major conclusions that can be reached from the models, taken together?

- The measles vaccination policy variable *mvacc* appears not to be a significant predictor of child stunting. In none of the six models is *mvacc* statistically significant. This could either because the variable is an inadequate measure of maternal/child health policies, or because the effect of maternal/child health policies on stunting is not pronounced given the impact of other, more powerful variables.

- Unfortunately, given data constraints, the impact of the consumer price policy variable *cte5* and the agricultural producer price policy variable *nra5* can only be evaluated with a small sample of 100 observations. In this sample, neither of the price policy variables appears to have a significant impact on stunting.

- The environmental health policy variable, measured by access to safe water (*water*), has somewhat ambiguous effects on stunting. In Policy Models I, III, and IV the predictor is not statistically significant at the 90% level. However, in Model II the association is significant (and in the expected direction), although the effect is not strong. In the male stunting model, the linear term is not significant, but the squared term is weakly associated with stunting; in the female model, both terms are weakly associated. Environmental health policy could thus be thought to be a weak correlate of stunting in this sample, although one that is sensitive to model specification.

- Education policy, as measured by the variable *educ5*, is unambiguously correlated to child nutrition. The variable is significant at the 99% level in all six models, and its effects are strong: a one year increase in educational attainment is linked to a 1.6 to 2.2 percentage point drop in stunting.

- As expected, the level of income per capita is a strong predictor of stunting. The results suggest that doubling income leads to a 5.9 to 8.6 percentage point drop in stunting. For poor countries, this is a correlation of large magnitude. However, recent macroeconomic volatility, as measured by the inflation variable *inflat5* and the growth variable *incgr5*, seems to not be associated with stunting. The global cereal price (*cprice5*) and fertilizer price (*fprice5*) are also not significant determinants of stunting. It appears that national and household level factors drown out the influence of changes in global prices.

- Exogenously determined environmental threats, as proxied by the malaria ecology variable, are also very important; the predictor is significant at the 99% level in Policy Models II and III, and at the 95% level in the small sample Policy Model I and the gender-disaggregated regressions V and VI. This association operates strongly especially at the lower end of malaria transmission risk – that is, as countries move from very low malaria risk to moderate risk. The other exogenous ecological variable, land quality (*lqi*), is also a significant predictor of stunting. The strength of association is particularly strong in the Pooled OLS Model III and the gender-disaggregated regressions.

- Household demographics are also important. The dependency ratio variable was significant at the 95% level in Policy Models II, III, and IV (as well as in male stunting model V and, at the 90% level, in the female stunting model VI) although not in the small sample Policy Model I. Controlling for relevant confounding factors, especially income and educational levels, a five-unit increase in dependency ratio – the difference between 95 dependents per 100 non-dependents and an equal ratio; or about the difference between present-day Zambia and present-day Niger – is equal to a one-percentage point increase in stunting. The message here is that an extremely young population – the result of an incomplete demographic transition, lack of family planning resources, a weak social security system, or other factors – can by itself put strain on household economic resources and thereby increase the risk of undernutrition.

- Cultural gender norms, as proxied by the sex ratio variable *sexrt5*, matter in Models II and III, although their effect appears to be weak. The parameter estimates for the preferred Model III suggests that an 10-person increase in males – a change from an equal ratio to 1010 males per 1000 females, for example – leads to a 0.14 increase in the stunting prevalence. Given that 90% of the observations in this study's dataset fall between 930 and 1090 males per 1000 females, or about a 1.6 percentage point impact on stunting moving from one end of this range to the other, the effect is clearly not strong.

- Conflict was seen to be an important correlate of stunting in Models II and III, although the effect was quite weak. In these models, an increase in annual battle deaths from less than 25 to between 25 and 999 raises stunting rate only slightly.

- Once other variables are included, the time trend control is insignificant in all models, suggesting that most historical changes have been captured by the tested explanatories. Overall, the explanatory power of the models is extremely high, with about three-fourths of the variation in stunting accounted for.

The overall message is that certain kinds of policies, especially those that affect educational attainment and access to safe water, matter strongly in reducing stunting. Economic growth is also important, as are inherent environmental endowments, especially with respect to disease threats and natural resource quality. Some factors that would have been thought to be critical – including vaccination rates, gender inequality as manifest in sex ratio, prices, and conflict – turn out to have a weak or insignificant effect on child stunting.

7. Political Economy Model I, Pooled OLS.

I turn now to the political economy determinants of stunting by estimating Equation (20) in various specifications. I first discuss the results for a pooled OLS model. The key political variables of interest are executive ideology (*exid20*), democratization (*polity20*), electoral competitiveness (*eiec20*), conflict (*conflict5*), and ethno-linguistic fractionalization (*elfviii*). Note again that the shorter-term 10-year political variables were also tested in the same specification, but were found to be weaker correlates of stunting. The other nine control variables indicated in Equation (20) are also included.

None of the "ideas" or "interests" political economy variables – *exid20, polity20,* and *eiec20* – are significant. An increase in conflict intensity and ethno-linguistic fractionalization are both strongly significant, but the magnitudes of association are both very weak; an increase in battle deaths from the 0-24 to the 25-999 level only results in a 0.54 percentage point increase in stunting, and 10% higher ethno-linguistic fractionalization leads to an 0.52 percentage point increase. The control variables that are significant correlates of child nutritional status are familiar: *depend5, sexrt5, maleco*, *lqi,* and *loginc5*. A three unit increase in dependency ratio is associated with just under a one-percentage point increase in stunting, a magnitude similar to that in most of the policy models. Sex ratio is significant but has an extremely mild effect. Malaria ecology and land quality have strong effects, but again in the "wrong" direction; recall that in this specification, the variables appear only in linear terms. A doubling of income is associated with a nearly 9-percentage point drop in stunting (95% CI: -11.08, -6.7). The overall explanatory power of the model is impressive, with 72% of the variation in *st2sd* being explained by the included variables.

8. Political Economy Model II, Pooled OLS Nonlinear

The second model has results akin to Political Economy Model I, but with the four variables hypothesized on the basis of the bivariate analysis (as well as the results from the Policy Models) to have a nonlinear relationship with *st2sd*: *polity20*, *eiec20, maleco,* and *lqi*.

The results are broadly similar to Political Economy Model I, although now *polity20* in quadratic form becomes significant. The effect, however, is so weak as to be practically meaningless: at the mean *polity20* value of -1.126, on a scale of -10 (hereditary monarchy) to +10 (consolidated democracy), a five unit increase – that is, a movement towards democracy equaling 25% of the total range – is associated with just a 0.39 percentage point increase in stunting. Executive ideology again is not significantly correlated with stunting. Even in quadratic form, the executive index of electoral competitiveness variable *eiec20* also remains insignificant. Conflict and ethno-linguistic fractionalization are again significant but very weak. The coefficient estimates on *maleco* now become similar to those in the Policy Models, with greater malaria risk associated with high stunting at low levels of risk, but the relationship weakening as malaria risk increases. Land quality becomes insignificant. *Loginc5* remains a significant correlate with broadly similar magnitudes of association as in Political Economy Model I. Other variables stay uncorrelated with stunting. Again, the explanatory power of the model is strong, with over three-quarters of the variation in stunting accounted for.

9. Political Economy Model III, Random Effects

As with the Policy Models, a Hausman test of the Political Economy Model suggests that a random effects specification will provide unbiased estimators.

The random effects results are similar to the OLS models. The only significant political economy variables are the quadratic terms on *pol20* and *elfviii*, although again the magnitudes of association are so small as to be almost meaningless. *Depend5* and *loginc5* are strongly correlated with *st2sd*, and both retain roughly the same magnitude of association with stunting as in the OLS models. The malaria variables are again significant at the 95% level. Because the OLS models have strong explanatory power and because of the loss of degrees of freedom in the random effects model, the former are preferred.

10. Political Economy Models IV and V, Pooled OLS with Dependent Variable Disaggregated by Gender

These models repeat the specification of Political Model II with the dependent variable measuring the stunting prevalence of male children only, for the 227 observations for which this data is available.

The male and female models show similar results with each other and with the preferred aggregate specification, Political Economy Model II. The quadratic term on the *polity20* variable is significant in both disaggregated models, but its effect is extremely weak, as are the coefficients on *conflict5* and *elfviii*. The coefficients on *depend5, sexrt, maleco, incgr5* and *loginc5* are very similar on the two models; in fact, the only notable difference between the two models is the significance of the quadratic term on land quality in the male stunting model, which also has a very weak association with undernutrition. The results suggest that the determinants of male and female stunting are, once again, broadly the same.

All five political economy models are summarized in Table 21 below.

Table 21. Summary of Political Economy Models I-V, cross-country.

	(I)	(II)	(III)	(IV)	(V)
VARIABLES	**OLS**	**OLS-NL**	**RE**	**Male**	**Female**
exid20	1.285	1.135	-0.102	1.365	0.953
	(1.200)	(1.069)	(1.243)	(1.271)	(1.289)
polity20	-0.224	0.0184	0.217	-0.0254	-0.000198
	(0.181)	(0.179)	(0.215)	(0.194)	(0.193)
pol20sq		-0.0914***	-0.0508**	-0.0895***	-0.0949***
		(0.0233)	(0.0247)	(0.0270)	(0.0260)
eiec20	-0.190	-3.497	-3.456	-0.324	0.529
	(0.643)	(2.794)	(2.463)	(3.354)	(3.300)
eiec20sq		0.270	0.162	-0.0939	-0.171
		(0.297)	(0.268)	(0.360)	(0.357)
conflict5	0.538**	0.492**	0.250	0.424*	0.491*
	(0.227)	(0.224)	(0.201)	(0.245)	(0.251)
elfviii	5.205**	5.811***	5.922*	8.956***	9.259***

VARIABLES	(I) OLS	(II) OLS-NL	(III) RE	(IV) Male	(V) Female
	(2.332)	(2.200)	(3.413)	(2.517)	(2.559)
depend5	0.331***	0.372***	0.311***	0.405***	0.363***
	(0.0627)	(0.0586)	(0.0623)	(0.0658)	(0.0694)
cprice5	0.0101	0.00915	-0.0166	0.00290	-0.00279
	(0.0171)	(0.0150)	(0.0128)	(0.0173)	(0.0178)
sexrt5	11.47*	10.02	-3.643	10.75	10.49
	(5.871)	(6.100)	(9.546)	(6.560)	(6.554)
maleco	-0.355***	1.565***	1.499**	1.359***	1.238**
	(0.0925)	(0.458)	(0.755)	(0.515)	(0.556)
malecosq		-0.185***	-0.169**	-0.169***	-0.165***
		(0.0379)	(0.0703)	(0.0423)	(0.0453)
malecocb		0.00416***	0.00379**	0.00374***	0.00374***
		(0.000840)	(0.00166)	(0.000908)	(0.000958)
ftprice5	-0.0547	-0.0642	0.0217	-0.0573	-0.0276
	(0.0533)	(0.0578)	(0.0343)	(0.0625)	(0.0632)
lqi	0.976**	-2.245	-0.908	-3.817	-2.457

VARIABLES	(I) **OLS**	(II) **OLS-NL**	(III) **RE**	(IV) **Male**	(V) **Female**
	(0.425)	(2.559)	(4.481)	(2.896)	(2.974)
lqisq		0.271	0.109	0.431*	0.305
		(0.224)	(0.376)	(0.251)	(0.258)
inflat5	-0.0352	-0.0450	-0.0196	-0.0112	-0.0342
	(0.0361)	(0.0343)	(0.0198)	(0.0377)	(0.0382)
incgr5	0.135	0.0827	0.0103	0.183**	0.174*
	(0.0912)	(0.0870)	(0.0897)	(0.0851)	(0.0908)
loginc5	-8.617***	-6.570***	-6.232***	-6.288***	-6.067***
	(1.110)	(1.097)	(1.176)	(1.161)	(1.210)
year	0.314	0.264	-0.296	0.0830	-0.0267
	(0.344)	(0.323)	(0.235)	(0.395)	(0.403)
Constant	-568.7	-464.9	667.3	-110.5	100.9
	(689.5)	(644.2)	(472.9)	(788.9)	(804.1)
Observations	290	290	290	227	227
R-squared	0.724	0.763	93	0.785	0.752

Robust standard errors in parentheses***. p<0.01, ** p<0.05, * p<0.1

Taken together, the political economy models suggest the following conclusions:

- Executive ideology is a not a strong explanatory of child stunting. In none of the models was the *exid20* (nor the *exid10*; results not shown) variable significant. It seems that other variables intercede between ideology, policy action, and child nutrition outcomes.

- Democratization appears to have a significant but very weak effect on stunting. At the mean level of democratization in the dataset, the association is not in the direction expected: greater democratization is correlated with slightly higher stunting. However, the very small magnitude of association renders this relationship essentially meaningless.

- The degree of electoral competitiveness in a country – the extent to which elections are contested by multiple parties – is unrelated to stunting. In all specifications, the *eiec20* variable is insignificant.

- Conflict and ethno-linguistic fractionalization, both measures of political stability are significant in all OLS specifications above, but the magnitude of association is consistently extremely weak.

- Dependency ratio is again a powerful correlate of stunting, highlighting the importance of demographic transitions in improving child nutrition.

- As in the policy models, the malaria ecology variable, representing environmental health threats, is significant when modeled in nonlinear form. However, the inherent land quality variable, important in the policy models, becomes insignificant when controlling for political variables, except in the linear Political Economy Model I.

- The *loginc5* variable is strongly significant in all political economy regressions, and its magnitude is about the same as in the policy models.

- The other variables tested, including cereal prices, fertilizer price, inflation, rate of economic growth, and time effects, were found to be unimportant in the political economy models.

- The explanatory power of the political economy models is strong, with between 70 and 79% of the variation in stunting explained in the specifications above.

One final issue regarding the political economy models above warrants discussion. The assumption in estimating Equation (20) is that the political economy variables work through the policies in Equation (19) – as well as other unobserved policies – to determine stunting. The question then arises: does omitting the policy variables in Equation (20)'s specifications lead to biased estimators for the political economy variables? Comparing a "mixed" model with both policy and political economy variables included with Political Economy Model II above – the preferred specification of Non-Linear Pooled OLS – can help answer this question. These results are compared with the preferred Policy Model III and the preferred Political Economy Model II in Table 22.

Table 22. Mixed and preferred Policy Model III and Political Model II, cross-country.

	(1)	(2)	(3)
VARIABLES	**Mixed**	**Policy**	**Political**
mvacc5	0.00480	0.00639	
	(0.0441)	(0.0423)	
water	0.417	0.477	
	(0.313)	(0.312)	
watersq	-0.00396*	-0.00426*	
	(0.00225)	(0.00222)	
educ5	-1.707***	-1.623***	
	(0.383)	(0.377)	
exid20	1.091		1.135
	(1.085)		(1.069)
polity20	0.237		0.0184
	(0.169)		(0.179)
pol20sq	-0.0924***		-0.0914***
	(0.0222)		(0.0233)
eiec20	-1.154		-3.497
	(2.861)		(2.794)
eiec20sq	-0.00385		0.270
	(0.299)		(0.297)
conflict5	0.221	0.569***	0.492**
	(0.205)	(0.211)	(0.224)
elfviii	7.519***		5.811***
	(2.035)		(2.200)
depend5	0.267***	0.231***	0.372***
	(0.0577)	(0.0577)	(0.0586)
cprice5	0.0231	0.0323	0.00915

VARIABLES	(1) Mixed	(2) Policy	(3) Political
	(0.0326)	(0.0343)	(0.0150)
sexrt5	9.559	14.44***	10.02
	(5.851)	(5.511)	(6.100)
maleco	1.582***	1.561***	1.565***
	(0.563)	(0.490)	(0.458)
malecosq	-0.226***	-0.202***	-0.185***
	(0.0498)	(0.0456)	(0.0379)
malecocb	0.00554***	0.00496***	0.00416***
	(0.00124)	(0.00116)	(0.000840)
ftprice5	-0.0747	-0.0836	-0.0642
	(0.0708)	(0.0676)	(0.0578)
lqi	-9.721***	-6.441**	-2.245
	(3.044)	(2.907)	(2.559)
lqisq	0.962***	0.627**	0.271
	(0.275)	(0.266)	(0.224)
inflat5	-0.0127	-0.00679	-0.0450
	(0.0330)	(0.0318)	(0.0343)
incgr5	0.0676	0.123	0.0827
	(0.172)	(0.161)	(0.0870)
loginc5	-4.904***	-6.390***	-6.570***
	(1.103)	(1.138)	(1.097)
year	0.489	0.667	0.264
	(0.532)	(0.552)	(0.323)
Constant	-905.8	-1,272	-464.9
	(1,062)	(1,104)	(644.2)
Observations	252	267	290
R-squared	0.807	0.770	0.763

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

It thus appears that the omitted policy variables in the political model are not biasing the coefficients of the political variables (or vice-versa).

* * *

What do the results of the policy and political models tell us overall? The strongest message maybe a negative one: it appears that few generalities about the policy and political determinants of stunting apply across countries. The policy model highlighted the importance of educational attainment and income growth, supporting the general conclusions of the literature. But the other policy variables one may expect to be significant predictors of stunting, including maternal and child health policy, safe water, and support to food producers and consumers were either weakly or insignificantly correlated to stunting. Among control variables, dependency ratio and malaria ecology (the measurement variable for environmental threats) had a strong effect on stunting but many others did not, including sex ratio, cereal and fertilizer prices, macroeconomic stability, and conflict. Similar statements could be made about the political economy models, in which executive ideology, democratization, and electoral competitiveness had no correlation with stunting, and conflict and ethno-linguistic fractionalization only a weak association.

One could point to model specification issues as the reason for the inconclusive results. Variables like epigenetic variation, program implementation quality, and total spending on maternal and child health are clearly important in determining stunting, but remain unobservable or lack sufficient data for cross-country analysis. The etiology of stunting is extremely complex, and every model, no matter no carefully constructed, contains numerous assumptions that require empirical confirmation; a single poorly theorized link or badly chosen measurement variable could lead to serious estimation bias in the final model. The literature provides some support for the assumptions embedded within the model used by this study, but this support is itself based on evidence from complex models that could themselves be challenged.

Thus improvement of a cross-country econometric model of the determinants of stunting demands a more careful testing of 1) each link in the hypothesized causal chain and 2) the fidelity of each measurement variable to the actual phenomenon being measured. Such testing would ideally be based not on aggregation of evidence from other highly complex, relatively small-sample cross-country models, but rather on large-sample experimental evidence focusing on the specific relationship in question. Indeed, it may be that the policies and political factors that we expect to have the greatest impact on child nutrition are relatively marginal compared to other, unexpected forces – a thesis supported by the narrative of Northeast Brazil's exceptional nutritional improvement in Part III.

Despite these concerns, I have made the case in the previous chapters of the advantages of this study's model, particularly the careful theorization of a reduced-form model and the use of lagged variables to deal with reverse causality. In addition, the explanatory power of the models in the previous chapters is extremely high, suggesting that the included variables are relevant determinants of child nutrition (or, less likely, strongly correlated to important omitted variables). If the structure of the model is indeed accepted is workable and without serious flaws, then the ambiguous results have to be interpreted as showing that the pathways to stunting reduction are diverse and generalizations across countries difficult. Many countries have indeed reduced child stunting – though only a few dramatically – and yet few common policy factors, and no common political factors, are evident in the regression results. The message may be that the complexity of undernutrition's causation also opens the door for a multitude of solutions. Again, this is a conclusion supported by the experiences of Brazil and India, as detailed in the following chapters.

PART III. Life in the Northeast: The Political Economy of Child Stunting in Brazil

In 1966, two years after the military coup that would interrupt Brazilian democracy for nearly a quarter century, the exiled doctor-activist Josué de Castro published *Death in the Northeast*, a stinging indictment of the role of Brazil's elites in causing the hunger and misery of the country's poor (de Castro 1966). De Castro focused his book on the Northeast Region, an area which had been the epicenter of Brazil's economy during the early centuries of the colonial period, its wealth fueled by the slave trade and Europe's increasing appetite for sugar (Skidmore 1999). By the mid-20th century, however, the Northeast had become Brazil's poorest region, its economic dominance supplanted by the mines, coffee, and cattle of the states of São Paulo and Minas Gerais to the south. The coastal forest and sugarcane regions of the Northeast remained productive, but the region's agricultural income flowed chiefly to the small, powerful landowning *coronel* class. The abolition of slavery in the late 19th century brought freedom from bondage but not from poverty, as newly liberated blacks and other landless people had few options but to work for low wages as plantation laborers or take their chances in the dry interior, a vast, lawless region known as the *sertão.*

The *sertão* is de Castro's center stage. Here, periodic droughts killed thousands of new settlers in the late 19th and early 20th century, and those who survived lived under the incessant threat of famine. Brazil's best-known accounts of class struggle arise from these desperate backlands, and they illustrate how persistent the specter of poverty in the Northeast has been in the national consciousness. The stories feature saint-bandit heroes like Lampião, a bespectacled leatherworker-turned-outlaw who would be further transformed by folk legend into a kind of Robin Hood of the *sertão*, a peasant rebel fighting against the *coronel* class. Less mythical is the history of the millenarian preacher Antonio Conselheiro, whose vision of race-blind communitarianism and independence from state and *coronel* authority culminated in 1897 in the War of Canudos, a brutal military campaign that wiped out fifteen thousand of Conselheiro's followers. The tragedy is immortalized in one of the great early works of Brazilian scholarship, Euclides de Cunha's *Os Sertões* (da Cunha 1902). De Castro himself writes at length of the Peasant Leagues, a rural movement that arose in the late 1950s to agitate for land reform in the states of the Northeast. Though the Leagues would be dismantled by the military dictatorship a few years after their birth, they were viewed during their brief existence as a serious threat to national stability – not just by the *coronel* class, but also by the United States Central Intelligence Agency and, later, Brazil's military dictatorship.

About twenty years later, the anthropologist Nancy Scheper-Hughes would write of the terrible hunger suffered by shantytown dwellers in the Northeastern state of Pernambuco in her acclaimed study *Death Without Weeping: The Violence of Everyday Life in Northeast Brazil* (Scheper-Hughes 1992). Her subject is a mother's love for children, and how the daily possibility of infant death forces parents to hedge against grief, to keep in reserve a resignation to suffering as a means to guard against the dangerous numbness that leaves one unable to take care of the living. Scheper–Hughes' thesis is psychological, but her book is more than a narrow account of human adaptation to pain: it is a careful, precise description of severe poverty.

* * *

The paragraphs above describe what the Northeast has historically been: a place of extreme hunger, of death without weeping. But the following chapters are not about death in the Northeast; they are about life in the Northeast. Half a century after de Castro, the region is no longer synonymous with famine and class rebellion. Instead, it stands as one of the world's great unheralded stories of human development. Over the past three decades, the prevalence of chronic undernutrition has fallen by an astonishing 89% (Figure 47). In 1975, over half of all children under the age of five in Northeast Brazil were stunted. By 2006-7, that figure had dropped to 5.9%. It is as if the children of the Northeast have in the course of a generation gone from living nutritional lives like those of children in present-day Burkina Faso to lives similar to those of children in present-day Kuwait.[28] Millions of infants and preschoolers have been saved from premature death and permanent cognitive and physical damage.

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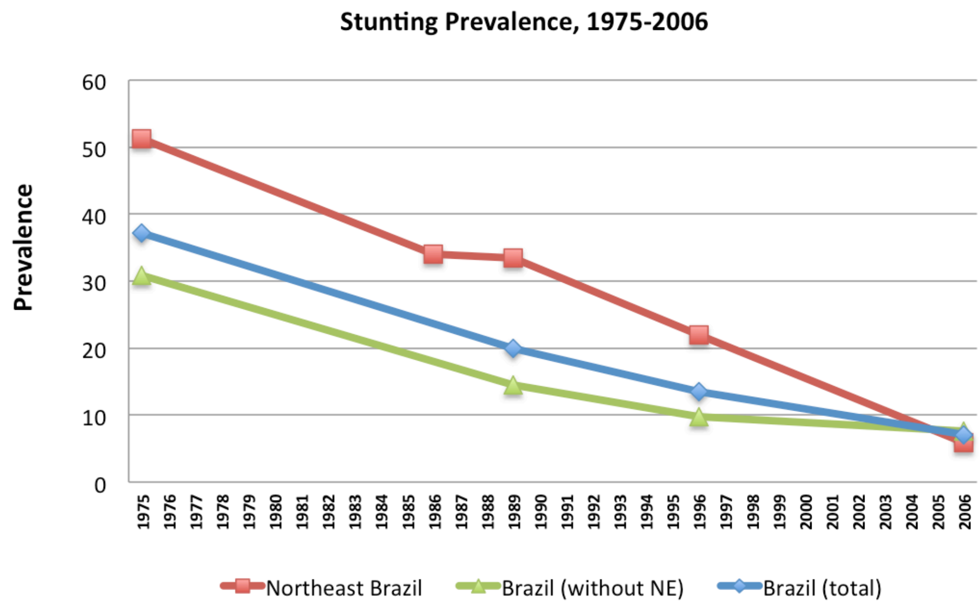
[28] In 2009, the stunting prevalence in Burkina Faso was 35.1%. In 2008, the stunting prevalence in Kuwait was 5.1%.

Figure 47. Total stunting prevalence, 1975–2006, Northeast Region and Brazil. Sources below.



(Observations from 1974-5, 1986, 1989, 1996, and 2006–7. Estimates from 1975 and 1989 are converted from NCHS-reference estimates using the algorithms suggested by Yang and de Onis (2008)). Each of the points in the square–marked line above represents a different, regionally representative anthropometric survey conducted in the Northeast. The points in the diamond-marked line represent prevalences from Brazil as a whole. The triangle-marked line is calculated by the author using historical population estimates from IGBE (2010). With the exception of the 1986 survey, which was only conducted in the Northeast, the data sources are the same for Northeast and Brazil data. The various surveys are: 1) the *Estudo Nacional da Despesa Familiar* (National Study of Family Expenditure; ENDEF) in 1974-5 (IGBE 1977); 2) the *Pesquisa Nacional sobre Saúde Materno–Infantil e Planejamento Familiar* (The National Survey of Maternal/Child Health and Family Planning; PNSMIPF) in 1986 (Arruda and others 1987); 3) the *Pesquisa Nacional sobre Saúde e Nutrição* (The National Health and Nutrition Survey; PNSN) in 1989 1989 (IGBE 1987); 4) the *Pesquisa Nacional sobre Demografia e Saúde* (The National Demographic and Health Survey; PNDS 96) in 1996 (Sociedade Civil Bem-Estar Familiar no

Brasil (BEMFAM) 1997); and 5) the *Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher* (National Child and Woman Demographic and Health Survey; PNDS 06) in 2006-7 (Centro Brasileiro de Análise e Planejamento (CEBRAP) 2008). The methodological approaches of these surveys enable comparison over time of aggregate stunting prevalence; they are the only nationwide surveys available for this purpose. All are included in the WHO's Global Database on Child Growth and Malnutrition, and have been evaluated by the WHO for data quality and methodological adequacy.

The graph shows that stunting reduction in the Northeast was dramatic even when compared to the superlative performance of Brazil as a whole (and in fact, the Brazilian trend is driven in large part by the achievements of the Northeast). In 1975, stunting prevalence in the Northeast was nearly fifteen percentage points higher than the country total. Today, the Northeast has a slightly lower rate than the rest of Brazil, a striking accomplishment for a region long infamous for its destitution.

At first glance, the slope of the line above is remarkable not only for its degree but also for its constancy. With the exception of a period in the mid-1980s – linked to the contraction of the Brazilian economy in the earlier part of that decade, as discussed in Chapter 7 – the pace of reduction appears relatively stable. As the following chapters argue, however, this constancy is to a large extent an artifact of data collection timing, and masks important variation in economic and political forces that drove the overall rapid downward trajectory. Stunting did not decline steadily, but rather was concentrated in the rapid growth period of the late 1970s, in the mid-1990s following the control of hyperinflation, and in the years since 2002, when the Lula administration began to increase the coverage of social assistance programs. The pace of decline, though considerable in the 1970s, was most rapid during these latter two periods.

"Explaining" this line – its steep slope, its hidden inconstancy – is the goal of Part III. Chapters 7 and 8 focus on each of the two major stages of Northeast Brazil's recent nutritional experience, the 1975-1994 and the 1995-2007 periods. Because the changes undergone by Northeast Brazil are strongly linked to federal-level policy, the scope of the chapters is not limited to the region itself, but to the country as a whole. Similarly, because stunting decline is the result not of programs with a narrow nutritional focus but rather of broad macroeconomic and social policies, the focus is on these overarching trends, not nutrition policy as such – in fact, until very recently, there is little to speak of in terms of large-scale programming focused directly on child nutrition in Brazil, a point further discussed below. At the end of each chapter, a political actor map is presented to illustrate the forces preventing or pushing the policy action required to bring about stunting reduction.

Chapter 7, "To 1994: 'Miracle' and Recession", deals with the years of the military dictatorship, when stunting declined substantially but remained very high at the onset of the 1980s. I then recount how the macroeconomic crisis of the early 1980s stalled stunting reduction, as evidenced by the lack of change between the 1986 and 1989 nutritional surveys. The chapter goes on to discuss the democratic transition following the end of the military regime in 1985, and argues that progress in reducing undernutrition was muted during these years by high inflation and flawed democratic institutions that prevented effective policy implementation. Chapter 8, "1995-2007: Stabilization and Redistribution", asserts that the lion's share of Northeast Brazil's nutritional success was achieved during the Cardoso and Lula administrations. The section argues that this success was not driven solely by orthodox, pragmatic economic policy (as Cardoso's supporters would state) or by ideological commitment to redistribution (as Lula's partisans might argue), but rather by a remarkable synergy of policy and political factors across the administrations. In effect, the Brazilian electorate, its power steadily increasing as the country's democracy matures, has demanded and received a coherent and durable policy package that emphasizes control of inflation and a basic social safety net. Chapter 9 then tests the formal hypotheses presented in Chapter 4 and summarizes the conclusions of Part III as a whole.

Two important points should be made before embarking on the analysis, one pertaining to the political economy of nutrition and one regarding the nutritional trend described briefly above.

First, Northeast Brazil was chosen as a case study solely because of its exemplary nutritional performance – as shown earlier in Tables 2 through 4, the region surpasses every country in the world in terms of total percent and total percentage point decline, and ranks fourth in rate of annual percentage point decline – and not because of any a priori assumptions about the political economy processes that led to this decline. The finding over the next few chapters that nutritional gains were largely a positive externality of other policy goals, and not due to an explicit focus on hunger and undernutrition as such, was unexpected, but in a sense reinforces the conclusions of both the econometric analysis in Part II and the India narrative in Part IV, as is discussed at length in the Conclusion of this study. For now, it is worth noting that the original intention to study the political economy of nutritional *outcomes* did not lead in Brazil's case to the study of the political economy of nutrition policy.

The second point has to do with the possibility that Northeast Brazil's impressive nutritional trend can be explained by regression to the mean – that is, because so few data points are available, the probability that any of the above prevalences is an artifact of asymmetric sampling is greater. Thus the improvement in nutritional outcomes observed in Northeast Brazil could be due to non-systematic error, i.e., random fluctuations, and the true prevalence throughout the historical period in question would have been closer to the Brazil prevalence.

I argue, however, that mean reversion is not driving the observed trend, for two reasons. First, the stunting prevalence of Northeast Brazil in the 1970s and the 1980s is historically plausible, given social indicators. As discussed further in the following chapters, Northeast Brazil did have a high stunting prevalence given its per-capita income in 1975 and 1986, but could not be considered an extreme outlier; many other country-year observations in the econometric dataset used in Part II have similar income-nutrition relationships. Other child welfare indicators, including mortality and morbidity, suggest that the trend of improving health is not restricted to nutritional outcomes alone (IGBE 2010). Various caloric sufficiency studies confirm that food intake in the Northeast in previous decades was well short of needs. A study in the early 1960s by the Getulio Vargas Foundation found that 75% of the population in the Northeast failed to obtain adequate calorie, protein, or fat intake (Fundação Getulio Vargas 1970). Another survey about a decade later found that the per capita calorie intake in the Northeast equaled about 75% of minimum need (Nobre 1974). In addition, although anthropometric data before 1975 does not exist for either Brazil or the Northeast Region, an immense qualitative literature, building on the foundations laid by Euclides da Cunha and Josué de Castro, has analyzed the 20th century history of hunger and extreme poverty in the Northeast (excellent syntheses are provided by Skidmore 1999, Baer 2008, and Pinheiro and Gill 2001). It is clear that the high rates of undernutrition suggested by the 1975 and 1986 surveys are not only plausible, but also probable.

Confirmation of this initial high rate of undernutrition comes from various small-scale surveys conducted in the Northeast. Ward and Sanders (1980) find, suing mid-1970s data from the state of Ceará, that nearly half of households had inadequate caloric intake. Torres (1982) finds that 46% of children between the ages of 3 and 72 months suffered from protein-energy malnutrition in one area of the Northeastern sertão. Using 1981 data, Tanner (1987) finds that over two-thirds of children were underweight in one municipality in the state of Paraiba. A survey by Dorea and others (1982) finds that 25% of children in an urban area of Bahia are stunted. De Freitas and others (1986), in a sample of 225 rural Northeastern families, find a 51% underweight rate. While these studies, and the dozens of others like them, are based on small samples and differing methodologies, their conclusions are remarkably consistent. The high stunting prevalences observed by the large-scale nutritional surveys of 1975 and 1986 are not likely to be the result of non-systematic sampling error, but rather reflect the true state of child nutrition at the time.

Chapter 7. To 1994: 'Miracle' and Recession

The first reliable data point from the Northeast comes from the 1975 *Estudo Nacional da Despesa Familiar* ("The National Family Expenditure Study"; ENDEF). The sample from this study indicates a stunting prevalence of 45.6% in the Northeast Region, as calculated by the old growth reference standards. Using the conversion algorithms developed by Yang and de Onis (2008), this point estimate suggests a prevalence of about 51.3% under the new WHO child growth reference. Thus just over half of the Northeast's children were stunted in the mid-1970s, similar to the present–day levels of height–for–age deficit in Ethiopia or Nepal. According to the 1986 *Pesquisa Nacional sobre Saúde Materno–Infantil e Planejamento Familiar* (National Survey of Maternal/Child Health and Family Planning; PNSMIPF), this prevalence fell in the intervening decade by one–third to about 33.9% – a drop of 17.4 percentage points. The 1989 *Pesquisa Nacional sobre Saúde e Nutrição* (National Health and Nutrition Survey; PNSN) indicates a Northeast stunting prevalence of 33.4%, a figure not statistically significantly different than the one obtained three years earlier.

The 1975, 1986, and 1989 prevalence estimates represent the sum consequence of the nutritional experience of children and mothers during the five year periods preceding each observation, 1970-4, 1981-5, and 1984-8, respectively. In this chapter, I construct a narrative of economic and social change across these three periods, seeking to establish correlations between the trend in undernutrition –

decline between the first two periods, stagnation between the latter two – and many of the variables tested in the cross-country regressions of Part II.

The next data point available after 1989 comes from the 1996 *Pesquisa Nacional sobre Demografia e Saúde* (National Demographic and Health Survey; PNDS 96). The PNDS 96 Northeast stunting prevalence of 22.4% suggests a steep decline from the 1989 PNSN figure. However, the change in stunting prevalence between 1989 and 1996 is not discussed in detail in this chapter, for the reason that – as will be argued further below – the dramatic observed fall is likely to have occurred in 1994 and 1995; little improvement took place in the years previous. The positive dimension of this line of argument – why stunting *did* fall in 1994–95 – is taken up in detail in Chapter 9. In discussing the 1989-1993 period, Chapter 8 restricts itself to justifying the contention that stunting decline did *not* happen in these earlier years.

A. Inequality and the Economic 'Miracle'

1. The Brazilian Economy in the Late Military Period

Although economic growth in Brazil since 1980 has been weak – per capita growth in GDP averaged around 0.5% per year between 1980 and 2007 – at the end of the 1970s Brazil was regarded as one of the great economic performers in the world (World Bank 2011). Brazil's annual GDP growth rate in the 20th century equaled around 4.4 percent, higher than nearly all countries in the world, including the United States and Japan (Maddison 1994). Growth was concentrated in the 50-year *desenvolvimentista* ("developmentalist") era, starting with the revolution that brought Getúlio Vargas to power in 1930 and continuing until the early 1980s. During this period, annual aggregate GDP growth reached almost 6% annually, and per–capita growth rates were just over 3% (Pinheiro and others 2001). The early years of the military dictatorship period saw especially rapid rates of growth; by 1976, the Brazilian economy had more than doubled in size since the coup d'état twelve years earlier. Growth rates in the Northeast were of similar magnitude. Between 1965 and 1980, the economy of the region grew by 4.4% per capita on an annual basis, with especially impressive growth in the early 1970s.

The rapid rates of economic growth of the 1960s and 1970s were generally due to orthodox macroeconomic policies. The government emphasized stabilization by cutting back public sector spending, improving tax revenue collection, and controlling inflation through limiting credit and wage growth (Baer and Galvão Jr 2008). As a result, budget deficits fell from over four percent of GDP at the beginning of military rule in 1964 to around 0.3 percent by 1971. Inflation stabilized to around 20 percent, even during the rapid growth years of 1968 to 1973, when the economy expanded by over 11 percent annually. Despite its orthodox macroeconomic policies, however, the state remained heavily interventionist, directing resources towards industrial enterprise, undertaking large-scale infrastructure investments, and providing incentives and subsidies to promote exports.

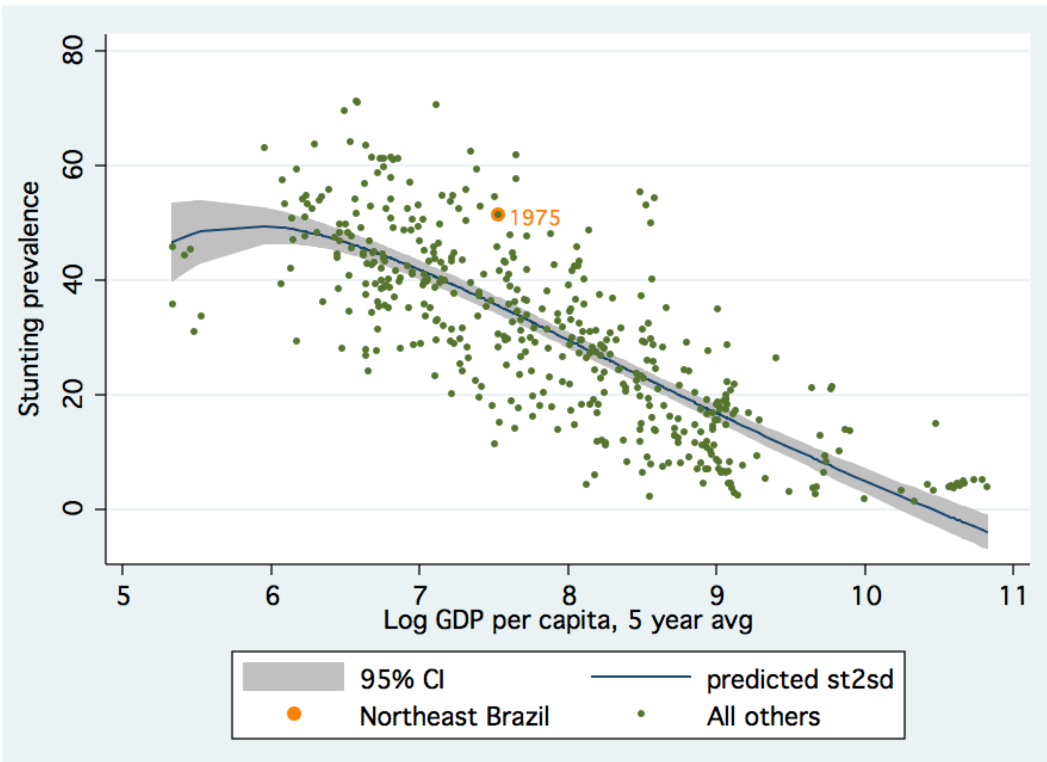
As was the case in many developing countries around the world, the oil shocks of 1973 and 1979 drastically altered the course of Brazil's development. The price hike of 1973 doubled the country's import expenditure almost immediately, and the country's current account deficit increased sevenfold to $7.1 billion by the following year (Banco de Brasil 2011). Brazil was faced with the choice of accepting economic contraction, running down its reserves to finance the deficit, or borrowing from abroad (Baer 2008). In the view of President Ernesto Geisel, the head of state, a slowdown of growth would have complicated the project of gradual democratic opening (*abertura*) being contemplated at the time (Lamounier and Moura 1986). The government chose to borrow from abroad, preferring to abstain from draining foreign reserves. International creditors were awash with petrodollars from oil-producing countries, and low interest rates made large-scale foreign borrowing possible.

Brazil's debt thus increased as it embarked on an ambitious new national development plan centered on import substitution. As in most of Latin America, the hope was that import substitution would reduce long–term trade deficits. By 1978, however, the net external debt – gross debt minus existing foreign reserves – increased to $43.5 billion (Batista Jr. 1987). As detailed later in this chapter, the ballooning debt would eventually lead to recession, as global capital markets dried up in the wake of Mexico's default in 1982.

Despite the stratospheric growth of the early military period – which propelled Brazil solidly into the ranks of middle-income countries, and lifted per-capita income in the Northeast to around $2000[29] – chronic undernutrition remained at distressing high levels in 1975. The relationship between wealth and nutrition in Brazil is not straightforward. The graph below shows the bivariate association between log GDP per capita and stunting prevalence for all countries included in the regressions of Chapter 6. The large dot indicates the 1975 stunting prevalence and log per capita income estimate for Northeast Brazil.[30]

[29] In 2005 constant international dollars, adjusted for purchasing power parity. These are the same units used in Part II's econometric model.
[30] As in Part II, log GDP per capita associated with a given stunting observation is taken as the average of GDP per capita for the five preceding years.

Figure 48. Bivariate association between GDP per capita (*loginc5*) and stunting prevalence, with Northeast Brazil 1975 observation. The Northeast Brazil data comes from the *Estudo Nacional da Despesa Familiar* (National Study of Family Expenditure; ENDEF) conducted in 1974-5 (IGBE 1977). The other country data comes from the WHO Database on Child Growth and Malnutrition (stunting prevalence) and authors' calculations based on the Penn World Tables 7.0.



In 1975, Northeast Brazil was well above the fractional polynomial fit line: the region had a stunting prevalence above what would be expected given its level of income per capita. In other words, income was less efficiently "converted" into nutrition than would be expected given the historical experience of other countries. As detailed in the next section, income and asset inequality was an important reason for the existence of this inefficiency.

2. Inequality and Its Effects

Brazil has been for decades one of the most unequal countries in the world, with a Gini coefficient persistently around 0.6 (IGBE 2011). The Northeast has historically been the country's poorest region, with income levels in the early-to-mid 1970s at less than 40% of the country's GDP per capita level. Local within-region inequalities were even more extreme. A decomposition analysis of inequality between municipalities in Brazil (the smallest administrative unit in the country), using the Theil index as the operational measure, finds that income differences in 1970 *within* states accounted for 49% of all inequality (de Vreyer and Spielvogel 2005).[31] Differences *between* states account for an additional 18%, and disparities between regions the remaining 33%. Thus the weaker than expected relationship between mean per-capita income and stunting prevalence in Northeast Brazil in 1975 was likely driven to a great extent by sub-region inequalities. Other possible explanations – for example, intrahousehold inequality leading to poor maternal and child dietary intake or high rates of child morbidity, controlling for income – are less plausible in the 1970s Northeast Brazilian context, given the (admittedly scant) evidence available to test such hypotheses.

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[31] The Thiel index is obtained using the following formula:

$$L = \sum_{i=1}^{N} \ln \left(Y/(y_i N) \right)$$

where y_i is the relevant well-being measure of individual i, usually income or expenditure; N is the number of people in a population; and Y is the total of the well–being measures of all individuals. The Theil index has a range between zero (signifying absolute equality) and one (signifying absolute inequality).

De Vreyer and Spielvogel (2005) also find that the Theil index, at 0.36, was much higher in 1970 in the Northeast than in any other region of Brazil; the next highest figure was 0.29 for the Southeast.

The persistence of very high inequality in Brazil into the 1970s also has partially to do with the shift of economic activity from agriculture into industry. This structural transformation first gathered momentum in the early decades of the 20th century, with agriculture ceding its primary position in the mid-1940s (Baer 2008). By the onset of military rule in 1964, agriculture was responsible for only around 16% of GDP (IGBE 2011). This figure had further fallen to around 10% by 1980, driven by the military government's focus on export-oriented industrialization of the economy. The growing industrial sector was characterized by very high capital-labor ratios in this period, and so GDP growth was mainly captured by the owners of capital (Amann and Baer 2009).

The suppression of labor unions by the military dictatorship also contributed to the stagnation of real wages. Until the 1978-80 nationwide strikes, discussed at greater length in the history of social mobilization in Chapter 8, Brazilian workers had few mechanisms by which to pressure the regime for concessions; the labor organizations that existed were largely under corporatist control of the government. Together, these factors contributed to greater inequality by increasing the demand for skilled relative to unskilled labor. Between 1960 and 1970, the richest five percent of the Brazilian population increased their share of GDP from 27% to 36%, while the poorest 40 percent saw their share fall from 11% to 9%. The effect of the skills wage gap on inequality was compounded by differences in educational attainment; a decomposition of the 1981 National Household Survey (*Pesquisa Nacional por Amostra de Domicílios;* PNAD 81) shows that nearly 40% of all inequality could be attributed to educational disparities (Ferreira and others 2006).

Inequality persisted at even higher levels within the agricultural sector itself, in which the majority of the country's poor worked. Throughout the colonial period until the advent of military rule, government policy towards agriculture was laissez-faire, with production increases coming about largely though the expansion of cultivated land area. Control of land was concentrated in the hands of a small elite class, especially in the Northeast. This pattern of land ownership continues to this day; in Brazil overall, the Gini land coefficient is a stunning 0.85, with little change since the 1960s. In some Northeast states, the coefficient inches even higher, with figures close to 0.90 in the states of Maranhão and Alagoas (IGBE 2011).

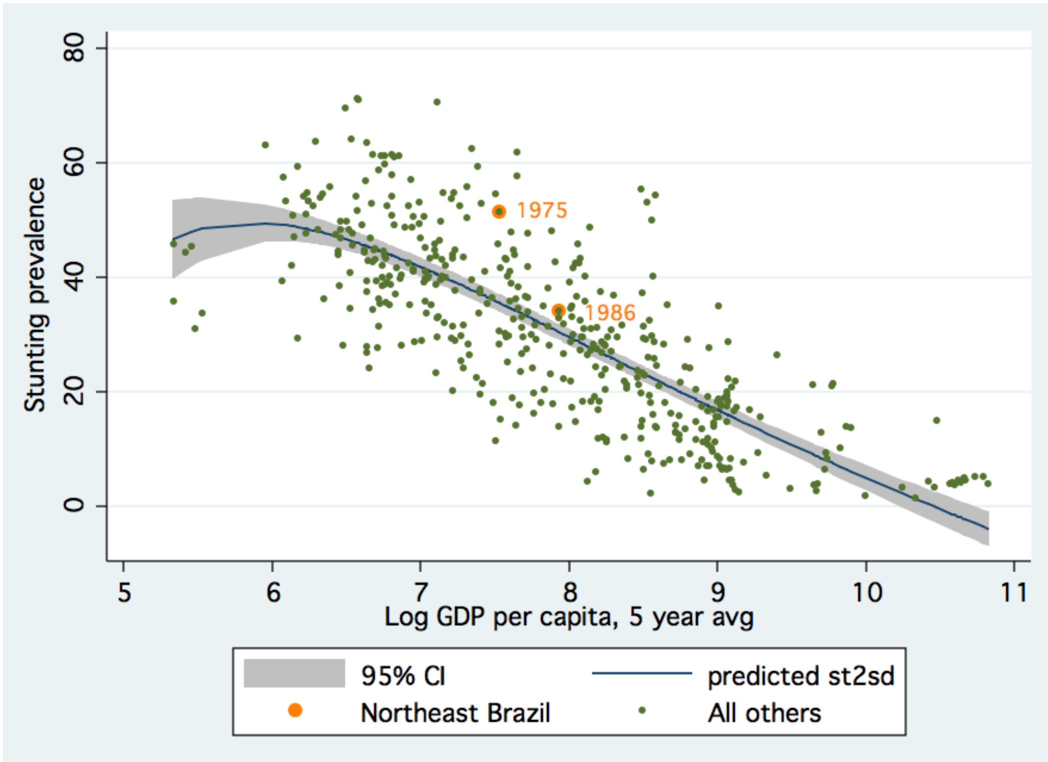
Agricultural policies during the military period did little to reverse land inequality, although as noted above the government did begin to intervene heavily in the sector itself, seeking to modernize production through subsidies, incentives, and price controls. Again, however, benefits largely went to the elite landed class, and more generally to the export–oriented agricultural systems of the Southeast (Baer 2008). In addition to increasing export earnings, the overarching goal of agricultural policy during the military period was to reduce food costs, especially for urban consumers. State intervention biased the internal terms of trade against non-tradable producers, particularly those in the Northeast, where cultivation of food crops was concentrated. With the fall in food prices came stagnation in rural wage growth. Additional downward pressure on farm wages came from the overabundance of available labor due to generally high capital-labor ratios in the modernizing agricultural sector. Because the majority of the Northeast's poor were landless rural workers or smallholders, agricultural policy in the military period thus did little to directly improve welfare among groups most at risk of undernutrition (Graham and others 2007). Overall, the military era could be characterized as one of "conservative modernization" in agriculture, in which productivity growth was concentrated among large-scale, export-oriented, well-capitalized farms (Mueller and Mueller 2006).

Inequality between the Northeast and other regions followed an inverted-U pattern over the period of military rule. In 1965, at the beginning of the dictatorship, per-capita income levels in the Northeast were about 49% of the national level. By 1975, they had dipped to 38%, the gap driven largely by the rapid rates of growth in industry in the southern states. As the country's growth slowed down in the recession of the early 1980s, however, inequality between regions lessened, and the above figure rose to 46% – about its 1960 level – by 1985. The increasing inequality in the early military period was dampened somewhat by federal redistributive efforts, especially through the actions of regionally focused government agencies like the *Superintendência de Desenvolvimento do Nordeste* (Superintendency for the Development of the Northeast; SUDENE), which directed capital to less developed areas. Increasing integration of the domestic market also helped to distribute the gains from aggregate national economic growth (Cavalcante and Uderman 2009).

Sub-regional inequality, however, did not significantly diminish in the Northeast until the mid-1990s, which suggests an interesting historical asymmetry in the relationship between income distribution and undernutrition in the military period. The data summarized above suggests that inequality contributed to the high *level* of undernutrition in 1975, yet the *change* in stunting prevalence between 1975 and 1986 was clearly not driven by improvements in income distribution. Insofar as changes in income had an impact on nutrition, they came through the growth rather than the redistribution effect. Yet this “rising tide lifting all boats” narrative also faces a major analytical challenge, illustrated in the graph below (Figure 49).

Figure 49. Bivariate association between GDP per capita (*loginc5*) and stunting prevalence, with Northeast Brazil 1974-5 and 1986 observations. Northeast Brazil 1986 data from the *Pesquisa Nacional sobre Saúde Materno–Infantil e Planejamento Familiar* (The National Survey of Maternal/Child Health and Family Planning; PNSMIPF) in 1986 (Arruda and others 1987); other data from sources listed in

Figure 48.



Between 1975 and 1986, Northeast Brazil became considerably more efficient at "converting" income into nutrition, as evinced by the movement of the 1986 observation above nearer to the overall trendline; by the latter year, the rate of stunting was close to what would have been expected given the region's per capita GDP. However, in the absence of major changes in inequality, a simple growth effect on nutrition would have suggested movement of the Northeast Brazil observation rightward and downward *parallel* to the regression line. One other statistic illustrates this point. Although 1970s data disaggregated by income quintile is not available for the Northeast alone, a look at the nutritional inequality trend in Brazil as a whole shows that the relative gap between rich and poor increased. The poorest quintile had a stunting prevalence nearly five times greater than the richest quintile in 1974-75; by 1989, this ratio had reached 7.7, before declining to 6.6 in 1996. The overall trend is of greater inequality, although all income groups did experience a rapid decline in absolute stunting rates during this time period (Monteiro and others 2010). Other factors, especially improvements in basic health services – discussed further in section C, "Health Policy" – thus appear to have intervened to improve the marginal nutritional returns to income over this time period.

Insofar as distribution-neutral growth mattered for nutrition, the gains occurred in the 1970s. We know this because between 1981 and 1985 – precisely the period of nutritional experience we expect to be summarized by the 1986 stunting prevalence of 33.9% – per capita growth in income stagnated in the Northeast (and in Brazil as a whole). The 1980 figure of around $2950 per capita in the Northeast fell by 6% in the first year of the recession, and did not recover to that level until nearly fifteen years later. If growth in income had a strong impact in the precipitous drop in stunting rates between 1975 and 1986, the effect can only have been concentrated in the latter half of the 1970s. Further evidence for this contention comes from the fact that stunting prevalence in 1989 was about 33.4% (as converted to the new WHO growth reference using Yang and de Onis' (2008) algorithms). Little improvement thus occurred between 1986 and 1989, which suggests that the economic stagnation of the early 1980s temporarily halted the decline in stunting. The growth effect on poverty has also been mild, not only because growth itself was anemic but also because the growth elasticity of poverty reduction has been markedly small: for every one percent increase in economic growth in Brazil between 1981 and 1994, poverty fell by just 1.09 percentage points, almost 50% underneath the developing country average for this period (Ferreira and others 2010).

Additionally, economic growth in the Northeast was indeed extremely rapid between 1975 and 1980, averaging a little over six percent annually per capita. The headcount poverty index fell from close to 90% of all people in the region in 1970 to about 67% a decade later.[32] The squared poverty gap index, which weights severe poverty more heavily, was nearly halved in this time period, falling from 0.43 to 0.23 (IGBE 2011). These figures suggest that, while growth in the Northeast was not *relatively* pro-poor, it was *absolutely* so, with strong effects on improving child nutrition.

To summarize: stunting fell considerably between 1974-75 and 1986. The very high stunting prevalence in the Northeast in the earlier year, controlling for income level, is likely to be the result of the extreme level of income and asset inequality prevailing in the country at the time; little evidence exists to support alternative explanations of why stunting would be so high at this income level. There was no decline in inequality between 1974 and 1986 – i.e., income growth among poor households did not exceed growth within the non-poor group – and so (re)distributive effects do not explain the fall in stunting over this period. An

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[32] Headcount is measured using the national poverty line, based on the cost of a basket of essential food and non–food items.

absolute increase in income did occur between 1974 and 1986, but all of this growth occurred before the early 1980s recession. Poverty also fell precipitously before 1980, but not after. Finally, there appears to have been little progress in reducing stunting between 1986 and 1989 – precisely when the effects of the recession on the growth of young children would have been felt. All of these facts taken together suggest that the rapid absolute (but not relative) increase in incomes of the poor drove stunting reduction in the late 1970s.

B. The Early Democratic Period

Increasingly large and vocal protests finally led the military to allow direct elections for the presidency in 1985. The democratic transition was, however, tumultuous. A coalition of opposition parties selected the longtime politician Tancredo Neves as its candidate; Neves easily won but died a few months after assuming office. The presidency was assumed by the vice-president, José Sarney, a conservative selected as a running mate largely based on his palatability to the still-influential military. Sarney's rocky tenure, discussed further below, was improbably exceeded in ineffectiveness by his successor, Fernando Collor de Mello. Collor, elected in 1989, was forced to resign by 1992 following a wave of corruption scandals, and vice–president Itamar Franco took his place until the end of the term two years later. It was not until the election of Fernando Henrique Cardoso in 1994 that Brazil's presidential succession finally took on a stable and enduring character.

1. Hyperinflation

The economy of the post-military years was characterized, above all else, by hyperinflation. Mean annual inflation between 1985 and 1989 exceeded 700% and jumped to over 1100% between 1990 and 1994. Growth slowed to a crawl in the latter period, averaging about 1.4% per capita annually (Baer 2008; Amann and Baer 2000).

The blame for hyperinflation in the early democratic period is usually attributed to an explosion in the number of interest groups seeking benefits from the newly accessible public sector (Weyland 1996). The weak state, lacking a clear strategy for balancing expenditures with revenues, succumbed to the demands for expansion. The push towards decentralization, as mandated by the new Constitution of 1988, further shifted federal resources towards states and municipalities, where patronage networks were even stronger and thus the risk of public sector budgets being used for political purposes greater (Montero 2000). The national political parties were too internally anarchic to prevent federal-level legislators from seeking and obtaining pork for their home states. Brazil's open-list proportional representation electoral system, which allows voters to choose the order in which a party's candidates are elected, further weakened party discipline and incentivized a personalist approach to lawmaking. Relatively loose guidelines for party registration also allowed a plethora of political parties to arise, making collective action in the legislature more difficult (Mainwaring 1999).

These new pressures of democratization were overlaid on the already existing frailties within the Brazilian state that had long prevented effective control of inflation. Most important of these was the long history of involvement by powerful rent-seeking actors in Brazilian politics, which helped to fuel the steady increase in the size of the state over the course of the 20th century (Hirschman 1981). The military government's emphasis on rapid and sustained growth, underwritten by heavy borrowing, also contributed to deep fiscal deficits and pushed mean annual inflation close to 45% by the second half of the 1970s. Inflation-indexation – the linking of securities, contracts, and wages to the rate of inflation to prevent real erosion of purchasing power – also became common during the military era. The effect was to protect the formal, politically connected sector from the short-term effects of inflation, which further reduced pressure for the government to take action to control price rises (Baer and Beckerman 1980). By the recession years of the early 1980s, the inflation rate had reached 130% annually (de Paiva Abreu 1990).

Before the introduction of the successful stabilization strategy *Plano Real* in 1994, discussed at length in the subsequent chapter, five distinct attempts to control inflation were employed in the post-military period. The expansionary Cruzado plan of 1986 under President José Sarney did succeed in increasing the economic growth to about 7.5% that year, but its effects were temporary. Even the initial surge in growth did not lead to a proportionate improvement in welfare: to control inflation, the government imposed price freezes which, despite the presence of rising demand, constrained the supply of goods (Haggard and Webb 1993). Black markets proliferated and the government was soon forced to rescind the price controls, leading immediately to high inflation and falling real incomes (Ferreira and others 2006).

2. Poverty and Inequality in the Transition Period

The 1980s were a time of economic contraction in Brazil; incomes shrank by 1.2% annually over the course of the decade in the country as a whole, and at a slightly slower rate in the Northeast. Growth was neither absolutely pro-poor nor relatively so; the poorest suffered a greater rate of negative growth than did the non-poor. As a result, poverty in the Northeast at the end of 1980s was greater than at the beginning of the decade. The headcount index increased slightly to around 72% by 1990, and the squared poverty gap index rose from 0.23 to 0.29 over the course of the decade. The recession and subsequent hyperinflation wiped out a portion, though not all, of the gains of the rapid growth years of the 1970s (IGBE 2011).

Inequality rose sharply in Brazil in the immediate post–military period, reaching an apex around 1989. Various indicators confirm this trend. The Thiel index climbed by nearly one-third from 0.68 in 1981 to 0.89 in 1989, and the ratio of income accruing to the richest 20% in comparison to the poorest 20% rose from an already high 23.4 to a thirty-year high of 33.5 (Paes de Barros and others 2006). Inflation was the most important culprit for this distributional deterioration. Hyperinflation affected the poor more strongly than other income groups, especially because the poor had more difficulty reallocating household portfolios away from cash to non-perishable consumption goods, and also due to the fact that employers of skilled and formal labor, especially the public sector, had greater flexibility in indexing wages to inflation during the recession years (Kakwani and others 2006). The poor, meanwhile, derived their income largely from the non-state and informal sectors.

As in previous decades, inequality in the first years of democracy was also driven by educational disparities, which accounted for just over a third of all income differences in 1993, just before the implementation of the Plano Real (Ferreira and others 2006). Skills premiums for the highly educated began to decline in the 1980s in the face of a weak job market, but not enough to offset the widening gap in educational attainment between the poor and the non–poor.

C. Health Policy

Spending on health during the military period was lower than in other countries, reaching only six percent of GDP in the mid-1980s, as compared to 10 percent in neighboring Argentina and considerably higher throughout the developed world. Health expenditure also became heavily biased towards curative versus preventative services, with a focus on hospital coverage. In 1965, a little over one–third of all public expenditures on health was dedicated to curative treatment. By the early 1980s, that figure had reached close to 85% (IPEA/IPLAN 1984). Although curative services are not exclusively utilized by the rich, fighting the "poor people's" diseases that contribute most heavily to child undernutrition and mortality is more effectively accomplished through investment in primary preventative care, and so the increase in health spending was largely regressive in nature.

The design of the Brazilian health insurance system also favored the better–off. The system had public and private components, with accredited private sector hospitals receiving substantial funding from public accounts, especially in the form of contracts and subsidized loans through the *Instituto Nacional de Assistência Médica da Previdência Social* (National Institute of Social Security Medical Assistance; INAMPS). Because INAMPS was an extension of the social security system, it concentrated on providing services to formal sector wage earners, and thus excluded many families at the greatest risk of undernutrition. The increase in health spending during the military era was devoted in large part to INAMPS, not to the Ministry of Health's broader public health portfolios. As a result, the impact on the poor of greater government expenditure on health was diminished. When the recession of the early 1980s forced a 20% overall cutback in health spending, preventive care programs were especially hard hit (McGreevey and others 1989).

Health policy did not move entirely in a regressive direction in the military period, however. By 1971, social insurance benefits had been extended for the first time in Brazilian history to the rural sector through the *Contribuição Previdenciária sobre a Comercialização Rural* (Rural Commercial Social Security Fund; FUNRURAL) program, and in the following year another important group, domestic workers in cities, were also covered. Health care coverage improved in absolute terms, with outpatient facilities increasing eightfold and per capita health spending increasing by 150% in the 1970s (Maddison 1992). Pro–poor policies like FUNRURAL, as well as regional development agencies like SUDENE and the Banco do Nordeste (Bank of the Northeast, which focused exclusively on development of the region), were also instituted, largely as a means to promote internal stability (Skidmore 1990).

In addition to nutritional status, other health indicators improved dramatically in the military period. In the Northeast, life expectancy rose by about ten years and infant mortality dropped by around 20% over the life of the regime. These gains in health illuminate a stylized fact of social policy during the military era: while the regime did not focus explicitly on the interests of the poor, its objectives dovetailed well enough with what was needed to reduce undernutrition (and improve health generally) that advances were indeed made. Section A discussed this topic with respect to economic growth: the military objective of accelerated industrialization did indeed lead to rapid economic growth and poverty reduction throughout the country, including in the Northeast. An analogous process occurred, albeit to a less extent, with respect to health policy. Although INAMPS largely benefited the formal sector, the program did represent movement towards universalization of social insurance; in the populist pre–military period, social services were delivered only to corporate groups linked to the government. These organizations fought actively against the institution of a federally managed universal health insurance scheme, which would dilute public spending across the population instead of preserve the existing group–based social security and health service system. The birth of the welfare state, under the authoritarian rule of

Getúlio Vargas in the 1930s, was in fact linked to this corporatist strategy (Segura-Ubiergo 2007). Vargas created a basic social security system aimed at serving state-recognized labor groups, thus reducing the incentive for independent organization of workers outside the state system and creating clientelist ties between the government and a potentially dangerous constituency. The end of Vargas' rule and the transition into democracy brought little change to the system, with the officially recognized unions able to lobby for greater benefits and unorganized workers excluded from the social safety net (Hall 2006). Although the military regime sought to weaken organized labor in order to control potential sources of internal dissent, an unintended outcome of this repression was the creation of greater space to undertake radical health policy reforms, including establishing the foundation of a universal health care system through the establishment of INAMPS and related programs (Luna and Klein 2006).

With the attenuation of corporatist links, clientelism in the public sector initially declined. The military regime in the early years of its rule in fact openly expressed a disdain for the patronage networks embedded in Brazil's government agencies, arguing for a more technocratic approach to public sector management. Over the course of its rule, however, the regime would exploit its powers of appointment to install preferred individuals in leadership positions, restoring with different masters the same webs of clientelism that had existed since the time of Vargas (Grindle 2010). The military's clientelism was different, however, in that it was more centralized, emphasizing a coherent federal policy instead of kowtowing to local bosses. As a result, the country's economic and social development was not necessarily hindered in the same way it would be in the early years of democratization, when a mad scramble for state resources led to hyperinflation and economic contraction.

The improvement in health policy was also spurred by civil society action, particularly by the sanitary movement, a group of health professionals that arose in the mid-1970s to highlight class-based inequities in the provision of health care. While their efforts were stymied by political opposition at the federal and local level, their ideas eventually came to influence thinking within the Ministry of Health, as discussed further in Chapter 8 (Weyland 1995).

D. Summary and Political Actor Map

Figure 50 below summarizes the relationships highlighted in the previous sections, in an effort to clarify the nutritional trend observed in the pre-1994 period. The circles represent the key political actors; the text within the circles summarizes the primary interests of each actor. The thickness of the line between each actor represents the power of influence in a given direction. The text corresponding to each link states how the actor exercised this influence. The web of links also provides a visual representation of the nature of alliances between state and non-state actors.

Figure 50. Brazil political actor map, 1970s growth and 1980s inflation period.

The diagram illustrates the strong control the government exercised over the groups that might have pressed for pro-poor reform: rural households, social movements, and organized labor (though all of these had internal difficulties as well in presenting an unified front to press the state for policy change). In contrast, the groups that had influence over the state – albeit limited in the military period – were precisely those had an interest in preventing reforms which would have accelerated poverty reduction and health system expansion: owners of capital in agriculture and industry, urban households, and politicians dependent on clientelist networks.

In sum, the various strands of continuity (e.g., economic inequality, concentration of political power) and change (e.g., economic growth, incremental health policy reforms) in the military and early democratic periods explain the trend in stunting observed in the two decades between 1974 and 1994. Impressive economic growth in the mid-to-late 1970s was not relatively pro-poor but absolutely so, and contributed heavily to a rapid decline in stunting in the Northeast. Reforms in the health and insurance systems also largely benefited the non-poor, but increased investment in these sectors did slowly and steadily improve the lives of the poor as well, as shown in the diagram above by the link between the state and rural hosueholds. The military's imposition of economic and health policy packages was possible because of their intentional weakening of potential sources of opposition, especially unions and clientelist politicians.

While these reforms fueled economic growth and welfare improvements for more than a decade, by the late 1970s heavy borrowing had made Brazil's trajectory vulnerable to external shocks. Those shocks arrived in the form of tighter international credit markets and high interest rates in the early 1980s, and the economy dipped into recession. The transition to democracy was politically and economically troubled. Various stabilization schemes failed to control hyperinflation, personalist gridlock prevented the formulation of coherent economic and social policy, and the trend of stunting reduction in the Northeast essentially halted. By 1994, discontent with the progress of democratization was widespread among the Brazilian populace, and political space opened for major reforms.

Chapter 8. Stabilization and Redistribution

Between 1989 and 2006, stunting prevalence in the Northeast fell by over four–fifths, from 33.4% to 5.8%. As a result, several million children were protected from cognitive and physical damage. The nutritional experience of the Northeast during these two decades – which, as this chapter argues, largely occurred in the several years after 1994 and since 2002 – is one of the world's most profound stories of human development. No one ideological paradigm has an explanatory monopoly on this narrative; good change occurred through a mix of traditionally conservative (orthodox stabilization measures) and progressive (redistributive social safety nets) policies. The following sections detail the history of this change.

A. Control of Hyperinflation

As discussed in the previous chapter, Brazil's economy stagnated in the 1980s, overwhelmed by the burden of foreign debt and mounting fiscal deficits. Inflation affected the poor disproportionately; between 1986 and 1990, the income of the poorest decile shrunk by 41%, and inequality worsened (Amann and Baer 2009). Several stabilization plans were attempted, most notably the Cruzado Plan in 1986 and the Collor Plan in 1990, but it was not until the introduction of the Plano Real in 1994 that inflation was finally controlled and the incomes of the poor recovered.

The Plano Real was in design very simple, containing just three major components. The first was the introduction of a new currency, the *real*, whose value against the dollar would be maintained with a chosen range by central bank action – specifically, by sales and purchase of the country's foreign reserves. The second element involved obtaining congressional approval to transfer control of nearly one-fifth of the national budget to the Ministry of Finance, which facilitated the cutting back of public sector expenditure and thereby addressed the major cause of inflation in Brazil. The final aspect of the Plano Real involved management of public expectations: a dual-price system was introduced in the market well before the *real*'s introduction, helping to build the popular faith in the currency necessary to contain the waves of panic consumption and speculation that could fuel inflation (Cardoso 2007).

The Plano Real instantly reduced hyperinflation in Brazil. Mean annual inflation fell from over 1100% in the 1990–1994 period to less than 20% in the last half of the decade. The gains were almost immediately felt by the poor after the implementation of the strategy in early 1994; in the Northeast, the headcount index and squared poverty gap index fell by nearly ten percentage points in a single year (Fiess and Verner 2004). In fact, most of the reduction in poverty observed in the 1990s in the Northeast was due to this steep decline in the wake of the Plano Real; besides 1994 and 1995, little annual change in poverty rate occurred in the other years of the decade, and no other policy mechanism deployed in 1994-95 can explain the sharp drop in poverty. The decline in inflation impacted poverty strongly not only through its effect on poor consumers, but also due to the fact that the stabilization plan included an exchange rate anchor, and so increased the prices of non-tradables in relative terms. Since many of Brazil's poor are producers and workers in the non-tradable sector, their real incomes benefited significantly from the price rises.

Comparison of the 1989 PNSN survey and the 1996 PNDS show that stunting prevalence in the Northeast declined from 33.4% to 22.2% over the seven–year period. As discussed in the last chapter, income growth and poverty reduction in the Northeast stagnated in the hyperinflation years before the introduction of the Plano Real, and inequality appears to have worsened slightly. Dynamic analysis of nutritional changes between 1986 and 1996 indicate that education and other non-income factors did impact stunting over this period, but their explanatory power is limited; the single most important observable factor behind the stunting decline between 1986 and 1996 was maternal schooling, which accounts for about 10% of the total reduction (de Lima and others 2010). Improvements in sanitation were responsible for a comparable impact, and changes in reproductive indicators – especially birth spacing and mother's age at birth – were slightly less important. Overall, the set of tested non–income factors explain less than one–third of the decline in stunting. Thus, to summarize: 1) the anthropometric data suggests that stunting reduction was concentrated in the 1989-1996 period; 2) the non-income determinants of stunting reduction only explain a fraction of the nutritional change over this time; and 3) income growth and poverty reduction was largely stagnant in this period *except* in the immediate aftermath of the Plano Real. Taking these facts together, I argue that there is a convincing case to be made that inflation control, the steep reduction in poverty, and the fall in undernutrition are closely linked.

Given the multiple failures of previous presidents to implement stabilization plans in the preceding decade, the Plano Real was a significant political accomplishment. The credit for the plan largely goes to Fernando Henrique Cardoso, a sociologist-turned-politician tabbed to be Finance Minister in 1993 under the presidential administration of Itamar Franco. The Plano Real was implemented under Cardoso's ministerial tenure, and its immediate success led to Cardoso himself being elected to the presidency in late 1994. He would hold Brazil's highest office for two terms, until 2002.

Cardoso's efforts to create a legislative consensus around stabilization as a policy priority was made easier by the fact that hyperinflation had reached such stratospheric levels. The severity of the crisis could not be denied, even by clientelist lawmakers and corporatist groups with a vested interest in the state's continued fiscal profligacy (Weyland 2002). Additionally, the failed attempts to control inflation in previous administrations had improved technocratic knowledge about which policy prescriptions were likely to be effective (Amann and Baer 2000). Finally, and perhaps most importantly, by the mid-1990s Brazil's populace became increasingly more vocal in their demands for the state to control inflation. In contrast to the immediate post–military period, in which democratization had contributed to inflation by increasing the number of actors making claims on the state's resources, widening participation in politics was pushing policymakers to make serious decisions about the public sector's budgetary malaise (Armijo 2005). Unlike in past decades, the real income of the "selectorate" – those within a country able to influence policy, which by 1994 had become the 77% of the voting age population that actually voted (IDEA 2011) – was strongly affected by hyperinflation. Additionally, the median “selector”, now equivalent to the median voter, was poor. Because social transfers at the time were regressive – a topic discussed at greater length further below – this poor median voter was unlikely to be the recipient of benefits from the state, and thus would have had less interest in fiscal expansion than in control of skyrocketing prices (Alesina 1988; Alesina and Rodrik 1991).

Successful stabilization enabled Cardoso to recentralize Brazilian policymaking at the federal level to an extent, which in turn would facilitate further reforms (Eaton and Dickovick 2004). Since the end of the dictatorship, the country’s politics had been characterized by a highly fragmented legislature. As noted earlier, elections took on more of a personalist than a party character, and switching between parties by individual legislators in pursuit of pork and political power was common (Deposato 2006). This was partially due to the fact that the Constitution of 1988 emphasized the importance of political and fiscal decentralization. As a result, the power of governors and other state officials grew, and federal-level legislators had more incentive to pursue gains for their constituencies – and thereby pave the way for their own eventual return to more lucrative state-level politics – than to make the compromises necessary to fashion coherent, effective national policies (Ames 2001). Fiscal decentralization also led to out of control and badly prioritized expenditure by states, especially in the use of payroll budgets to sustain patronage networks. Until the mid-to–late 1990s, national revenues were distributed without concomitant regulation of how local governments could spend this new money.

The almost overnight success of the Plano Real gave Cardoso the credibility to pursue further reforms in this contentious political milieu. Many of his reforms, which have been critical to sustaining Brazil's macroeconomic stability since 1994, focused on limiting the fiscal autonomy of states. One–fifth of the constitutionally mandated federal transfers to states were withheld by Cardoso in his first term on grounds of fiscal oversight. Under the broad *Lei de Responsbilidade Fiscal* (Fiscal Responsibility Law; LRF) of 2000, which has special status as a "complementary law" to the constitution and thus is protected from repeal, transfers in Cardoso's second term were stopped entirely if states failed to meet debt obligations. Since 1994, state governments have been required to spend at least one-quarter of their revenues on education, and another 15% on health. All but two of the country's 26 state-level banks were privatized during Cardoso's rule and a debt ceiling established, which severely limited states' ability to grow budgets simply by making soft loans to themselves (Eaton and Dickovick 2004). Despite the climate of crisis, each of these reforms presented serious political obstacles, and would have been impossible had the administration not gained immense popular support in the wake of the Plano Real. Cardoso also lessened the governors' resistance by tying reforms to one-off bailouts to states in serious fiscal crisis (Ames 2001). It should be reiterated that because hyperinflation itself was politically desirable at the state level – allowing governors to disguise ballooning debt loads and payroll expenses – the Plano Real was not only an enabling factor for further political and economic reform, but also was a powerful reform mechanism itself.

The design of Cardoso's macroeconomic reforms came through a careful technocratic process. Leadership from the highest levels of relevant Ministries and careful building of technical consensus was critical to arriving at effective policy blueprints; especially important was strong buy-in by the Ministry of Finance and the Central Bank, who play the most critical roles in managing the overall macroeconomic environment, especially with respect to controlling inflation. While sectoral ministries had an incentive to spend without regard to social impact, the finance ministry had to consider the long–term costs and benefits of such spending, and thus provided the internal counterbalance needed to resist sectoral pressures (Krueger 1993). Cardoso sought and received strong support from the heads of these agencies, greatly facilitating the reform process.

Overall, implementation of the technical blueprints was a profoundly political achievement, depending on both the structural factor of deepening democratization, which increased popular support for reform from the voting public, and the more contingent influence of Cardoso's prowess at countering the opposition of political elites. Much has been made of Cardoso's use of special decrees (*medidas provisórias*) to implement the macroeconomic reforms, but in actuality the difficult process of policy change depended less on formal executive power – which was relatively weak in Brazil as compared to other countries in Latin America at the time of Cardoso's ascension – than skillful use of this limited power in the ways described above.

The Plano Real, however, was not without adverse macroeconomic impacts. The Central Bank, led by its President Gustavo Franco, chose to keep the nominal exchange rate low in order to increase imports of consumer and durable goods, thus creating competition, forcing Brazilian industry to increase productivity, and controlling prices. Keeping the nominal exchange rate low lead to appreciation of the *real*, and so exports (and thus the country's trade balance) suffered in subsequent years. The need to maintain the overvaluation of the Real also increased Brazil's vulnerability to the economic crises in East Asia, Russia, and neighboring Argentina (Bezerra and Cavalcanti 2009). The exchange rate anchor was eventually abandoned in 1998, at the beginning of Cardoso's second term. However, the combination of initial vulnerability to external shocks, the depreciation of the Real following the move to a floating exchange rate system, and increased public sector fiscal austerity together slowed aggregate growth and caused real wage levels to stagnate at the end of the 1990s, contributing to the loss of Cardoso's chosen successor, José Serra, in the presidential elections of 2002 (Coes 2009; Kakwani and others 2006).

B. Reversing Inequality

The gains in real income following the implementation of the Plano Real explain much of the improvement in child nutrition between 1989 and 1996. Slower but steady increases in maternal education, access to safe water and sanitation, and access to basic health services over the course of the 1980s also drove stunting reduction (de Lima and others 2010). These latter factors were made possible by historical processes discussed in the previous section and Chapter 7: greater government investment in health coverage, the influence of health professionals from the sanitary movement in setting policy following democratization, and a federal commitment to ensure that states increased health and education spending.

Stunting reduction continued to accelerate in the period between the last two nationwide surveys, in 1996 and 2006–7, falling by nearly three–quarters from 22.2% to 5.9%. The latter figure is below the stunting prevalence of the rest of Brazil taken together, and as such illustrates the extraordinary transformation of the Northeast from a region known for the depth of its poverty to a human development success story equaled by few places in the world.

The latest period of nutritional improvement coincided with lackluster economic performance. Between 1996 and 2006, the annual growth in GDP per capita in the Northeast region equaled about 1.3% (IGBE 2011). with almost no gains at all between 1996 and 2003. How, then, was stunting so rapidly reduced in this time period? The answer appears to be that Brazil's historically persistent inequality is slowly being reversed through improving social assistance, education, and health policies. The following pages discuss these factors.

1. Social Transfers

Income inequality in Brazil declined rapidly immediately following the initiation of the Plano Real, remained stable throughout the late 1990s, and then underwent a steady decline in the 2000s. The Gini coefficient reached a historical low of 0.564 in 2004, falling about ten percent from its peak of 0.625 in 1989. The fall has been driven most strongly by progressive public transfer policies.

Public expenditures in Brazil have historically been regressive (Clements 1997); in fact, throughout the 1990s higher government expenditures were associated with higher income inequality at the municipality level (Baer and Galvão Jr. 2008). The regressive nature of government transfers is largely due to the pensions burden. At the end of the Cardoso administration, over 70% of all federal benefits (monetary and non–monetary, including health and education transfers) were dedicated to pensions. Over half of the total value of pensions went to the richest tenth of the population, while the poorest half only received one–tenth of pension benefits. Between 1981 and 2004, this social security system actually became more regressive, with its proportionate contribution to overall income inequality rising from 9.5% to 18% as the population became older and pensions coverage expanded (Ferreira and others 2006).

However, this regressive social insurance spending has been offset by Brazil's widening social safety net, the origins of which are found in local projects initiated during the Cardoso administration, especially food aid programs and municipal conditional cash transfer programs. Of particular importance is *Bolsa Escola*, a program first piloted in Brasília in 1994 under the leftist administration of Cristovam Buarque (Guidry 2003). The Ministry of Education later scaled the program up to national level during President Cardoso's second term. The program provided cash benefits for families who agreed to enroll their children in school – specifically, to meet an 85% attendance threshold (Hall 2006).

The social assistance budget expanded considerably with the election of President Luiz Inácio "Lula" da Silva in 2002, increasing from R$10.2 billion in that year to

R$22.0 billion by 2006. The various existing direct assistance programs – along with Bolsa Escola*, Bolsa Alimentacão, Cartão Alimentacão,* and *Auxílio Gás* – were folded into an umbrella program, *Bolsa Família*, at the beginning of Lula's term. This integration helped to ease the administrative difficulties that had plagued these programs in previous years. Under Cardoso, each program had previously been overseen by a different Ministry, complicating targeting and disbursal of payments (IPEA 2003). Bolsa Família, in contrast, was managed by the newly created Ministry of Social Development, and targeting and payment were based on a unified register of below–poverty line households. In exchange for meeting school attendance (and, where relevant, prenatal care, child vaccination, and health and nutrition training) conditions, the program provides a transfer of up to R$95/month per family, depending on the household's size and degree of poverty. Municipalities were given the responsibilities of participant registration and monitoring of adherence to the agreed–upon conditions.

By the time Lula completed his first year in office, the program had been extended to all of the country's municipalities. Between 2002 and 2006, funding for Bolsa Família grew by nearly 250%, increasing from $R2.4 billion to $R8.3 billion. The program attained central importance in the government's safety net strategy, increasing its share of social assistance resources from 23% to 38% over this same time period (Ministério da Fazenda 2005). The rise in expenditure has been driven by geographical expansion of the program; by the middle of Lula's second term, nearly all of Brazil's poor – nearly one-quarter of Brazil's population – were covered by Bolsa Família (Hall 2006). Despite this growth, however, Bolsa Família continues to be dwarfed by the value of pension transfers, which impose a cost burden to the government 35 times greater than that of the conditional cash transfer program.

Overall, a decomposition of the sources of pro–poor growth between 1995 and 2004 shows that non-labor income (i.e., program transfers) is by far the strongest contributor to the increase in incomes of the poor, particularly in the first few years of the 2000s. In that period, non-labor income accounts for as much as four-fifths of total pro-poor income growth, and for around half of the decline in inequality (Kakwani and others 2006). A more narrowly focused study of the 2001-4 period confirms this trend, finding that over one-third of the fall in inequality is due to changes in the distribution of income not derived from work, which is interpreted to imply benefits from public transfer programs (Paes de Barros and others 2006). An evaluation of Bolsa Família conducted by the University of Minas Gerais in 2007 indicates that one-fifth of the decline in inequality observed during Lula's first term is attributable to the program alone (Centre for Development and Regional Planning 2007).

Social assistance programs have contributed nearly as much to poverty reduction in the post–stabilization period as has economic growth; one–third of the reduction in both headcount and poverty gap index can be attributed to government transfers (Ferreira and others 2010). These transfers have driven nutritional improvements by increasing household purchasing power among the poorest, even in a period of weak economic growth. Analysis of the correlates of stunting reduction at the household level, using data from the 1996 and 2006–7

PNDS, shows that increases in family purchasing power accounted for one-quarter of all improvements in chronic undernutrition, despite the economic slowdown (de Lima and others 2010).

To date, limited information is available about the direct impact of Bolsa Família on nutrition, but what data exists shows promising results. A recent evaluation of the program commissioned by the World Bank found that, in a sample of 11 thousand families in 24 states across Brazil, undernutrition rates among children were 39% lower among Bolsa Família participants when compared to the control group (Medici and others 2011). Another evaluation of four high–risk areas in Brazil – the sertão of the Northeast, agrarian reform settlements, Amazonas state, and *quilombos* (settlements founded by people of African origin, usually escaped slaves) – found that children of Bolsa Família participant families were 26% less likely to be stunted than those of non-participant families (Paes Sousa and Pacheco Santos 2009).

2. Education and Health

Compared to other countries with similar income levels, educational attainment in Brazil has been extraordinarily low. Average years of schooling increased only slightly in the military period, rising from 2.78 to 3.22 years between 1965 and 1985. Nearly one–third of the Brazilian population had no schooling at all in the latter year (Barro and Lee 2010). Disparities in education play an important role in overall inequality in the country; data from the late 1990s indicated that nearly half of the wage gap at that time was attributable to educational inequalities alone

(Bairros and others 2003). Skills premiums linked to educational level are an important part of this story. A study on the causes of inequality in the country found that, in the late 1990s, Brazilians with postsecondary education earned nearly four times the wages of those with incomplete primary education, a gap that far exceeds both of the two other large regional economies, Mexico and the United States. Data is not available to assess the size of this gap in the military period, but the differential appears to have widened in the 1990s (World Bank 2004). Overall, in 2004 around 35% of inequality in Brazil could be attributed to disparities in educational attainment, a figure close to the historical trend (Ferreira and others 2006).

However, marginal returns to schooling – that is, the extra income associated with, say, an additional year of education – appear to have declined in the Cardoso/Lula years. Because inequality in educational attainment is so pronounced in Brazil, this fall in marginal returns has *improved* income equality: having another year of schooling matters less for income than it has in previous decades (Ferreira and others 2006). This is likely due to the demand for highly educated workers not expanding as quickly as supply, although to what extent this is due to the success of tertiary education policy versus slow growth in the high-technology sectors is unknown. Additionally, despite remaining at low levels, educational indicators did improve during the Cardoso administration. Between 1990 and 2000, average educational attainment of females rose from 3.72 to 4.5 years (Barro and Lee 2010). School enrollment also increased significantly, reaching around 100 percent gross secondary school enrollment by 2000 (World Bank 2011). This improvement had significant impacts on stunting; an increase in maternal education accounted for nearly one–fifth of the steep decline in stunting in the Northeast between 1996 and 2006, second only to the effect of income increases (de Lima and others 2010). Previous data from the 1989 Brazilian National Health and Nutrition Survey also found that parental education and child stunting are strongly and significantly linked. Taking direct and indirect effects together - that is, the direct impact on improving caregiver knowledge and thus child care practices, as well as the indirect impact of increasing household income - lifting maternal educational attainment from primary first cycle level (i.e., <4 years) to primary second cycle level (4-7 years) was associated with a 40% lower stunting prevalence in the 1989 sample. Lifting maternal years of schooling to at least 11 years essentially eliminated stunting altogether. The effect of paternal education was less pronounced, but still significant (Kassouf and Senauer 1996).

Health spending was highly progressive in the post-stabilization period, with the poorest half of the population receiving 70% of expenditure (Ferreira and others 2006). Improvements in the public health environment were strong drivers of the drastic fall in stunting in the Northeast region between 1996 and 2006. Better access to safe sanitation accounted for about 13% of this decline, and improvements in basic health services another 9%. Changes in maternal reproductive indicators, including birth spacing and mother's age at birth, were responsible for another 12% of the reduction; thus changes in the health environment taken together accounted for over one–third of the observed fall in stunting (de Lima and others 2010).

These improvements are largely driven by primary health care reforms first introduced in the Constitution of 1988, which mandated the creation of the *Sistema Único de Saúde* (Unified Health System; SUS) to provide free health services. The SUS transferred funds to states based on the level of services provided, incentivizing locally driven improvements in the health system, even in poor communities (Arretche 2000). The system has been praised for its success in vastly expanding basic health service coverage; by 2006, nine out of ten municipalities in the country were integrated into the system (Ministério da Saúde 2004). Increasing political participation by the previously uninsured has had a positive impact on the availability and quality of care in the SUS (Mobarak and others 2009). The SUS has also played an instrumental role in the steep decline in child mortality observed in recent years (Aquino and others 2009). In addition, the creation of the SUS drove the trend of increasing professionalization in the sector, in terms of greater data collection efforts about the determinants of illness and health outcomes, as well as an improvement in the quantity and quality of the community health worker force. In the present day, 236,000 health workers provide near-universal coverage for basic services in Brazil, including a wide range of maternal and child health interventions (Paim and others 2011; Victora and others 2011).

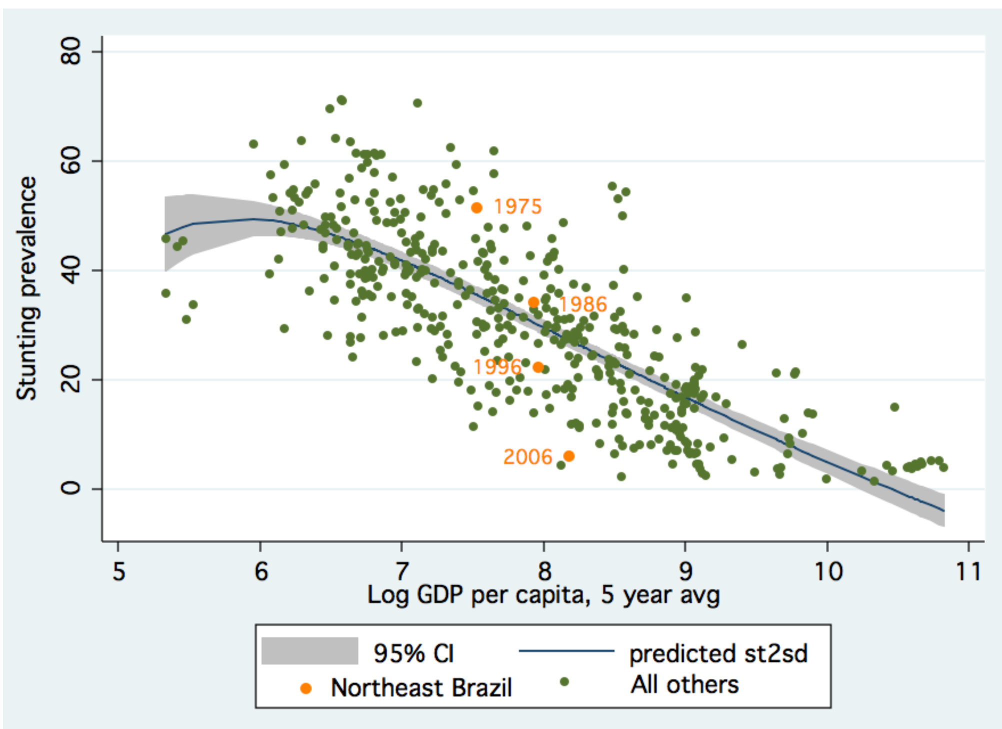
The health professional-led sanitary movement, mentioned in the previous chapter, had a strong impact on the design of the SUS (Paim and others 2011). The movement had been hampered in their push for sweeping health care reforms during the military and early democratic eras by resistance at the local level; the push for federal oversight and health spending mandates advocated by the movement threatened to undermine the considerable flow of resources into local patronage networks, and a result many state and municipal politicians resisted health care reforms (Weyland 1996). By the 1990s, however, members of the sanitary movement obtained key leadership in the two Ministries relevant to public health, the *Ministério de Previsión y Asistencia Social* (Ministry of Social Security and Assistance; MPAS), which administered social security and pension benefits, and the *Ministério da Saude* (Ministry of Health; MS) itself. Although bureaucratic conflict between the two agencies fragmented the strength of the sanitary movement as a whole, the basic ideological priorities of the movement, especially the principle of access to high quality primary health care for the poor, eventually came to occupy center stage of the health care reform debate in Brazil.

*   *   *

Overall, poverty reduction was possible in a context of slow aggregate growth in the 1990s and 2000s because income inequality in Brazil fell, driven especially by public sector program transfers. The poor were protected from macroeconomic stagnation by an expanded social safety net. The reduction in income inequality is also reflected in a reduction in nutritional inequality. Between 1996 and 2006, the gap in stunting prevalence between the poorest and richest quintiles narrowed dramatically. In the earlier year, poor children were more six times as likely to be stunted as those in the richest quintile; by the beginning of Lula’s second term, this ratio had been reduced to 2.6 – still considerable, but a significant fall (Monteiro and others 2010).

In concluding this section, it is worthwhile to take another look at the relationship between income and stunting prevalence in Northeast Brazil, this time adding the data points from the 1996 and 2006–7 nutritional surveys.

Figure 51. Bivariate association between GDP per capita (*loginc5*) and stunting prevalence, with Northeast Brazil 1974-5, 1986, 1996, and 2006 observations. The 1996 data is from the *Pesquisa Nacional sobre Demografia e Saúde* (The National Demographic and Health Survey; PNDS 96); the 2006-07 data from the *Pesquisa Nacional de Demografia e Saúde da Criança e da Mulher* (National Child and Woman Demographic and Health Survey; PNDS 06) in 2006-07; other data sources are same as in previous figures.



The trend is striking. Whereas in 1975 Northeast Brazil had displayed an exceptional inefficiency at "converting" income into nutritional health, the situation was reversed thirty years later. The region had become an outlier in the opposite direction. While countries at comparable levels of wealth struggled with still-high stunting rates – countries as diverse as Egypt (30.8%), Bolivia (27.2%), and Indonesia (40.1%) – the Northeast, despite continuing income poverty, had made singular nutritional gains. The political challenges of assuring macroeconomic stability, widening the redistributive safety net, and steadily improving access to basic health care and primary and secondary education had been skillfully met by Brazil's leaders.

It is worth noting that none of these policy changes were specifically targeted at the Northeast, and yet all had profound effects on the region. In arguing for the Plano Real, Cardoso did refer repeatedly to the objective of not just macroeconomic stabilization but also poverty reduction – but poverty was by no means an exclusively Northeastern phenomenon (Cardoso 2007; Flynn 1996). The headcount ratio is Brazil as a whole in the years just prior to the implementation of the Plano Real, though barely half that of the Northeast, still exceeded 20% (Fiess and Verner 2004). However, given that the clientelist network-fed state payrolls that were largely to blame for fueling hyperinflation were as strong in the Northeastern states as anywhere in Brazil – for example, in the state of Ceará in 1995, the salaries of government employees alone exceeded the entirety of state revenues (Flynn 1996) – the fiscal recentralization measures introduced by the President had particularly powerful effects in the Northeast. In sum, however, inflation control was a national goal without intentional regional focus.

The same must be said of Bolsa Família. The conditional case transfer program was rolled out nationally, although as discussed above its inequality-reducing effect was especially potent in the Northeast – mainly because inequality within the states of the region was more pronounced than anywhere else in the country. Bolsa Família also had another profound regional effect: the increase in political participation by the poor of the Northeast, a trend that swung the region towards the leftist PT in the 2006 elections, as discussed in the subsequent section. Yet this effect was also unanticipated, at least in degree.

Finally, the improvements in health service and education facility coverage discussed in the last section were also driven by national-level objectives. The Sistema Único de Saúde (SUS), the program vehicle responsible for much of the improvement in access to basic health services over the last twenty years, was designed on a state-driven incentive model wherein the level of funds provided was linked to the type and coverage of services offered, without any in-built bias towards the Northeast. However, to the extent that the Northeast lagged behind the rest of the country in quality and coverage of such services, the region had the most to gain from health system upgrading. The same is true of educational expansion: increases in educational attainment were impressive in the Northeastern states partially because of its low starting point relative to other regions, not because the policy push was framed or implemented in strongly regional terms.

In sum, federal-level policies had impressive regional results without an explicitly formulated intention to redistribute resources, or political attention, from Brazil's richer states to the impoverished Northeast. With regards to child welfare, the most important change in the relationship between the federal and state governments in the Cardoso and Lula periods was not a conscious reversing of regional bias, but rather, as discussed earlier, the recentralization of fiscal power following the implementation of the Plano Real. The decentralization process mandated by the Constitution of 1988 had led to the creation of powerful patronage networks and an overextended state incapable of investing in the basic services essential for improvements in child nutrition: health services, educational facilities, and social safety nets. Taming inflation and state debt confronted these problems directly and paved the way for subsequent reforms in these areas.

C. Civic Mobilization

The issues of poverty, inequality, and hunger have become mainstream political concerns in present–day Brazil. The changes in social policy discussed in the previous section arose from a combination of social movement pressure and an intentional focus on poverty and inequality by the country's leadership, particularly during the administration of President Lula. The impact of civic mobilization on political action is discussed in this section, with a focus on the two movements of most relevance to child stunting in the Northeast: the agrarian reform movement and the Partido dos Trabalhadores (Workers' Party; PT).

1. The Land Reform Movement

Given the high rates of land inequality in the country – with a land Gini coefficient of around 0.85 even in the present day – and the concentration of poverty in rural areas of the Northeast, land reform has been at the center of the poverty debate throughout the history of democratic Brazil. Despite this, large–

scale agrarian reform has never been successfully carried out in the country. The initial attempts to do so by the administration of João Goulart in the early 1960s contributed to the elite backlash that hastened the military coup of 1964 (Hammond 2009). The issue was off the agenda for the duration of the authoritarian period. Although attempts by several post-military administrations to address the issue have been consistently resisted by the strong rural caucus in the Brazilian Congress, the groundswell of social movement pressure for meaningful reform grew in the democratic period, with important consequences on the political landscape of today.

Civil society action for land redistribution has been led by the *Movimento dos Trabalhadores Rurais Sem Terra* (Landless Workers' Movement; MST) and the *Confederacão Nacional de Trabalhadores Agrícolas* (National Confederation of Agricultural Workers; CONTAG). These movements assisted landless people to occupy "socially unproductive" land, as permitted by the Constitution of 1988. The issue was thus forced on the government, and the first substantive steps towards reform were taken in the years immediately following the Plano Real. The stabilization plan brought about a fall in land prices, which allowed the Cardoso government to increase the quantity of land purchased for land reform initiatives (Mueller and Mueller 2006).

The pace of reform fell short of the demand for redistribution, however, and land occupations led by the MST increased in number in the late 1990s, as did violent repression of the movements by landowner-backed militias. According to records kept by the *Commisão Pastoral da Terra* (Pastoral Land Commission; CPT), a church-based group sympathetic to agrarian reform, around 1,500 people have been killed in land conflicts since the end of the military regime (CPT 2008). Of these deaths, less than one-tenth have resulted in trials, illustrating the considerable influence of rural elites over local judicial systems (CPT 2000). In the most brutal and well-known massacres, in 1995 at Corumbiara in Rondônia state and in 1996 at Eldorado dos Carajás in Pará state, military police forces were implicated in the killings.

Settlers accepted these risks because the rewards of land occupation are concomitantly high. A 2001 study of occupations in the Northeast found that settlement led to a doubling of income and a significant improvement in other indicators of welfare among the previously landless (Buainain 2003). Another study at the national level found similar conclusions, showing that settlers had managed to reach income levels above the minimum wage line and comparable to local salaried workers (Sparovek 2003).

The land reform movement, though falling well short of its goals of radical redistribution of land, has been broadly successful in both substantive and political terms. In the decade between 1995 to 2005, spanning both the Cardoso and Lula administrations, the government redistributed $7.7 billion worth of land equaling over 42 million hectares to nearly 3 million people (Mueller and Mueller 2006). More importantly, the dramatic actions of the occupiers helped to put issues of poverty and inequality, especially in the Northeast, on the front page of national newspapers. Public opinion generally supported the land reform movement, especially following the 1995 and 1996 massacres, and so the issue helped to create political space in 2002 for candidate Lula to run a campaign based on an anti-poverty, anti-inequality platform.

2. The Rise of the Workers' Party

The Workers' Party (PT) was the first broad-based popular movement to gain political influence in modern Brazil. Previous reform movements, including the Peasant Leagues and the MST, were indeed engaged with issues of importance to the poor and of relevance to child nutrition, but their focus was restricted in thematic or geographical scope.

The worker strikes that swept through Brazil in 1978–80 initiated the political movement that would lead to the formation of the PT. The strikers' ostensible demands included wage increases and the right to form independent trade unions, but the deeper objective was political opening and movement towards democracy. Starting with a sit-down of a hundred bus workers outside São Paulo in May 1978, the movement expanded to over half a million strikers nationwide by 1980, and included transport workers, longshoremen, teachers, and a wide range of blue–collar and white–collar professions (Guidry 2003). After decades of corporatist control by the government, which had enabled the military regime to carry out their economic and social agenda with little opposition, the strikes served as the catalyst for not only for Brazil's first bottom-up labor movement, but also for broad–based organized opposition to the authoritarian government.

The New Union Movement, as it was called, also received the active support of the Catholic Church, a progressive force in Brazil since the early 1960s. Church-organized "ecclesiastical base communities" provided a means to organize widespread resistance to the military regime and to the patronage networks that controlled local politics, especially in the Northeast (Guidry 2003). The New Union Movement was led by Luiz Inácio "Lula" da Silva, a metalworker who had grown up in poverty in the Northeast and would, two decades later, become Brazil's president. Partially in response to the increasing popular pressure, the military regime under General João Figuerido slowly proceeded with their program of *abertura* ("opening"), and by 1979 the electoral rules allowed political organizations other than the military–run *Aliança Renovadora Nacional* (National Renewal Alliance; ARENA) and the officially sanctioned opposition party *Movimento Democrático Brasileiro* (Brazilian Democratic Movement; MDB). Under the leadership of Lula, the Workers' Party formed in 1980, and grew quickly to become the strongest leftist party.

Although initially a trade union–based movement, the PT eventually came to represent a broad range of progressive priorities, and to this day has remained carefully autonomous of organized labor and other social movements (Guidry 2003). The PT's breadth and internal discipline quickly made the party a force at the national level, especially in the highly personalist Brazilian political system, where switching between parties is common and ideological distinctions between many of the strongest parties are less pronounced than in other countries. The ability of the PT leadership to hold a broad-based coalition together and to promote an image of unity and discipline propelled the party to a series of ever-increasing numbers of victories in mayoral, gubernatorial, and legislative elections. By 2002, the party had gained one-sixth of the seats in the Chamber of Deputies (the lower house of Congress) and one-tenth in the Senate, in addition to nearly 200 mayoralties throughout the country (Álvarez-Rivera 2010).

The PT's leader, Lula, won Brazil's presidency in 2002 and again in 2006, following defeats in the three previous elections against Fernando Collor de Mello and Fernando Henrique Cardoso. By 2002, Brazil's voters were disenchanted with weak growth, persistent inequality, and rampant corruption, and Lula's transformative message carried him to victory.

Contrary to initial expectations, the Lula government maintained the orthodox macroeconomic policies of the Cardoso administration and focused on generating budget surpluses, which soon allowed Brazil to pay off in full its existing debt to the International Monetary Fund, a symbolically important political victory. High interest rates helped to control inflation, although fiscal austerity and tight credit moderated the pace of economic growth. Between 2003 and 2007, Brazil's annual GDP per capita growth rate was around 3.2%, greater than in the past two decades but much slower than in the rapidly expanding economies of Asia. This rate of growth, however, was impressive as compared to Cardoso's final years, and the perception of improvement contributed to Lula's re–election in 2006, as did the success of Bolsa Família. The program was universally popular in the run–up to the election, with opposition parties promising not just to preserve the program but also to expand it (Hall 2006).

Falling interest rates and increased credit availability, as well as increases in the mandated minimum wage, have stimulated consumer activity and sustained the Brazilian economy in recent years (Hunter and Power 2007). Annual per capita GDP growth rates have averaged around four percent between 2004 and 2008. In addition, growth was strongly pro-poor even in the slower early years of the 2000s. Per capita income in the first half of the decade in fact increased by nearly 8 percent a year among the poorest decile, while the top decile saw their incomes decrease in absolute terms during the same period (Paes and Barros 2006).

Lula's chosen successor Dilma Rousseff was elected to the presidency in 2010, extending the PT's reign by another four years. In the 2010 general elections, the PT became the largest party in the Chamber of Deputies and the second largest in the Senate. PT-led coalitions gained majority representation in both houses, and nearly half of all of the country's governors are either members of the PT or supported by the party. In three decades, the party had gone from being a loosely organized leftist social movement to becoming the dominant political force in Brazil.

Along the way, the PT's ideological position moved markedly towards the center. Prior to Cardoso's market reforms, the PT had stridently advocated socialist transformation of the Brazilian economy and warned against the dangers of neoliberalism. Given the runaway inflation and economic stagnation of the early democratic period, the message found receptive ears, and the PT's radical platform did surprisingly well against Collor in the 1989 elections, although Lula lost the contest (Hunter 2007). The success of the Plano Real and subsequent reforms, however, changed the political calculus. The almost immediate effect of the Plano Real in suppressing inflation propelled Cardoso to easy victory in the 1994 elections. Cardoso was again lopsidedly re-elected in 1998, and it was clear that the Brazilian populace credited the president's market-friendly reforms with the country's economic recovery.

The PT realized that electoral success required a more moderate platform. Because Cardoso's reforms had moved his own party, the Partido da Social Democracia Brasileira (The Brazilian Social Democracy Party; PSDB), towards the ideological center, the center–left position that the PSDB had once occupied was now available to be filled by the PT. Lula's 2002 presidential campaign reflected just such a move, choosing a business-friendly candidate as a running mate and stepping back from its earlier ambitions to nationalize key industries (Hunter 2007).

However, even in the midst of such ideological moderation, the PT maintained the characteristics that had marked its ascent, especially strong internal discipline and a programmatic focus on poverty reduction and equality. The party's views on how to achieve these latter goals had clearly become more pragmatic, but Lula's commitment to address the needs of the poor remained clear throughout his campaign and his years in office; Bolsa Família and associated social welfare programs continued to be a focus of political attention throughout Lula's rule. As a result, Lula's electoral base – once largely restricted to urban workers and the progressive professional classes – expanded to include the tens of millions of Brazilians living under the poverty line (Zucco 2010). In previous presidential elections, despite the fact that he originally hailed from the region, Lula had resoundingly lost the Northeast, undone by the power of local patronage politics. In 2002, however, the PT leader captured the region easily, garnering nearly 62% of the vote – a higher proportion than in any other region expect the Southeast (Nicolau 2008).

Despite corruption scandals at high levels of the PT in the run-up to the 2006 elections, Lula again won handily, buoyed largely by the support of the poor and especially because of the popularity of Bolsa Família. For Brazil's poorest, malfeasance seemed to matter less than tangible resource benefits, although lack of information about the corruption scandals among the less educated may have influenced voting (Hunter and Power 2007). In the 2006 run-off polls, 69% of Brazil's poorest class (those making an income under twice the minimum wage, which is nearly half of the country's population) voted for Lula, while only 44% of the richest (those above ten minimum wages) did so; a breakdown by educational level yields similar results. In the Northeast, more than three-quarters of voters stated an intention to vote for Lula, and a regression of state per capita GDP against Lula's vote share in 2006 finds that low levels of development were strongly and significantly associated with support for the incumbent, even controlling for vote share in the previous election (TSE 2011). Even more tellingly, vote share for Lula in 2006 was strongly correlated with the size of the Bolsa Família program at the municipality level. In a study done of Brazil's more than 5000 municipalities, a one percentage point increase in the number of families covered by Bolsa Família is associated with a 0.35–0.46 percentage point increase in the 2006 Lula vote, controlling for a wide set of variables including 2002 vote share, race, religion, population size, party of mayor and governor, GDP, taxes, and size of the public sector (Zucco 2008). Voter turnout proportion across states also appears to be strongly correlated with Bolsa Família coverage, suggesting that Lula's programs were encouraging low-income families to participate in elections (Hunter and Power 2007). Largely through a conditional cash transfer program, the Workers' Party won the hearts of the country's poor, and with them a hold on the presidency.

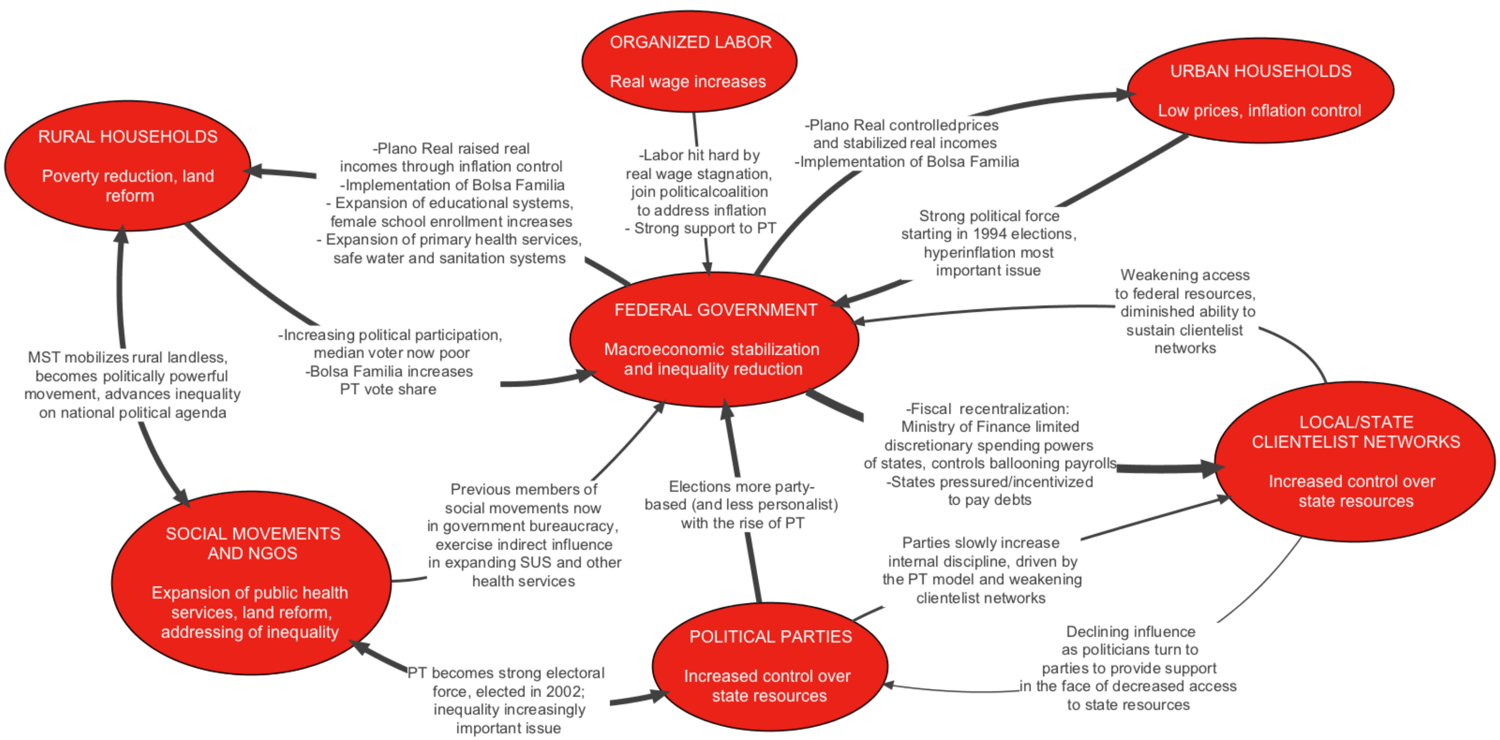
* * *

Social movements in the post–military period redefined Brazilian's political discourse and shifted the attention of policymakers towards the issues of poverty, inequality, and hunger. The sustained decline in stunting in the post–Plano Real years has been profound, and is explained to a great extent by the fall in inequality brought about by redistributive social policies, especially conditional cash transfer programs. Brazil's political center of gravity has been steadily moving towards a mixed model of orthodox macroeconomic policies and a social–democratic vision of the state's role in guaranteeing the basic needs of the poor, and the latter is largely due to the influence of the country's social movements.

D. Summary and Political Actor Map

The narrative of the preceding pages is summarized in the political actor map on the following page. Again, major players are indicated in circles with their interests written below; arrows indicate links of influence, with the thickness of

Figure 52. Brazil political actor map, Lula and Cardoso periods.



the lines representing strength of influence and the corresponding text type of influence. Note that, as compared to the political actor map in the previous chapter, the number of outward links (indicating influence) from the government to other actors is reduced. The state, which had previously exercised strong control over labor, political parties, and social movements, found itself exposed to the interests and growing power of these actors. Alliances between rural households, land reform- and inequality-focused social movements, leftist political parties, and the middle class further increased the ability of these actors to set policy agendas, particularly around inflation control and eventually redistributive policy. Meanwhile, crucially, Cardoso's skillful mix of carrots and sticks increased federal power over state resources and thereby attenuated clientelist networks, paving the way for continued reforms to limit inflation and strengthen Brazilian democracy. Partially as a result of weakened patronage systems, parties were able to exercise more influence on individual politicians, paving the way for party-based politics and the subsequent rise of the PT to power.

Chapter 9. Analyzing the Brazilian Experience

The previous two chapters have presented in narrative form the political and economic forces associate with the decline in stunting in Brazil between 1975 and 2007. In this chapter, I revisit the formal hypotheses introduced in Chapter 4, and utilize the narratives to confirm or refute the various presumptive explanations, using a process–tracing approach.

A. Hypothesis Testing

1. Mass Movements

The *mass movements* hypothesis asserts that mass movements had a direct impact on the formulation and implementation of policies causally linked to lower child undernutrition. In the process-tracing approach used in this study, each of the four steps outlined in Figure 9 would have to be independently confirmed for the overall hypothesis to be confirmed. The steps are listed in turn below.

"Step 1: A poor people's mass movement with interests related to child nutrition or its determinants is established and gains power".

As discussed in the "Civic Mobilization" section of the previous chapter, two major mass movements with agendas linked to poverty and equality have been active in Brazil since the mid-1970s: the landless workers' movement and the Workers' Party. Although the Workers' Party is a formal political party, it has been – at least until its recent ideological moderation and ascension into power –

considered an umbrella social movement for a variety of progressive causes. The sanitary movement of the 1970s and 1980s, mentioned briefly in the previous chapter, also had a pro-poor agenda. However, the movement was very much an elite-driven project and had considerable difficulty gaining broad-based support, and so is not considered in this hypothesis. Non-governmental organizations (NGOs), meanwhile, did not greatly increase in number until the democratic transition.

The Workers' Party has been tremendously influential in raising the importance of inequality and poverty within the Brazilian political dialogue. Overall, Brazilian social policy has moved towards the left since the mid-1990s – that is, to say, has become more progressively redistributive – even while the Workers' Party itself became more moderate. One of the outcomes has been an increase in the participation of the poor in Brazilian electoral politics, especially beginning with the 2006 elections (Zucco 2008; Hunter and Power 2007). Broadly speaking, the reduction of poverty and its symptoms is the single most important voting issue for this group, particularly vis-á-vis the maintenance and expansion of social safety nets.

Mass movements were less important in the first major cause of stunting reduction – control of hyperinflation – although, as stated earlier, widespread public concern over hyperinflation across socioeconomic classes provided Cardoso with political "cover" to enact his chosen orthodox reforms. This concern was manifest less through organized pressure groups than a general acknowledgement, a form of which appeared daily in the mass media, that hyperinflation was the country's single most pressing problem.

Summary: Step 1 is confirmed for both the Cardoso period (1994-2002) and for the Lula period (2002-2006). Mass movements were indeed also present during the military period and the early hyperinflationary democratic period, although they did not strongly influence economic or social policy formulation.

"Step 2: Mass movements effectively apply pressure (i.e., have sufficient power in the existing political bargaining arena) on policymakers to reform the policy environment pertaining to child nutrition or its determinants".

During the military period, social movements generally had little engagement with the policy environment as it pertained to undernutrition. The Workers' Party and the labor union movement did manage to affect power relations between industrial labor and the government, largely through their strike activity between 1978 and 1980, but these actions were far removed from a focus on economic and social policy in the Northeast.

In the post-military period, social movements more actively applied pressure to reform government policy pertinent to inequality, poverty, and ultimately child welfare. The landless workers' movement sought to address the extremely skewed distribution of land ownership in the country and the Workers' Party served as a unified political vehicle for a host of redistributive agendas.

The form of pressure applied by social movements in the post-military period has been characterized more by negotiation with the government apparatus rather than outright confrontation. Non-governmental organizations, for their part, often appear to be extensions of public sector agencies, providing services where government has been unwilling or unable. This implementation role is important, but the organizations have little influence in designing underlying policies (Foweraker 2001). The lack of influence is in part tied to funding imperatives. With the advent of democratization and the steadily increasing professionalization of the public sector, international donors took less of an interest in Brazil (and in Latin America in general). Highly visible issues like forest conservation and the welfare of street children remain priorities for external funding agencies, but broader issues like undernutrition have generally been deemphasized, or were never taken up in the first place. Non-governmental organizations thus became more dependent on the state for their continued material survival, which necessitated agreeing to a role as an "extension" of the public sector rather than its critic and watchdog. As the state grew in the post-military period, so did its ability to influence the NGO agenda.

The influence of mass movements and NGOs is perhaps stronger at the municipal level. The fiscal decentralization policy pursued by Brazil in the post–military period encouraged movements and NGOs to engage directly with local governments as a means of influencing policy. Unfortunately, the highly clientelistic nature of Brazilian politics often led to NGOs becoming dependent on the agendas of local elites, who – at least until the more stringent fiscal regulations of the late 1990s – had wide berth to utilize devolved federal funds for their own political priorities. These priorities rarely included provision of basic social services to the poorest (Valla 1994; Foweraker 2001).

Even the influence of the MST on government policy has weakened over the decades, despite the landless movement's strong international profile. The movement can be said, at present, to be less an activist force for land redistribution than a "coordinating body for a number of NGO-style development projects" (Foweraker 2001). Ironically, the election of Lula, a strong advocate of land reform, may have attenuated the movement's political voice by taking away the rationale for activist confrontation with the government. However, the landless movement's actions in the democratic period have greatly advanced the cause of agrarian reform, and more generally lifted the issue of socioeconomic equality into the political mainstream.

The most effective form of pressure, and the one most directly relevant to child nutrition, has been through the ballot, facilitated by the Workers' Party. Although the initial scale–up of conditional cash transfer programs in Brazil was undertaken by the Cardoso administration, it was the PT under Lula that transformed Bolsa Família, and more generally the issues of poverty and inequality, into a core campaign issue. The popularity of the program helped the PT to win the national elections in 2006 and again in 2010, and by doing so created a formidable constituency for future pro-poor policy.

<u>Summary:</u> Step 2 is confirmed for the Cardoso period – in the sense of influencing the policy debate around inequality that would inform social policy,

and in the weaker sense that there was widespread support for inflation control – and for the Lula period. One could say that the step is also confirmed for the hyperinflationary democratic period (1986-1993), in the sense that the Workers' Party and other leftist movements pushed for a more progressive social policy, but rejected for the military period.

"Step 3: Policymakers consider mass movement political pressure in their cost–benefit calculations of self–interest".

The sanitary and landless workers' social movements were in some respects victims of their own success. The sanitary movement did manage to encourage a greater focus on primary care services with the Ministry of Health, and the landless movement did place the issue of rural poverty and inequality into the field of concern of Brazilian voters. However, once these issues became prominent in the rhetoric of mainstream politicians, the movements lost some of their standing as vanguard defenders of the excluded (Foweraker 2001).

The power of these movements has in a sense been transferred more directly to the voter, including the poor Northeast voter, through the intermediary role of the PT. The Workers' Party has won the last three national elections running on a pro-poor platform. As a result of the demographic strength of the poor and of the Northeast generally, issues of poverty and equity have been politically mainstreamed.

<u>Summary:</u> Step 3 is confirmed for the Lula democratic period; clearly the PT administration did consider their electoral base in policy formulation. The record

with respect to the Cardoso period is more ambiguous. On the one hand, the social movements did introduce inequality into the political debate and mobilize voters around poverty issues; although Lula did not win an election under 2002, his presence in preceding elections did inject redistributive priorities into the discussion. It is unclear, however, whether Cardoso and his party considered this pressure in their calculations of electoral self-interest – for example, whether Cardoso's support for the initial scale-up of Bolsa Escola was the outcome of his own belief in the program or a means to attract voters; the recorded discourse does not shed much light on this.

"Step 4: Policymakers enact policies closely linked to mass movement demands, and which are known to have a causal relation to lower stunting prevalence".

Labor activism in the late 1970s led to greater efforts by the military government to include unions in the political process, but no tangible results pertaining to policy that would impact stunting resulted from this pressure. As noted earlier, social movements had greater success in democratic period influencing the formulation and implementation of policies and programs related to conditional cash transfers (and through them, improvement of income distribution) and primary health care services, both of which have known casual relationships to improved child nutrition. Most of these policies were linked to the electoral victory of the PT, although reform in these areas did occur during the Cardoso years.

Overall, the mass movements hypothesis is refuted as an explanation of the improvements in child nutrition seen during the military regime, and confirmed in varying senses for the democratic period. The actions of the sanitary and agrarian reform movements helped to bring about substantive changes in government health and land policies, although the influence of these movements is better described as having taken place through negotiation and slow bureaucratic reform rather than direct political pressure. More straightforward is the success of the Workers' Party in putting poverty and equity concerns on the campaign agenda, and transforming mass movement priorities into a programmatic vision. In sum, the deepening enfranchisement and participation of the Northeast voter, channeled through the PT, is the type of mass movement pressure that has had the greatest impact on the reduction of child stunting in Brazil.

2. Elite/Poor Alliances

"Step 1: An alliance between elites with political power and poor people's organizations with interests related to child nutrition or its determinants is established and gains power".

There is little evidence for any such alliance existing during the military period. The sanitary movement of the 1970s and 1980s, comprised of public health academics and professionals seeking to address health care inequities, did attempt to build alliances with the poor during the authoritarian regime period. Such attempts, unfortunately, largely failed (Weyland 1995). While the ideas of these elites did impact the direction of Brazil's public health policy, their influence was epistemic rather than power-political: their ideas entered the Brazilian health bureaucracy through slow diffusion, not by political force.

The public reaction to the hyperinflation of the immediate post-military years, however, does suggest that a harmonization of the interests of varying economic classes – if not exactly an alliance – was necessary to make possible the reforms enacted by Cardoso. Powerful interests, especially local governments for whom inflation provided political cover to expand payrolls and thus patronage networks, stood in the way of macroeconomic reform. Cardoso's political entrepreneurship, initially with the support of President Itamar Franco, was certainly the most important proximate factor driving reform. Without broad-based support for stabilization measures, however, it is unlikely that Cardoso would have succeeded. The elections of 1994 and 1998 validated the strategy of focusing on macroeconomic issues.

Such harmonization of political interests appears to be diminishing. As the election maps below show, geographical interests in Brazil are becoming more polarized, and the lines they follow mirror socioeconomic differences across states. In the 1998 and 2002 elections (as well as in the 1989 and 1994 elections, not depicted below[33]), the winning candidate was supported by a broad national consensus. In 2006 and 2010, however, the PT's victory was brought out by its

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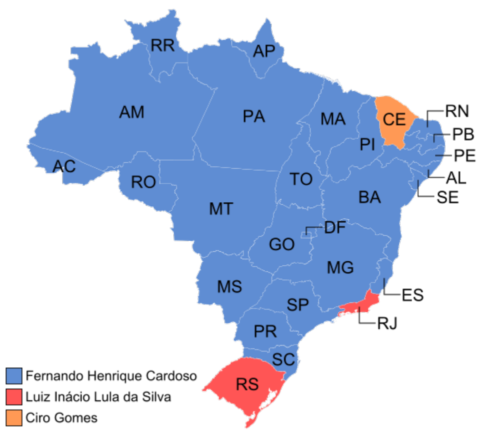
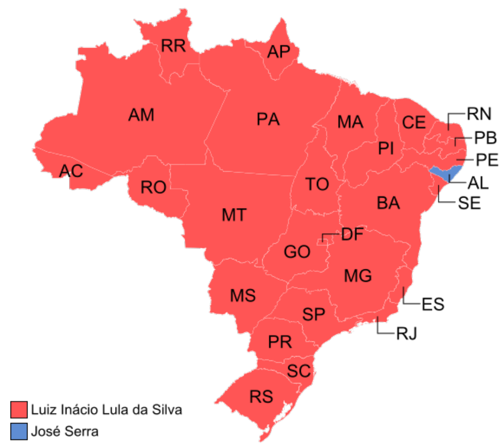
[33] In the 1989 runoff election, Fernando Collor de Melo won every state except Pernambuco, Rio de Janeiro, Rio Grande do Sul, and Distrito Federal. Of these, only Pernambuco, a state in the Northeast, had a per capita income lower than the overall Brazilian mean; this is also Lula's home state. In the 1994 election, Cardoso won every state except Distrito Federal and Rio Grande do Sul, both relatively well-off areas.

strong support in the poor Northeast region; the party lost nearly all of the wealthier southern and southeastern states. As noted earlier, Lula in 2006 gained the vote of nearly 70% of Brazilians making under two minimum wages, but less than half of the vote of the richest class (those making above ten minimum wages).

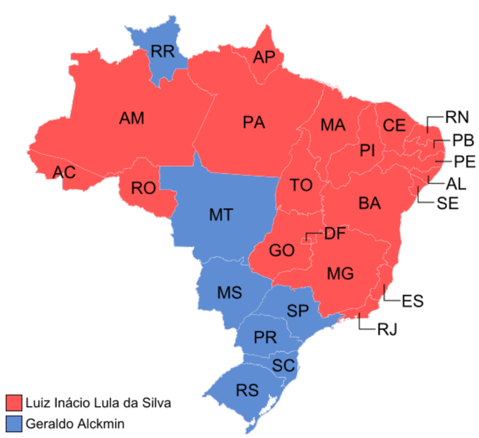
Figure 53. Results by state of presidential elections in 1998, 2002, 2006, and 2010. Blue color indicates PSDB victory, red color PT victory. Source: Felipe Menegaz, from Wikimedia Commons.



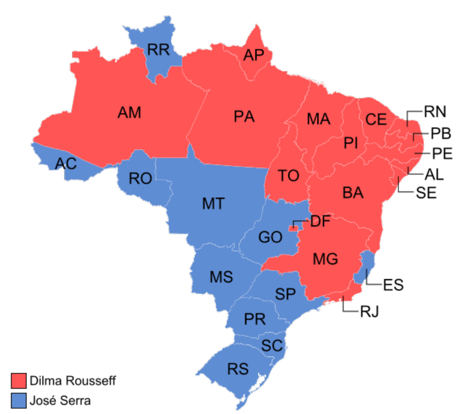
1998 Election



2002 Election



2006 Election



2010 Election

Summary: The step is confirmed for the Cardoso period and rejected for all other periods.

"Step 2: Alliance effectively applies pressure (i.e., has sufficient power in the existing political bargaining arena) on policymakers to reform policy environment related to child nutrition".

The 1994 election was essentially a referendum on the Plano Real. Cardoso won easily, riding the success of the stabilization program; and, as noted above, a harmonization of class interests provided the political capital for Cardoso to carry out subsequent reforms. Stunting reduction could not have occurred without macroeconomic stability in the Brazilian economy, as evidenced by the immediate reduction in poverty following the implementation of the Plano Real. Thus the electorate provided a kind of negative pressure that enabled nutritional improvement in the 1990s: pressure not on Cardoso to carry out reforms, but rather pressure on obstructionist policymakers to not stand in the way of reforms. As discussed above, this unified pressure has dissipated in recent years, replaced in the 2006 and 2010 elections by more class–based patterns of voting.

Summary: Confirmed for the Cardoso period. As Step 1 was rejected for all other periods, the process-tracing chain is rejected as a whole and this step is not evaluated.

"Step 3: Evidence indicates that policymakers consider alliance political pressure in their cost–benefit calculations of self-interest".

Again, this step is confirmed in a negative sense for the Cardoso administration. Although Cardoso appeared to be motivated more by technocratic commitment (as discussed in Section 4, “Personal Ideology”) than political self-interest in his pursuit of macroeconomic reforms, his initiatives would have been stymied were it not for broad-based public support to control inflation.

<u>Summary:</u> Confirmed for the Cardoso period.

“Step 4: Policymakers enact policies closely linked to alliance demands, and which have causal relation to lower stunting prevalence”.

In sum, alliance–type pressures relevant to child nutrition did not exist in the military period, and thus the hypothesis is rejected for that era. Cardoso’s reforms, meanwhile, were made possible because potential sources of opposition within the government were stifled by popular sentiment supporting control of hyperinflation. Although this popular support was not characterized by formal alliances or organizations, the underlying importance of the alliance hypothesis is indeed confirmed for this period. The demands of the elite accorded well with the demands of the poor. Those demands were centered around macroeconomic stability, and without such stability, nutritional progress in the 1990s would not have been possible.

3. Personal Ideology

“Step 1: Policymakers display an ideological stance consistent with reducing chronic child undernutrition or addressing its determinants”.

Five presidents, all handpicked by the regime itself, served lengthy terms during the military period: Humberto de Alencar Castelo Branco (1964–67), Artur da Costa e Silva (1967–69), Emílio Medici (1969–74), Ernesto Geisel (1974–79), and João Figueiredo (1979–85). None of them, either in personal discourse or formal policy statements, evinced strong ideological concern with issues related to child welfare; neither did the presidents in the early democratic period, prior to the election of Fernando Henrique Cardoso.

Cardoso was, in essence, a pragmatic technocrat. Prior to the beginning of his political career in the late 1970s, Cardoso had been a renowned sociology professor at the University of São Paulo, and by his own admission an academic worldview was the primary influence on his governing style. He writes in his memoir: "I would contend that, even as I settled into my new job [as president], I was still a sociologist at heart…I still tried to see Brazil's problems with the same detached objectivity…It was surprising how often a dilemma could be solved by taking an honest, objective look at the different groups involved and then imposing the fairest solution for everyone" (Cardoso 2007).

Although Cardoso's administration diverted more resources than previous governments towards social programs, especially basic health care, primary and secondary education, and land purchase for redistribution, he viewed poverty in Brazil as largely a consequence of macroeconomic volatility, and interpreted his mandate accordingly:

> My presidency was, at its most basic level, about trying to turn Brazil into a stable country. For our entire history, we had lurched from one crisis to another, mainly because of our refusal to follow rules…I believed that, if I could now

> establish a minimal degree of stability as president, then the foundations for a modern society – private investment, effective social policies, the reduction of poverty – would follow.
>
> (Cardoso 2007, p.204)

The president thus focused most strongly on economic stabilization, especially the control of inflation and reduction of budget deficits. In retrospect, Cardoso's ideology of center-left pragmatism was in fact consistent with reducing child stunting, although throughout his rule he was roundly criticized by the left for not addressing poverty and inequality more aggressively. In sum, Cardoso was a unique example of a politician who had the ability to analyze a situation objectively, the conviction to commit to a course of action that he truly believed in, and the skill in statecraft to overcome the interest-based obstacles that opponents created.

It should be noted, however, that child nutrition specifically was not prominent in Cardoso's discourse, and ultimately nutritional improvement was an unintended outcome of the larger poverty reduction strategy. If stabilization had not been as successful as it was in reducing poverty, we might be more hesitant to say that Cardoso's ideology was "consistent with reducing chronic child undernutrition or its determinants", statements like the one above notwithstanding. However, the fact is that Cardoso was right: the Plano Real and subsequent fiscal recentralization actions *were* critical to poverty reduction, and ultimately to child nutritional gains.

Lula's expressed worldview, if not his actual policy, contrasted somewhat with that of Cardoso. The "worker-president" kept his rhetorical focus firmly on poverty and inequality, and especially on the issue of hunger and undernutrition, throughout his five presidential campaigns and his two terms of office, even as his proposed solutions became less radical and more pragmatic. In his 2003 inauguration speech, Lula stated:

> This is a country that has so much fertile land and so many people who want to work that there is no reason to talk about hunger. Millions of Brazilians inside and outside the cities, however, lack food today. They survive, miraculously, under the poverty line, if they do not die while begging for a piece of bread. This is an old story... This situation cannot continue. As long as one of our Brazilian brethren is hungry, we have enough reason to be embarrassed... If at the end of my term every Brazilian person has three meals per day, I will have fulfilled my life's mission...
>
> (Luiz Inácio de Silva, 2003)

He followed up this speech with the creation of a new Ministry of Social Development and Fight Against Hunger, under which programs and policies aimed at hunger eradication, together known as *Fome Zero* (Zero Hunger), would be coordinated. In practice, the multi-intervention vision of Zero Hunger was replaced by a narrower focus on the political popular conditional cash transfer program Bolsa Família (the failure of Zero Hunger itself is discussed further below). Smaller projects, such as cistern creation in the semi-arid *sertão* and low-cost subsidized restaurants, were indeed implemented, but Bolsa Família quickly began to dominate political attention.

Lula's own personal experience of growing up in poverty in the Northeast informed his position, as did his decades as a labor leader. Ironically, Lula first rose to prominence as a result of receiving support from the older generation of corporatist labor leaders, who played a critical role in his election to the presidency for an important union, the São Bernando Metalworkers, in 1975. Following the arrest of his brother by the military regime later that year, however, Lula began radicalizing his message, and the formation of the Workers' Party in 1980 cemented his image as a spokesperson for the left (Branford and Kucinski 1995; Guidry 2003).

<u>Summary</u>: Confirmed for both the Lula and Cardoso periods; rejected for the military period and the pre-Cardoso hyperinflationary period.

"Step 2: Policymakers did not have a clear self–interested political incentive to act upon their ideological stance; costs to doing so were either equal to or exceeded benefits".

Fernando Henrique Cardoso is fond of describing his ascension to the presidency as "accidental" (Cardoso 2007). In his memoir, he asserts the post of Finance Minister was forced upon him by President Itamar Franco in 1993; Cardoso had no training in economics, and the string of failed Finance Ministers before him made the post less than desirable. Yet he accepted, and the success of the Plano Real – and the fear that Lula, the frontrunner for the presidential election at the time, would roll back the reform effort – created presidential aspirations in Cardoso. He won the 1994 contest easily.

Yet, despite the close connection between Cardoso's policy successes and his political fortunes, Cardoso's reasons for advancing his reform agenda were not entirely, or perhaps not even mostly, self-interested. As noted in Chapter 8, implementing the Plano Real and subsequent reforms to control budget deficits –

including the $19 billion privatization of Telebrás, one of the largest Brazilian state enterprises, and the passing of the Camata Law of 1995 and the Fiscal Responsibility Law of 2000, both of which severely curtailed states' freedom to spend freely – were risky, formidable political tasks. Cardoso faced intense opposition from the legislature, local politicians and others who benefited from a bloated state, as well as groups in the population who feared that budget cutting in a time of slow economic growth would disproportionately hurt the poor. The fact that Cardoso doggedly persisted in his reform attempts – many of which failed, most notably pension reform that would have begun the process of altering Brazil's highly regressive social security system – is a testament to his belief that his actions were, despite the electoral risks, the "right thing" to do.

As for Lula, disentangling the influence of interests and ideas is more difficult. Lula's radical platform, informed by his personal beliefs, played a role in his defeats in the presidential elections of 1989, 1994, and 1998. His public rhetoric following these losses, in particular his vociferous criticism of Cardoso throughout the 1990s, suggests that he genuinely believed that the macroeconomic reforms being pursued would in the end prove disastrous to Brazil. In the 2002 contest, however, Lula moderated his views (even running on a campaign slogan of "*Lula, Paz e Amor*" (Lula, Peace and Love)!), reassuring international markets with his promise to continue running budget surpluses and generally continue Cardoso's movement towards liberalization and integration with the global economy. It is unclear, however, whether this change was driven by the realization that Cardoso's reforms had in fact placed Brazil on a sounder footing to confront poverty and inequality or whether moderation was instead a straightforward political calculation that a radical redistributive/inward–oriented platform was unelectable. There is evidence that Lula pushed moderation within the PT well before the 2002 campaign, but was prevented from doing so by rank-and-file opposition. Again, however, whether those efforts were due to a shift in ideas or recalculation of interests is difficult to ascertain (Samuels 2004).

In either case, Lula devoted considerable political capital during his tenure to highlighting the issue of poverty, and particularly hunger. After his initial anti-hunger vehicle, a collection of programs called *Fome Zero* ("Zero Hunger"), sank under the weight of administrative and logistical difficulties early in his first term, Lula retrenched and placed his weight behind the most important component of Fome Zero: the conditional cash transfer program Bolsa Família. Doing so would eventually prove politically expedient, as the popularity of Bolsa Família helped carry him to a re-election victory in 2006, but in the initial years of his first term, such a move was far from being obviously politically shrewd. In the final analysis, Lula's campaign and governing strategies were probably motivated by a mix of electoral incentives and core beliefs, and the relative importance of the two is uncertain. However, it is fair to assert that, in confirmation of this causal step of the personal ideology hypothesis with respect to Lula, that the political costs versus benefits of focusing on hunger issues was not obvious, at least during the run-up to the 2002 presidential elections.

<u>Summary</u>: Confirmed for the Cardoso and Lula periods; previous step rejected for other periods.

"Step 3: Policymakers enacted and effectively implemented policies consistent with their ideological stance (and which have causal relation to lower stunting prevalence), and institutions permitted such actions".

Macroeconomic stability was an important factor behind Brazil's dramatic decline in child stunting in the last 15 years. Cardoso's success in implementing the broad set of politically unpopular reforms that led to this stability depended on both a general "interest-based" process (democratization, which meant that the median "selector" was now poorer) and an "ideas-based" contingent choice (the personal prioritization of an objective that greatly eased the pain of this median selector: the control of hyperinflation).

It is also worth noting that Cardoso's ideas and priorities were shaped by external factors. Weyland (2006), in a comparative study of social sector reform in five Latin American countries, including Brazil, finds that policymakers were heavily influenced by policy experiments in neighboring countries. In Weyland's analysis, the adoption of policy ideas does follow interest-based logic, but in a haphazard manner, a product less of cost-benefit calculations than of policymakers' own cognitive biases (Weyland 2006). In this way, the successes of Chile, Mexico, and Argentina with macroeconomic reform gave impetus to Cardoso's agenda, and likely contributed to the president's persistent efforts to fight against resistance from political elites (Roett 2003).

The institutional obstacles to policy entrepreneurship in Brazil have been highlighted throughout Part III. The basic problem throughout the 1990s was that clientelist networks and undisciplined party structures led to a high number of veto players able to hinder policy innovation (Roett 2003). Yet Cardoso, confronted with institutional obstacles, took advantage of certain institutional advantages as well: this was the essence of his political skill. For example, legislators generally attempt to avoid supporting policies with concentrated costs and diffuse benefits, and many of Cardoso's proposed reforms were precisely of this character. Elected officials found themselves in a difficult position; failing to act on the reforms and allowing hyperinflation to continue unchecked would lead to risks in subsequent elections, but taking a stance of public support for the reforms carried the danger of alienating their clientelist networks. Cardoso offered a way out by agreeing to accept the risks and responsibilities of policy leadership, and cushioned short-term impacts by offering moderate but enticing concessions, such as one-off bailouts for states facing financial troubles.

In addition, in 1994 control of hyperinflation offered a political avenue to address poverty in a way that redistributive programs likely would have not. Given the precarious fiscal position of the Brazilian state and the degree of political obstructionism at the state level, large-scale anti-poverty programs would have been untenable, although Lula's electoral appeal in 1989 and 1994 (despite his losses) certainly illustrated a growing disenchantment in the Brazilian populace with inequality. Throughout the past few chapters, I have characterized stunting reduction in Brazil in the 1990s as an unintended positive externality of other policy objectives, but it is unlikely that a direct focus on child nutrition could have had a more dramatic impact than stabilization, given the prevailing political and fiscal reality.

Lula, meanwhile, disappointed many of his supporters on the left by not undertaking more radical redistributive measures himself, and by not undoing Cardoso's liberalizing reforms, but it cannot be argued that his administration deviated from the moderate language used during the election campaign. As was detailed in previous pages, Lula's focus on policies like Bolsa Família could be seen as politically opportunistic during the re-election campaign and during his second term, but generally speaking there is a consistent social democratic vision in his presidential record. The strengthening of Brazil's democratic institutions, particularly the increased willingness of the country's poor to support candidates based on their support for social transfers, facilitated the implementation of this vision. Overall, personal ideology played an important role in informing both Cardoso's and Lula's policy priorities, and the actions taken by both presidents had a substantive impact on reducing child stunting.

To summarize, the personal ideology hypothesis is rejected for the military period and confirmed for the Cardoso and Lula administrations.

4. Party Ideology

"Step 1: Party ideology was focused on reducing chronic child undernutrition or addressing its determinants".

The military regime was focused on economic growth as a key source of legitimacy, but concerns about poverty and inequality were not prominent in their discourse. Although there were some direct attempts at addressing poverty, largely through regional development agencies like SUDENE (the Superintendency for the Development of the Northeast), policy under the military regime focused on industrialization-led growth. As discussed in Chapter 8, economic growth in the 1970s was rapid enough to have poverty-reducing effects in the Northeast. This growth, along with improvements in the health system, enabled stunting reduction. However, party ideology was not focused on poverty, hunger, undernutrition, or the determinants of these phenomena, and so this hypothesis is rejected for the military period.

During the democratic transition years, Brazilian political parties are best characterized as weakly ideological. The open-list proportional voting system allows parties to field as many candidates as they wish for elections, undermining party unity and leading to highly personalist contests. The traditional ambiguity of party ideology has, however, changed in recent years. Parties are steadily becoming more distinct in their policy preferences, and their members are increasingly agreeing to adhere to a common party program (Hagopian and others 2008). The origins of this change date back to the mid-1990s and Cardoso's market reforms; faced with a shrinking government, parties developed more distinct ideological positions to better compete in the battle for programmatic resources (Gaetani and Heredia 2002). A smaller public sector also meant a reduction in patronage power, which pushed legislators to value party (over personal) identity more strongly. Particular reforms designed to check fiscal irresponsibility at the state level also helped limit patronage, especially the

Camata Law of 1995 and the Fiscal Responsibility Law of 2000. The former limited the percentage of state resources that could be used for payrolls, the primary vehicle for local patronage, and the latter stipulated more stringent public sector spending limits and borrowing guidelines (Bressan 2002).

Demand-side pressures from the Brazilian electorate hastened the changes. A backlash against corruption and clientelism swept the PT to power in 2002, and in doing so placed a party characterized by tight policy cohesion, strong internal discipline, and a highly partisan membership at the center of the Brazilian political system. The other parties recognized the advantages of such characteristics and sought to emulate the PT's strengths. Socioeconomic development in of itself weakened patronage systems, as better educated, media-savvy voters made more careful choices, and households emerging from poverty began to discount the future less and thus were less likely to "sell" their votes for short-term patronage promises (Hagopian and others 2008). These changes hold even in Brazil's historical epicenter of clientelism, the Northeast, where strong voter support for Lula has increased legislators' willingness to hew to the party line.

However, despite the strong public profile of Fernando Henrique Cardoso, his Brazilian Social Democratic Party (PSDB) still suffers from an indistinct ideological image. This has partly to do with the PSDB's catch-all roots; as Cardoso writes of the party's founding, "While most of the other new parties focused on appealing to narrow niches of Brazilian society…we aimed to build as broad a consensus as possible" (Cardoso 2007, p.168). The price of such breadth was ideological dilution. The PSDB currently occupies a centrist space on the political spectrum characterized roughly by a commitment to "free market reform and social responsibility", as Cardoso describes it, but this image pales in strength next to the PT's forceful social justice-oriented personality. Even today, nearly a decade after Cardoso's departure, the PSDB is associated more strongly with his administration than any distinct set of ideas.

An analysis of policymaker self-perceptions allows Power and Zucco Jr. (2009) to trace the ideological movement of the PT and the PSDB, as well as other parties in Brazil, on a left-right scale between 1990 and 2005. Their findings confirm the discussion of the previous chapters: both parties have shifted rightward. The movement, however, has been non-monotonic; the PT moved slightly left between 1993 and 2001 before swinging to the center during Lula's first term, and the PSDB reversed to the left in 2005 after more than a decade of increasing economic conservatism under Cardoso. It is also interesting to note that the median legislator in Brazil has moved steadily to the left since 1990, a trend largely due to the increasing representation of left-of-center parties in Congress (Power and Zucco Jr. 2009).

Summary. This step is confirmed for the Lula period and rejected for all other periods. As noted in previous sections, the PT's poverty- and inequality-focused ideology is indeed consistent with reduction of child undernutrition. The same statement cannot be made about the PSDB. Its ideological orientation could be described as centrist, but the ambiguity of its platform and the lack of rhetorical priority it has placed on poverty and related issues suggests that this hypothesis should be rejected for Cardoso's party. Cardoso's actions were largely motivated by personal convictions, with the PSDB's platform (vague as it was) having little discernible impact on specific policy actions, especially pertaining to the President's efforts at macroeconomic stabilization. In contrast, the PT's ideology was as important in shaping Lula's policy choices as Lula was in shaping the PT's ideological development.

"Step 2: Party did not have a clear self-interested political incentive to act upon its ideological stance; costs to doing so were either equal to or exceeded benefits".

I suggested earlier that the PT's ideology informed its anti-hunger policymaking, but electoral incentives certainly contributed to its commitment to such a platform, at least in the 2006 and 2010 elections. The transformation of the PT from a hard left to a left-center party is explained partially by the personal ideas of Lula himself; the history of the PT and its ideological development is connected so intimately with the leadership of Lula that, despite the PT's identity as a broad-based progressive coalition, the party and the man cannot be entirely separated. This is changing in the present day; the new president of Brazil, the PT's Dilma Rousseff, has gone to lengths to chart her own course.

However, Lula's leadership alone does not explain the ideological shift towards the center in the PT. The Workers' Party, reflecting its roots as a social movement, has always been characterized by strong popular participation. This deeply democratic nature has restricted the ability of its top-level leadership to act autonomously of rank-and-file membership (Samuels 2004). Pragmatic moderation of the PT occurred only after it began to capture legislative and mayoral seats over the course of the 1990s. Faced with the day-to-day challenges of governance and compromise, the party began to concern itself more with the possible and less with the ideal. As the rank-and-file themselves moderated, Lula was able to chart a new center-left course for the party.

In any case, the Workers' Party ideology remained consistent with inequality and poverty reduction, although the means by which it pursued its goals were adapted to conform to political opportunities.

<u>Summary</u>: Confirmed for the Lula period.

"Step 3: Party elites enacted and effectively implemented policies consistent with their ideological stance (and which have causal relation to lower stunting prevalence), and institutions permitted such actions".

Again, the Workers' Party did implement policies consistent with their ideology, especially Bolsa Família, although the focus of their ideas moved from radical redistribution to expansion of social safety nets. To summarize, the party ideology hypothesis is rejected for the military period and for the Cardoso administration, and confirmed for the Lula period.

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The discussion of the preceding section is summarized in the following chart, showing which steps of each hypothesis are confirmed for the time period analyzed by this study (confirmed steps are shaded black). The three decades between 1975 and 2006–7 are subdivided into five categories: the fast growth military period, the recession military period, the hyper–inflationary democratic period, the Cardoso administration, and the Lula administration. The final result column states whether the hypothesis has been confirmed for all steps (four steps in the cases of the mass movements, elite/poor alliances, three steps in the case of the personal and party ideology hypotheses; note that steps 3 and 4 are combined into a single column, as no hypothesis reached step three but failed to reach step four).

Table 23. Summary of tested hypotheses.

STUNTING REDUCTION	PERIOD	Step 1	Step 2	Step 3/4	Result
RAPID	Fast growth military regime (1974-1980)				
	Mass movements				REJECTED
	Elite/poor alliances				REJECTED
	Personal ideology				REJECTED
	Party ideology				REJECTED
NONE	Recession military regime (1980-1985)				
	Mass movements				
	Elite/poor alliances				
	Personal ideology				
	Party ideology				
NONE	Hyperinflationary democratic (1986-1993)				
	Mass movements				
	Elite/poor alliances				
	Personal ideology				
	Party ideology				
VERY RAPID	Cardoso democratic (1994-2002)				
	Mass movements				REJECTED
	Elite/poor alliances				CONFIRMED

STUNTING REDUCTION	PERIOD	Step 1	Step 2	Step 3/4	Result
	Personal ideology				CONFIRMED
	Party ideology				REJECTED
VERY RAPID	Lula democratic (2003-2007)				
	Mass movements				CONFIRMED
	Elite/poor alliances				REJECTED
	Personal ideology				CONFIRMED
	Party ideology				CONFIRMED

To summarize the chart above:

- All of the potential political economy explanations explaining the links between military policy action and child nutrition are rejected. This is unsurprising: as noted, the military regime was not explicitly concerned with poverty or stunting reduction. Improvement in child nutritional status was the unintended consequence of rapid economic growth processes in which political pressure or ideational forces related to child nutrition or closely related issues were irrelevant to the phenomenon.

- As expected, none of the causal processes described above were present during either the recession or the hyper-inflationary democratic period. Had they been present, we would expect significant stunting reduction, which did not occur during this time.

- Personal ideology – Cardoso's dogged commitment to the importance of stabilization – and the elite/poor consensus regarding the importance of controlling hyperinflation were the political factors driving stunting reduction in the mid-1990s. Poor people's movements were indeed present, but exercised only a weak (and not independent) causal impact on nutrition-relevant government policy.

- Mass movements, in the form of poor people's electoral strength, did however play an important role in leading to the nutrition-relevant policies implemented during the Lula administration. The ideologies of Lula and his Workers' Party were also critical in placing a special focus on issues of inequality and poverty.

B. Discussion

1. Political Equifinality and Synergy

The overall goal of this research is to identify generalizable processes, or at least broad patterns, by which stunting is reduced. The cross-country econometric analysis in Part II showed that factors like income, education, and environmental threats are indeed significant predictors of child nutrition across countries. However, many other variables known to be strong drivers of stunting reduction in a particular context were not robust correlates of child nutritional status when evaluated in a cross-country dataset. This suggested that multiple ("equifinal") policy pathways to stunting reduction exist, depending on the current human development context of a given country.

The political economy analysis of Northeast Brazil's nutritional experience over the past three decades suggests similar lessons. First, different policies drove nutritional improvement in the three time periods during which stunting reduction was concentrated – the late 1970s, following the introduction of the Plano Real in

1994, and in the Lula administration. Rapid economic growth in the military period drove stunting reduction; export-oriented industrialization, fueled by public sector deficit spending, transformed the structure of the economy and reduced poverty in the Northeast, even while exacerbating income inequality. President Cardoso's implementation of stabilization measures in the mid-1990s controlled runaway inflation and bolstered the purchasing power of the poor. The expansion of social assistance following Lula's inauguration in 2002, especially the Bolsa Família program, made inroads to reducing the extraordinary inequality that has plagued Brazil for centuries. A slowly but steadily improving public health and educational infrastructure amplified the impact of all of these policies on undernutrition.

The political economy forces underlying the formulation and implementation of these policies were as diverse as the policies themselves. The "miraculous" economic growth rates achieved during the military period had a powerful impact on poverty reduction, but without a specific focus on addressing poverty itself. Rather, the military viewed economic performance as key to maintaining popular legitimacy, and what half-hearted redistributive measures they took in the Northeast were motivated more by a desire to quell the threat of internal agitation than by a commitment to fight hunger and misery.

Meanwhile, Cardoso's reforms were motivated by a deep-seated personal belief that political and economic stabilization – the rule of law and the rule of an objective technocracy – were critical antecedents to all other goals, including growth and poverty reduction. Cardoso threw his presidency into these priorities, though facing formidable political obstacles. Like other Latin American countries, Brazilian macroeconomic policy has often been steered by short-term political expediency rather than the long-term commitment to the policies necessary for sustained economic growth. In the early democratic period, the core of the problem in Brazil had to do with imperfect information and ineffective political accountability mechanisms, which together prevented principals – i.e., citizens – from demanding and receiving the "correct" policy reforms from their elected and unelected political agents (Wiesner 2008). The result was that public sector rent-seekers and clientelist politicians utilized inflation to divert state resources for private benefit. Yet, with singular political skill, Cardoso took subtle and slow measures to disenfranchise veto players. He offered immediate benefits to local governments, such as one–off state bailouts, in exchange for ceding of longer-term financial autonomy to federal authority. The hyperinflation crisis itself presented Cardoso with the opportunity to make sweeping arguments to the public about the need for reform, and thereby built a constituency – constituency increasingly empowered by Brazil's deepening democratization – to protect the agenda against clientelist threats. The result in 1994 was the successful implementation of the Plano Real, which immediately cut poverty and undernutrition dramatically. Subsequent reforms increased fiscal accountability within the Brazilian state and dampened the risk of future inflation crises. In sum, Cardoso's belief in the importance of sound economic ideas was matched by his political deftness in recognizing and overcoming the obstacles to implementing those ideas.

President Lula confronted a different Brazil in 2002 than Cardoso had in 1994: a country out of crisis, but beset by a sense of gloom over its economic stagnation and persistent inequality. Though offering a far less radical set of ideas than he had in the past, Lula won the 2002 elections running on a transformative message, one promising a more just Brazil. He continued Cardoso's legacy of orthodox macroeconomic management, but expanded social assistance, especially the conditional cash transfer program Bolsa Família. The material benefits offered to the poor by Bolsa Família gained his Workers' Party substantially expanded political support, especially in the Northeast, carrying Lula to victory again to 2006. The redistributive social policy ideas of Lula and the PT were now part of the political mainstream, and protected by the voting strength of the poor: ideas and interests locked together.

Thus different political forces contributed to drastic stunting reduction in Brazil over the past three decades, suggesting that equifinal political economy pathways are available to improve child nutrition. Yet along with equifinality, the importance of policy and political synergy should also be recognized, particularly pertaining to the link between the Cardoso and Lula administrations. With respect to policy, the macroeconomic stability brought out by Cardoso's reforms, and the subsequent reduction in the state's fiscal deficits, enabled Lula's expansion of the social safety net. Similarly, Cardoso's tenure helped to consolidate Brazil's fledgling democracy, both by virtue of the administration's stability and because Cardoso's policies helped to weaken the clientelist networks that had bedeviled Brazil's political system for decades. Party identity is far stronger in the present day than it had been in the mid-1990s, and voters are increasingly making choices based on ideological predispositions, as seen in the PT's victories in 2006 and 2010. While this has the potentially negative effect of increasing political polarization among voters, it is a step forward from a patronage-based system. Especially remarkable is the transformation in the Northeast, where local bosses exerted iron-fisted control over electoral politics for decades.

Other important links exist between the administrations of Cardoso and Lula. The PSDB and the PT have together defined the political center of gravity in Brazil: a combination of a market–friendly, fiscally responsible economic approach with an expanding social safety net to address basic needs and reduce inequality. As noted earlier, although the PT has itself steadily moderated its views, the party's increasing representation in Congress has shifted the median legislator to the left, and raised the issue of poverty to a higher priority status. Meanwhile, Cardoso's orthodox economic policies, once pejoratively labeled "neoliberal" by the PT, are acknowledged by all mainstream parties as necessary foundations for a healthy Brazilian state. Thus the impressive decline in child undernutrition enjoyed by Northeast Brazil is due not only to policy innovation on either the part of Cardoso or Lula, but also synergy; the adversary parties have together created a policy and political environment amenable to human development.

2. Historical Contingency and Political "Laws"

The Brazil case study illustrates some important lessons about the role of both ideas and interests in improving child welfare, and for enacting pro-poor policy more generally. We have seen that a personal ideological commitment to sound macroeconomic fundamentals played an important role in stabilization; that marking out a distinct political space, as opposed to being defined as "catch–all" party, brings political credibility; and that values and beliefs persist strongly in individuals and organizations and help to explain the direction and extent of ideological change. We have also seen that drawing the poor into the voting game through material benefits ensures political support for the continuation and expansion of redistributive measures; that the shared experience of crisis, and the shared belief of the causes of crisis, can allow the forging of elite/poor popular alliances to overcome powerfully entrenched political interests; and that reforms can happen quickly when ideas and interests intentionally or coincidentally overlap.

However, there is also a deeper implication that arises from the Brazil case study: that historical contingency and the "laws" of political science interact in ways that make an exclusive focus on one or the other unproductive. This issue lies at the heart of this research, which approaches the central question – *what political factors drive variation in stunting rates?* – with both the ambition of drawing generalizable conclusions and a healthy skepticism that such sweeping generalizations are possible or fruitful.

Yet the Brazil analysis suggests a resolution for these competing positions. Political laws did matter in the narrative of the preceding chapters, especially the axioms that actors are largely self-interested, and institutions provide the incentives or constraints that shape the behavior of these self-interested actors.

Inflation ran rampant because there were few incentives to contain profligacy, especially within the patronage-infected public sector. By skillful statecraft, Cardoso changed the rules of the game – first by addressing the symptom of hyperinflation, then by permanently limiting the fiscal autonomy of local governments through strong legislation – and thereby cemented the norms necessary to preserve macroeconomic stability. Legislators had few incentives to develop federally coherent policy until clientelist networks were broken, stronger party discipline achieved, and electoral rewards for better performance present. They continued to act in a self-interested manner before and after those reforms, but the incentives changed, and now deepening democratization pulls the self-interest of legislators and the self-interest of their constituencies, including the poor, ever closer.

Good change thus depends on the ability of leaders to shape the political environment so that future winners, in pursuit of their self-interest, are incentivized to act according to the interests of society's poorest. That is what Cardoso and Lula have done, the former by creating an alliance of rich and poor around the imperative of macroeconomic stabilization, the latter by leveraging the voting power of the poor to institutionalize redistributive programs.

There is of course a conundrum here: if policymakers are self-interested, then how to break an institutional equilibrium that, in any given point in time, does not encourage actors to behave according to the interests of society's poorest? This is where individuals matter, and where ideas matter. Cardoso was a radical sociologist convinced over time of the necessity of macroeconomic stabilization, Lula a union leader who came to believe that social safety nets would be an effective means of social transformation. In the happy, *historically contingent* history of Brazil, the meeting of these ideologies resulted in an institutional equilibrium where the voting poor matter; where social safety nets bring guaranteed material benefits; and where (almost) everyone wants to control inflation.

The phrase “historically contingent” is italicized in the sentence above to emphasize that ideas cannot have an impact if the environment does not permit it – which is why inflation was not controlled before 1994 and why Lula lost the first three elections in which he participated. Contingency is critical in many aspects of this process: for example, how and whether the environment is shaped, and what “durably” means. But once ideas have an impact, they can change the environment, and those changes can be durable. While the harmony of ideas with existing interests may determine their influence at any given moment in history, their imaginative power also plays an important role, especially in driving leaders to transformative action.

3. A Political Economy of Nutrition…?

This research began by confronting the following puzzle. Given that 1) children have no political voice, and their families – often poor rural households – are usually weak political actors; 2) despite its immense costs, chronic undernutrition is a largely invisible public health problem, both to policymakers and households; and 3) addressing chronic undernutrition often demands bold, politically difficult policy reforms, how has Northeast Brazil managed to reduce stunting so dramatically over the past few decades?

Regarding the first issue noted above, we have seen that the poor have indeed become more politically powerful over the past 20 years, a change resulting from deepening democratization, pressure from social movements, and the leadership of elected reformers. However, the previous chapters also concluded that the latter two constraints listed above have in reality not been a major impediment in Brazil, because *the dramatic nutritional improvement was largely an unexpected positive externality of macroeconomic and social protection policy not narrowly designed for nutritional goals.* Rather surprisingly, one of the world's most impressive nutritional success stories has little to do with either policymakers or citizens demanding action on nutrition – at least not nutritional deficiencies specifically. Studying the political economy of nutritional *outcomes* has not led us to the political economy of nutrition *inputs*, but rather to the political economy of inflation control and the political economy of redistributive transfers. This conclusion was entirely unexpected; I did not, at the outset of the Brazil research, anticipate deviating from a study of food and nutrition programs into the politics of orthodox macroeconomic policy, or even of cash transfers.

However, the puzzle is not entirely resolved if we conclude with these statements. If the answers to high stunting prevalence were simply "inflation-reducing macroeconomic stabilization" and "inequality-reducing cash transfers", the many other countries in the world that have attempted such reforms would not have persistently high stunting rates, including others in the Latin American region that have faced similar political and economic conditions as Brazil over the past twenty years.

Rather, the Brazil analysis points to another stylized fact: if the goal of advocates and policymakers is to reduce stunting as fast as possible in a given time frame, then a direct nutritional/public health response may be less useful than careful and accurate diagnosis of the causality of stunting – or rather, identification of those that determinants of stunting that are 1) vulnerable to policy impact and 2) have the greatest potential for marginal nutritional gains. A third criteria might be that the policy reforms needed are "politically feasible", but I am hesitant to unconditionally include this on the list: we have seen in Brazil, especially during Cardoso's tenure, that skillful statecraft can overcome even strongly entrenched political opposition.

More evidence for these conclusions comes from the negative fact that the one major initiative designed specifically to address hunger in Brazil – the integrated package known as "Zero Hunger", introduced by Lula at the beginning of his first term in 2002 – failed to gain traction. The initiative, which had been trumpeted as a centerpiece of Lula's electoral campaign, was comprised of a large set of interventions, including the conditional cash transfer programs *Bolsa Escola* and *Bolsa Alimentação* (the latter focused on maternal nutrition), a food credit card system, low-cost restaurants, water supply systems for poor areas of the dryland *sertão*, and so on (Government of Brazil 2012).

The program's diversity was, however, its undoing. Separate administrative structures were created for each intervention, complicating the task of coordinating targeting, monitoring and evaluation, and financial reporting (Hall 2006). By the midpoint of Lula's first year in office, the ministerial leadership admitted to massive inclusion and exclusion targeting errors in Zero Hunger, echoing criticisms from major international donors, including the World Bank (Folha de São Paulo 2003a; Folha de São Paulo 2003b). In October, less than an year after Lula's inauguration, Zero Hunger in its envisioned form was abandoned in favor of Bolsa Família, which integrated four conditional cash transfer programs, of which the largest was the school attendance-based initiative Bolsa Escola. Although the "Zero Hunger" label was retained for the government's wider raft of hunger and small-scale agriculture-related programs to emphasize policy continuity, high-level political attention began to be almost exclusively focused on Bolsa Família.

Zero Hunger can be said to be a political failure in the sense that the key problem was the coordination of interests and procedures across Ministries, despite Lula himself expressing strong support for the program. Bolsa Escola was managed by the Ministry of Education, the maternal nutrition and food card benefits by the Ministry of Health, the gasoline cash transfer program by the Ministry of Energy, and various rural development interventions by the Ministry of Agriculture. In contrast, the factors identified as having driven nutritional change in the previous chapters all relied on a relatively narrow political base within government. Cardoso intentionally courted and heavily depended on the Ministry of Finance backing in his push for fiscal recentralization, the sanitary movement played a major role in pushing the Ministry of Health towards a focus on preventative interventions, and Lula created an entirely new body – the Ministry of Social Development and Fight Against Hunger (*Ministério do Desenvolvimento Social e Combate à Fome)* – to oversee Bolsa Família. The implication is that identification of political opportunity and clever statecraft may indeed be of more importance than targeted vision in achieving nutritional gains.

Also of relevance to this latter point of "targeting" is the fact that the policies and programs most responsible for reducing stunting in the Northeast – macroeconomic stabilization, redistributive transfers, and improving health and education – were federal initiatives, and were not in fact designed to have specifically regional impacts. This is not to say that Cardoso and (especially) Lula were unconcerned with the fact that the most severe human development problems in the country were concentrated in the Northeast, but rather that there is little evidence, either in their discourse or in the substantive content of their initiatives, that they designed policies to have a powerful impact specifically in the region. And yet those aforementioned policies did exactly that. The case of Northeast Brazil reminds us of the curious possibility that the most effective response to micro-level problems (chronic undernutrition among poor rural households in a certain region) may sometimes be geographically untargeted, macro-level action.

The preceding passages are emphatically *not* to say that the implementation or improvement of direct nutrition programs in the area of specific concern is never the most powerful means of reducing stunting. It often may be, and the following chapters on India in fact explore this possibility. The message, rather, is that the complexity of the causal web that leads to stunting demands equally sophisticated analysis; no policy package is likely to produce major gains in every context, and rather simple, well-tailored policy packages may in fact produce dramatic results in the right context.

I also do not wish to imply by the above discussion that Cardoso and Lula actually performed such careful analysis of the determinants of stunting reduction prior to committing to their course of action. Clearly they did not, and what analysis they did undertake was aimed at broader goals of stabilization and equality. This poses a problem when generalizing the results of this case study to other countries seeking to rapidly reduce stunting: if the nutritional gains in Northeast Brazil were not exactly "accidental" – after all, the policies enacted did address the major sources of household poverty – they were indeed unintended externalities. One cannot of course advise policymakers concerned with nutrition to design policies that do not explicitly take nutrition into account!

The chief lesson of the Brazil case study is, of course, not this, but rather a more subtle one: when evaluating the political constraints to stunting reduction, one must first determine what the bottlenecks to rapid nutritional improvement are, and then analyze the political economy of those policies that have potential to overcome those bottlenecks. This seems superficially obvious, but in reality "working top to bottom" in such a way offers an opportunity to bridge the ideologically-driven debates that bedevil health and nutrition policy reform today

– systemic vs. narrow solutions, preventative vs. curative care, individual vs. household interventions, and so on. The answers are dictated by the environment, not by ideas held a priori. This may be less true for the many public health issues whose etiology is largely invariant across countries, but for those considering how to overcome the political obstacles to stunting reduction, this is an important message.

PART IV. The Political Economy of Child Nutrition in India: Persistence and Policy Reform

In Part III, we saw how Northeast Brazil drastically reduced stunting rates over the last thirty years despite fairly slow economic growth. The analysis concluded that deft statecraft by Fernando Henrique Cardoso – that is, well-conceived strategies to attack a set of highly historically contingent political constraints – as well as the steadily growing influence of the inequality-focused Workers' Party and its leader Lula was responsible for effecting institutional change that politically empowered the poor, in addition to steady improvements in the health and educational infrastructure of the country.

The following chapters focus on the converse situation: a country, India, where economic growth in recent years has been singularly impressive, but with little impact on child undernutrition. Though India has long possessed a comprehensive anti-hunger blueprint, it has not been implemented well, with disastrous consequences for the welfare of children. However, in the past decade a range of political forces have combined to bring about profound reforms in federal food and nutrition policy. Perhaps more than at any point in the country's history, the prospect of rapid stunting reduction seems possible because of these reforms. In addition, several states of India have indeed managed to achieve impressive nutritional outcomes through enacting sweeping health and nutrition policy reforms.

The next three chapters focus on these topics. Chapter 10, "Why Does Undernutrition Persist in India?", introduces the issue by taking a look at the economic and policy determinants of stunting in India. The first section of the chapter describes the state of child nutrition in India, looks at the magnitude of across-state differentials, and summarizes the commonly identified bivariate and multivariate correlates of undernutrition in the country. The next two sections, B and C, then look at the association (or lack thereof) between aggregate growth, stunting rates, and poverty reduction in the country. Finally, the chapter examines two issues critical to understanding the persistence of stunting: social inequality and social protection policy. The conclusion of the chapter is that three factors attenuate the potentially strong link between growth and stunting reduction: geographical and sectoral exclusion of the poor from growth; the role of social institutions in promoting inequality and muting the potential impact of social gains; and the ineffective implementation of food and nutrition programs that, in design, have great promise in reducing stunting.

Chapter 11, "Explaining Nutritional Variation Within India", then looks at state-level variation in stunting. In the first part of the chapter, I utilize Part II's econometric policy and political economy models to look at the determinants of stunting across states. I find that demographic and environmental factors have the most powerful effect on stunting of all included variables, and the policy and political economy variables tested – including electoral competitiveness and ideology – have little correlation with stunting across states. It appears that variation is driven by idiosyncratic factors at the state level, a conclusion explored further in the subsequent chapter's section on Kerala and Tamil Nadu.

I look at successful reform efforts in Chapter 12, " India's Recent Wave of Social Policy Reforms", focusing on the success at the federal level over the past decade in pushing through (partial) reform of India's major social programs, defying the same set of political constraints that have stymied program implementation in the past. I also examine the health and nutrition policy reforms in Kerala and Tamil Nadu that took place in the 1970s and 1980s, and which led to exemplary nutritional performance in these states as compared to the rest of India. Once again using the process-tracing approach, I argue at the end of the chapter that the two political forces most responsible for the policy reforms are elite/poor alliances and the ideological leanings of key leaders. Meanwhile, in Kerala and Tamil Nadu, a long history of class-based mobilization by mass movements has led to a permanent embedding of basic health and nutrition policy issues in the mainstream political dialogue.

Chapter 12 differs from the Brazil policy and political economy analysis in Part III in two closely related ways. First, the explicit focus is on the political economy of food, nutrition, and health policies in India. This is a conscious choice given the results of the Brazil chapters, wherein tracing the political economy of nutrition *outcomes* led unexpectedly to a concern with macroeconomic reform and redistributive programs. Here, I opt instead to concentrate on nutrition *inputs* – especially food subsidies and maternal and child health programs – that have a direct link to nutritional well-being. There is a compromise involved here: unlike in the Brazil case, the federal policy reforms in question have not yet had an empirically confirmed causal effect on stunting, having taken place only in the last decade (although the Kerala and Tamil Nadu reforms are somewhat older and are more strongly causally linked to stunting reduction). However, the theoretical basis for believing that good implementation of these policies will have a future impact on nutrition is strong, and, just as importantly, the contrasting approach offers an opportunity to analyze how the political economy of nutrition outcomes differs from that of nutrition inputs.

The second difference is in the scope of analysis. The Brazil chapters, in keeping with the nature of the triggers of stunting reduction, looked at macro-level processes of economic stability and inequality. The India case study also looks largely at federal- and state-level policies, but the focus is on civil society action and other micro-level reform efforts that led to reform. As such, while government statements and third-party analyses inform the narrative, the perspectives of those actors who actually participated in the reform process are privileged.

Chapter 10. Why Does Undernutrition Persist in India?

This chapter looks at the question of why stunting rates remain stubbornly high despite India's rapid economic growth. The first section, "An Overview of Stunting in India", looks at aggregate stunting prevalence in the country, variation across states, and commonly identified correlates of undernutrition. Section B, "Economic Growth and Stunting", then reviews the growth trend and concludes by putting forward three hypotheses that may explain the growth-nutrition puzzle: geographical and sectoral exclusion of the poor from growth; persistent inequality across (especially) gender and caste lines; and weak implementation of the major public sector food-, nutrition- and health-related redistributive programs. The next three sections, "Poverty Reduction", "Social Inequality", and "Food, Nutrition, and Health Policy", review each of these topics in detail.

A. An Overview of Stunting in India: Prevalence, State-Level Variation, and Correlates

1. Nationwide Prevalence

Child undernutrition is arguably India's greatest public health emergency. As noted in Chapter 1, India contains nearly a third of the world's stunted children, nearly sixty million in all. The latest round of the National Family and Health Survey (NFHS-3) in 2005-06 found that an astonishing 48% of all children under the age of five were at least moderately stunted. Half of this group, or nearly one in every four children, are severely stunted. The consequences on child health are grave; Arnold and others (2009) note that over half of all child deaths in India are associated with undernutrition.

Stunting in India fell only slightly in recent years. Between the second round of the NFHS-2 in 1998-99 and NFHS-3 in 2005-06, the stunting prevalence for children under age three[34] dropped from around 51% to 45%. The historically high stunting rates in India, and indeed in all of South Asia, have in the past led some to argue that genotypic differences between the populations of the subcontinent and those of other regions are partially to blame. Another famous (and hotly contested) theory is that of Sukhatme and Seckler, who proposed in the early 1980s that high undernutrition rates in South Asia may partially be a result of individuals adapting to moderate nutritional deficiencies without serious consequences on development or health: the "small but healthy" hypothesis (Sukhatme 1982; Seckler 1982).

These debates have been greatly muted by the release of the WHO Child Growth Standards in 2006, discussed earlier in Chapter 1. There is now an emerging consensus within the nutrition community that, with the exception of a few extraordinary population groups, children all over the world have similar growth potential under optimal circumstances (WHO 2006a). The Government of India has adopted the new WHO standards, and undernutrition rates in the country

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[34] Because data for children ages 4-5 was not collected in NFHS-2, comparison of the 0-5 age group between the two surveys is not possible. As noted above, the NFHS-3 found that 48.0% of children in the 0-5 age group were stunted.

under these new guidelines suggest that the problem is considerably worse than previously imagined. The nationwide total stunting rate revealed by the NFHS-3 in 2005-06, for example, is six percentage points higher under the new standards than it would have been under the old growth reference.

The NFHS-3 data also confirms that Indian children growing up under "elite" conditions[35] have growth curves very similar to children across the world with normal growth patterns, undermining the genotypic differences argument (Arnold and others 2009). Another recent study confirms these results by showing that the growth of ethnic Indian children living in the United Kingdom was positively correlated to the amount of time they had spent in developed world conditions, and those who had lived their entire lives in the UK had anthropometric outcomes close to that suggested by the WHO growth curve (Tarozzi 2008).

Although these studies appear to strongly suggest that the WHO growth reference is applicable for India, contrarian opinions still exist even at the highest levels of the nutrition community. In an interview, Dr. Prema Ramachandran, director of the influential Nutrition Foundation of India and a member of Prime Minister Manmohan Singh's special advisory council on nutrition issues, expressed her opposition to the use of the international height-for-age growth reference to assess India's nutritional condition. She suggests that genetic and epigenetic factors may

[35] "Elite" children are those whose parents have at least a secondary school education, whose families have access to electricity, own a refrigerator, TV, and vehicle, who did not have diarrhea or a fever in the two weeks before the survey, were exclusively breastfed until five months of age, and received complementary foods after five months of age (Arnold and others 2009).

create a "floor" stunting prevalence rate in South Asia, perhaps around 20-25%, below which rates cannot fall; she notes that even among the wealthiest quintile in NFHS-3, stunting rates were around this level. Such constraints may also restrict the rate at which stunting can decline on an annual basis. Ramachandran points especially to the elevated rate of low birthweight in the country, an important contributor to later stunting, and asserts that we cannot with our present knowledge ascertain whether this is a function of *in utero* nutrition, female life cycle nutrition, or parental heights. Each of these possibilities would have different implications for the time frame over which stunting can be reduced, even with optimal program intervention (Ramachandran, interview).

However, Dr. Ramachandran's views are currently in the minority among public health professionals. As detailed at greater length in Chapter 12, the belief that India's abysmal nutritional indicators are real manifestations of poor child health is also becoming widespread within the policymaking community.

2. Variation Across States

The alarmingly high all-India figures for undernutrition mask considerable variation across states, as Figure 54 and Figure 55 below show.

Figure 54. State total stunting prevalence, 2005-06. Source: IIPS and Macro International (2007).

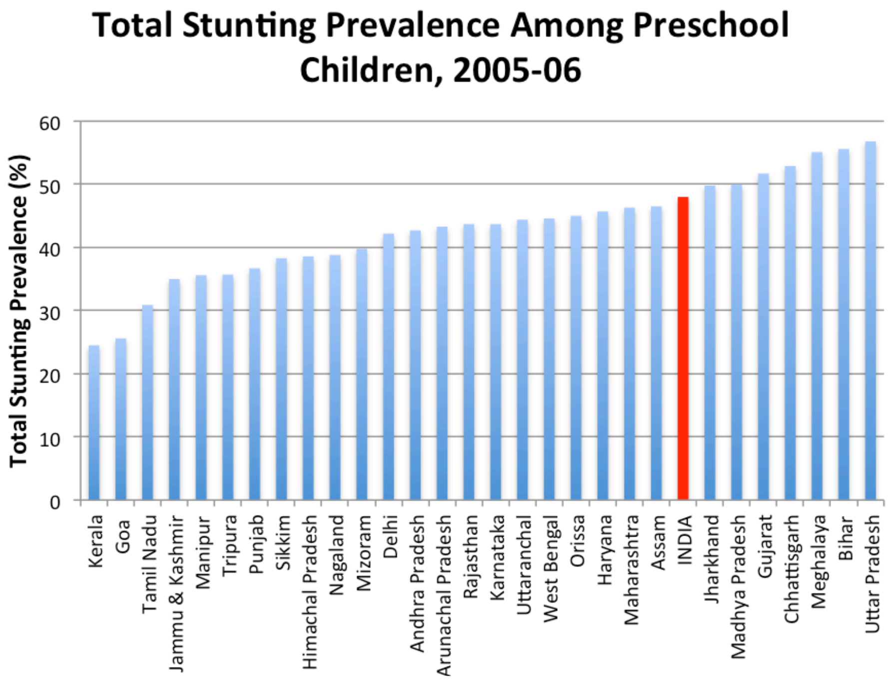
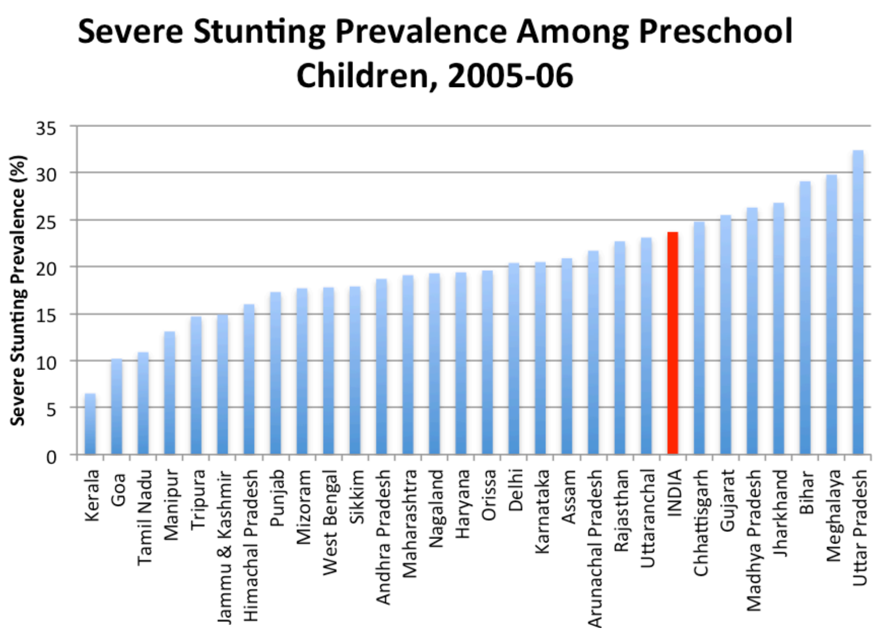


Figure 55. State severe stunting prevalence, 2005-06. Source: IIPS and Macro International.

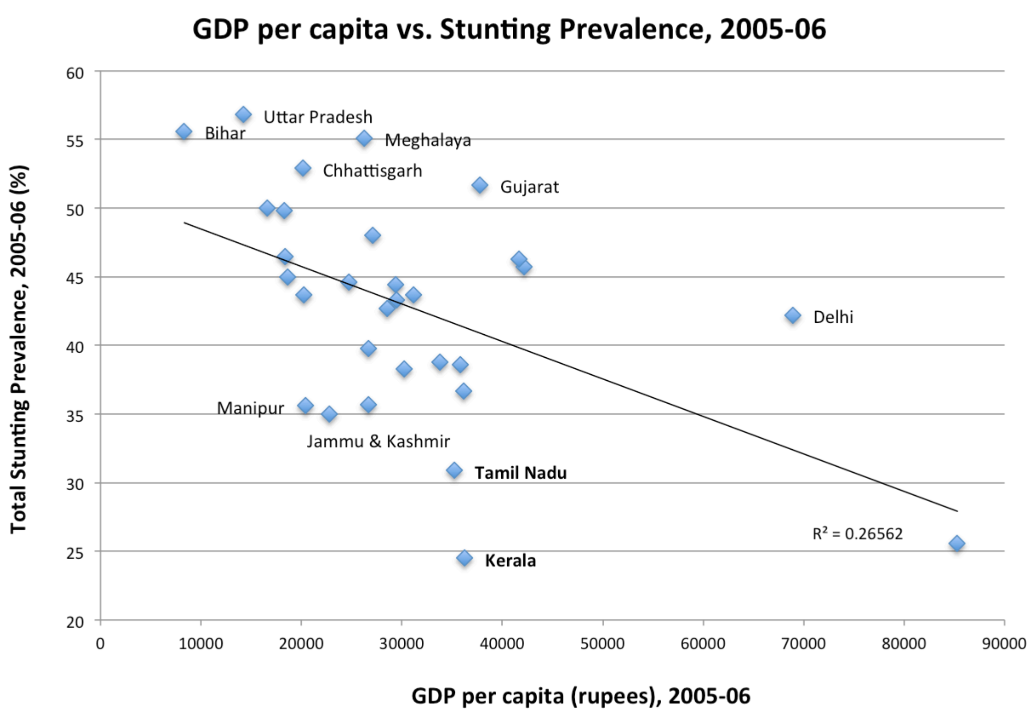


The epicenter of undernutrition in India is in the north-central "Hindi belt" region, particularly in the large states of Uttar Pradesh, Bihar, and Madhya Pradesh, where nearly 400 million people live. Total stunting rates in this area approach 60%, and in several states over a quarter of children are severely undernourished. To put the situation into perspective: were Uttar Pradesh a country it would have more stunted children than any other nation in the world, by a wide margin, and several of the other Hindi belt states would be in the top ten.

In contrast, several of the southern states have performed relatively impressively in protecting child welfare, especially Kerala, Goa, and Tamil Nadu. Kerala and Tamil Nadu are not small states: the former has a population of over 33 million people (comparable to Uganda) and the latter 72 million people (a bit more than the Democratic Republic of the Congo). Although anthropometric data for states in India before the 1990s are not available, a host of food security indicators suggest that Kerala and Tamil Nadu had similar levels of undernourishment to the all-India averages in the early 1970s (Drèze and Sen 2002). Thus improved child nutrition in these states has likely saved millions of children from premature death and excessive morbidity over the past several decades. The total stunting prevalences of around 25-30% achieved by these states are still unacceptably high, but in the context of India they are success stories.

Further, the differentials in child nutritional status across states are not solely explained in a bivariate sense by GDP per capita, as seen in Figure 56 below. Although income is indeed a powerful driver of lower stunting, as the downward sloping trendline shows, there are a large number of states lying far from the trendline in both directions; some of the more notable cases are labeled. Tamil Nadu and Kerala are well below the linear trendline, while Gujarat, Uttar Pradesh, Meghalaya, Bihar, and Delhi have stunting rates considerably above what would be expected given their income. As will be discussed at length in this and the following chapters, a variety of factors appear to mediate the relationship between income per capita and child nutrition.

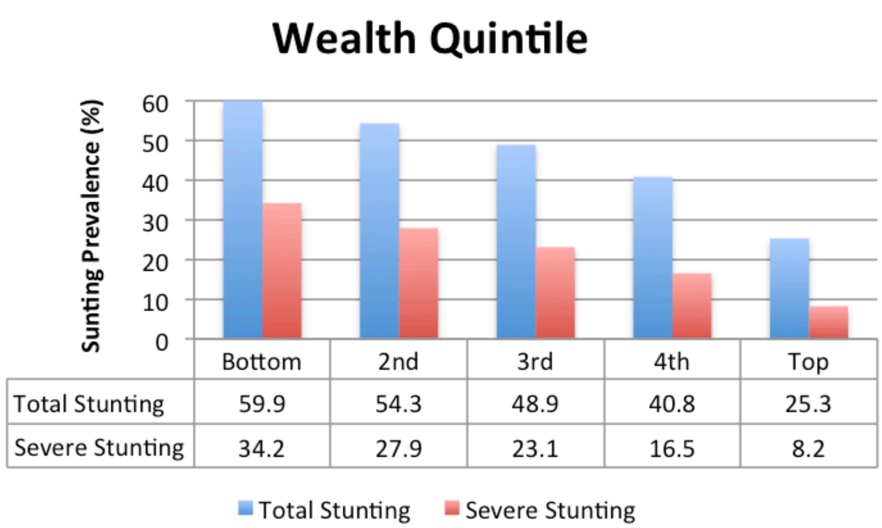
Figure 56. GDP per capita vs. total stunting prevalence, 2005-06. Source: GoI (2008b), GDP per capita data; IIPS and Macro International (2007), nutritional data.



3. Correlates of Stunting Prevalence

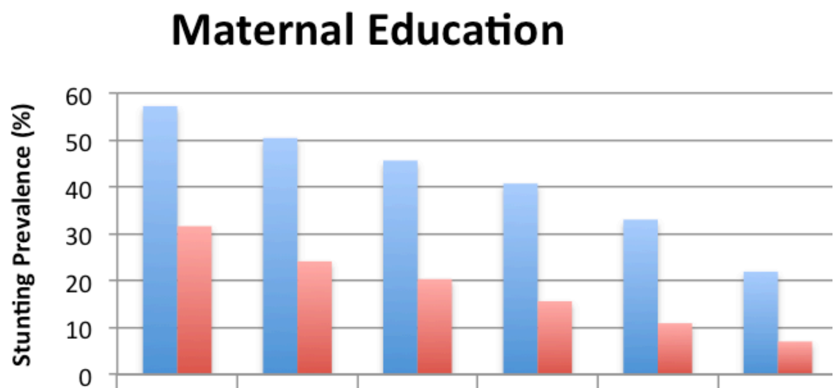
Bivariate analysis of the correlation between stunting and socioeconomic characteristics at the national level, using NFHS-3 data, implicates the usual suspects: wealth, maternal educational level, maternal nutritional status, place of residence, and caste (see figures below). The poorest households have more than twice the stunting prevalence as the richest, with a staggering three out of five children undernourished in the lowest wealth quintile, over one-third severely so (Figure 57). Improving maternal education shows a relationship of similar magnitude with lower stunting (Figure 58). The difference between children of underweight and normal BMI mothers is not as pronounced, but children of overweight mothers are indeed much less undernourished (Figure 59). Rural-urban disparities persist in India, with stunting prevalence almost one-quarter lower in cities and towns (Figure 60). Households not classified as either scheduled caste, scheduled tribe, or backward caste have better nourished children, although the stunting prevalence among this "other" (i.e., higher caste) category remains high at nearly 41% (Figure 61).

Figure 57. Stunting prevalence by wealth quintile, 2005-06. Source: IIPS and Macro International.



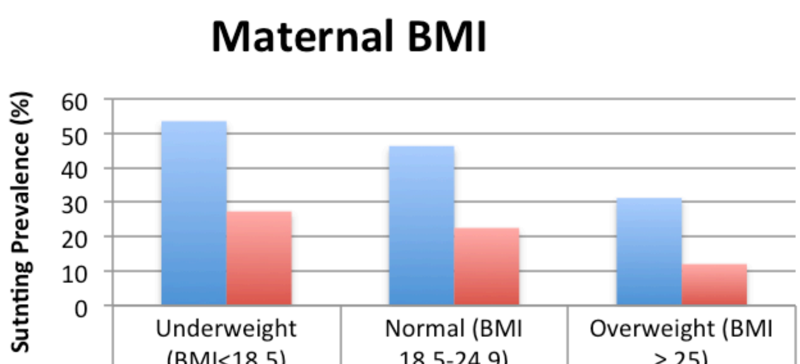
	Bottom	2nd	3rd	4th	Top
Total Stunting	59.9	54.3	48.9	40.8	25.3
Severe Stunting	34.2	27.9	23.1	16.5	8.2

Figure 58. Stunting prevalence by maternal education, 2005-06. Source: IIPS and Macro International.



	No education	<5 yrs	5-7 yrs	8-9 yrs	10-11 yrs	≥ 12 years
Total Stunting	57.2	50.4	45.6	40.7	33	21.9
Severe Stunting	31.6	24.1	20.3	15.6	10.9	7

Figure 59. Stunting prevalence by maternal body mass index, 2005-06. Source: IIPS and Macro International.



	Underweight (BMI<18.5)	Normal (BMI 18.5-24.9)	Overweight (BMI ≥ 25)
Total Stunting	53.5	46.3	31.2
Severe Stunting	27.3	22.5	12

Total Stunting Severe Stunting

Figure 60. Stunting prevalence by place of residence, 2005-06. Source: IIPS and Macro International.

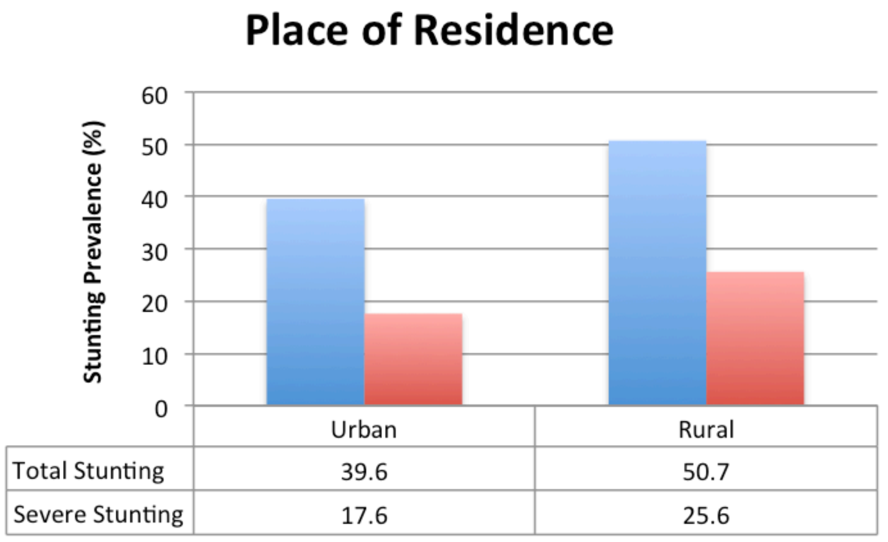
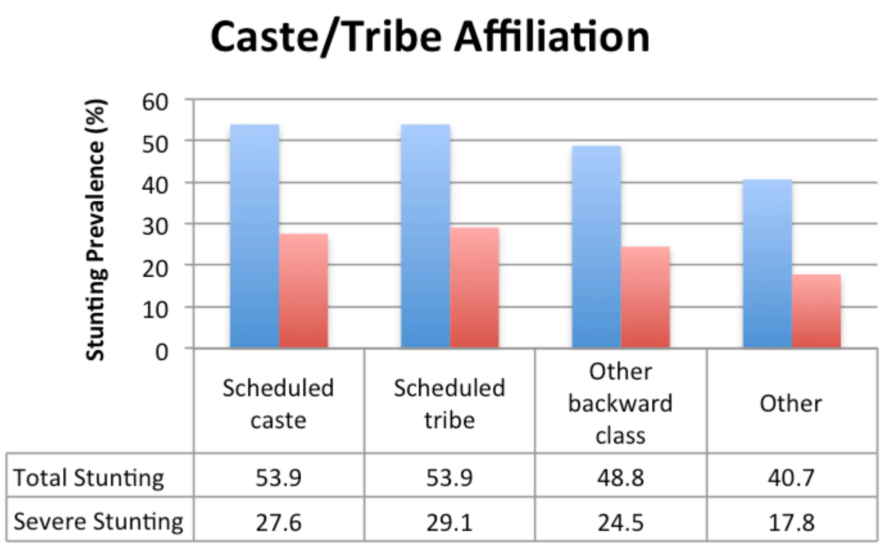


Figure 61. Stunting prevalence by caste/tribe affiliation, 2005-06. Source: IIPS and Macro International.



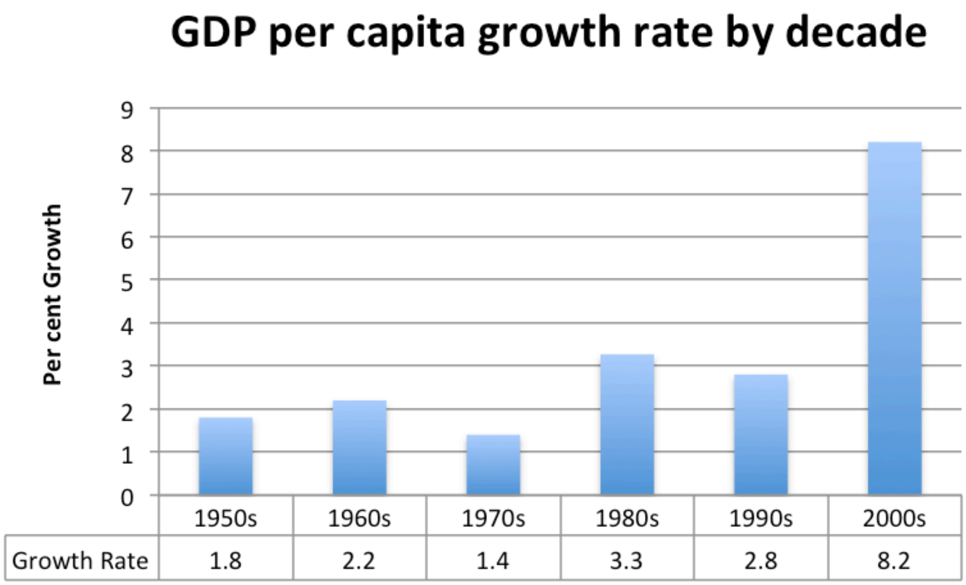
A wide range of econometric analyses of the determinants of child undernutrition in India has been conducted using data from various large-scale surveys, including the three rounds of NFHS. The most important of these were reviewed earlier in Chapter 2; taken as a whole, they emphasize the importance of maternal health, knowledge, and proper feeding practices over other variables (Brennan and others 2004; Bhandari and others 2001; Griffiths and others 2002; Harttgen and Misselhorn 2006). Another critical lesson emerging from these papers is that the correlates of child nutrition may vary depending on state, pointing to the need for a more localized approach to address undernutrition (see especially Griffiths and others 2002).

The following sections analyze the puzzle of why stunting levels remain so high in the country even in the face of rapid economic growth. Section B, "Economic Growth and Stunting", outlines the empirical record of growth in India, and looks in a preliminary fashion at the links between growth and nutritional outcomes. The following three sections examine different hypotheses for explaining the lack of association between growth and child nutritional status.

B. Economic Growth and Stunting

India's growth history since Independence is more nuanced than the popular narrative of a "sleeping elephant" unleashed by the liberalizing reforms of 1991 (McCartney 2009). As Figure 62 below suggests, growth has indeed accelerated greatly in the past decade, more than doubling growth rates of previous decades.

Figure 62. Decadal GDP per capita real growth rate. Source: Heston and others (2011).

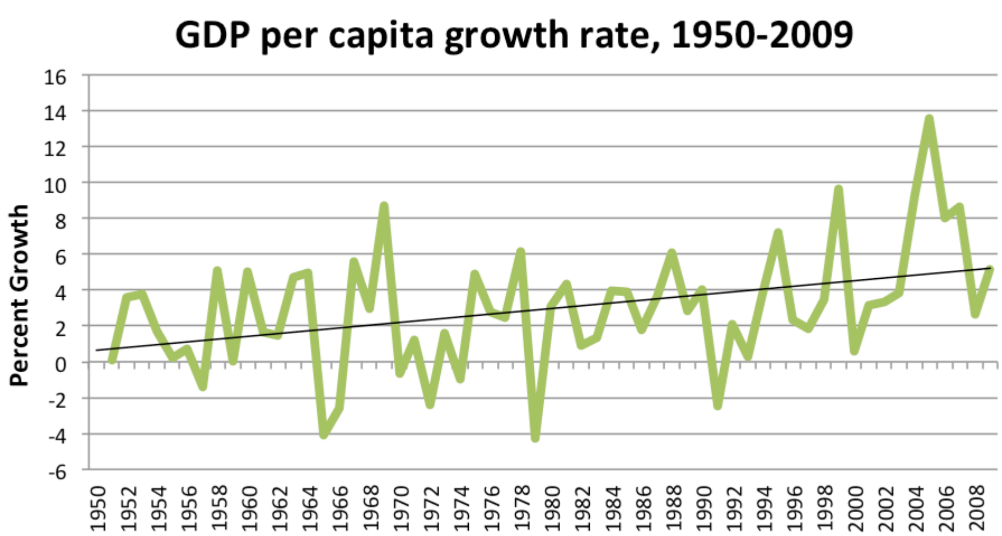


But several other points are worth noting. First, growth in the pre-liberalization period was slow but not stagnant. In the 1951-1964 Nehru period, India averaged 2.4% per capita growth annually, although following the Prime Minister's death through the 1970s, growth did slow to 1.5% annually. Deficit financing was largely responsible for fueling recovery and moderately rapid growth in the 1980s, but a balance of payments crisis subsequently resulted, paving the way for the economic reforms of the early 1990s (Corbridge 2011; Ravallion 2010).

The second challenge presented by the empirical record to popular understanding of India's growth has to do with the immediate effect of liberalization; as the graphs above and below show, reforms did not immediately lead to a growth acceleration. In fact, growth was slower in the 1990s than in the decade previous. This growth was also unevenly spread across India, with negative growth rates in states like Bihar and income nearly doubling in states like Gujarat (Corbridge and others 2011). Generally, the southern and western states grew faster than the northern and eastern states (Jayadev and others 2011).

Finally, India's growth, while generally quickening pace since Independence, has been in a year-to-year sense highly uneven. Even in the 18-year post-liberalization period, there have only been seven years where India's per capita growth has exceeded 4%, and several years in which growth has been quite sluggish, falling to around 2% or lower. All of this is not to refute that India's growth is accelerating – it is, dramatically – but rather to note that the pattern of growth is more complex than linear acceleration.

Figure 63. Annual GDP per capita. Source: Heston and others (2011). Real GDP Per Capita (Laspeyres), derived from growth rates of consumption, growth, investment, at 2005 constant prices.



Has the recent growth has been distribution-neutral? At first glance, inequality as measured by the Gini coefficient does not indicate a significant worsening of income distribution in India between 1991 and 2005. The Gini rises only slightly from 0.31 to 0.33 in this period, in contrast to (for example) an increase from 0.29 to 0.42 in China during the same years (Jayadev and others 2011). Recall in addition that Brazil has historically had a Gini coefficient around 0.6, and even today the figure remains around 0.55 (World Bank 2011).

However, India's aggregate figure may be misleading for several reasons. First, as Ravallion (2010) points out, India's Gini is usually calculated using consumption rather than income data. Because households often smooth consumption over the course of a year, consumption-based measures of the Gini may underestimate the extent of income inequality. A second question pertains to equality within the agricultural sector, which contains the vast majority of households at risk of undernutrition in India. While the Gini coefficient for the agricultural sector (as well as rural areas a whole) in the country decreased between 1983 and 2004, inequality in agricultural land ownership has worsened, reaching an extremely high 0.73 in the latter year (Vakulabharanam and Motiram 2011). A final consideration is the pattern of localized inequality. De Haan and others (2009) note that, though the national Gini has risen only slowly, inequalities within states may be increasing; they point specifically to the widening disparity in poverty rates across regions within one of India's poorest states, Orissa.

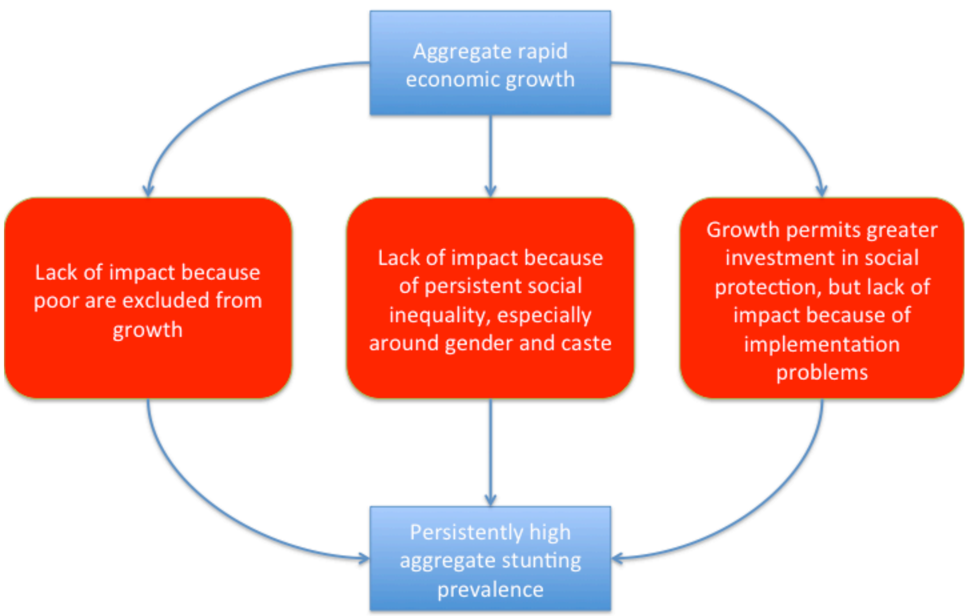
Mazumdar (2010), using NFHS-3 data, in fact finds that a statistically significant association between wealth inequality and nutritional inequality exists at the state level in India; that is, the more unequal a state is in terms of household wealth, the more likely that stunting will be concentrated among the poor. Mazumdar also shows that inequalities in maternal education, paternal education, and health services utilization also contribute to nutritional inequality.

Keeping all of this in mind, what can we say about the relationship between recent growth and stunting prevalence in India? First, it is clear that India's "growth elasticity of nutritional status" has been quite weak over the past few decades. For every percentage point of economic growth per capita between 1992 and 2005, stunting rates for children under the age of three fell by just 0.29 percentage points. Compare this, for example, to Northeast Brazil's elasticity of −1.04 between 1975 and 2006.

Subramanyam and others (2011) examine the question more closely by using data from all three rounds of the NFHS (1992-93, 1998-99, and 2005-06) to assess whether state-level economic growth is significantly associated with the probability of an individual child being stunted, controlling for a wide set of socioeconomic and demographic variables. For nearly every model they test, the answer is in the negative: a puzzling result, but one that confirms the bivariate observation that, even as India's economy rocketed along in the 2000s, undernutrition rates declined only marginally. Maternal education, paternal education, caste, and religion, meanwhile, are more powerful explanatories of stunting risk. Further, Subramanyam and others' results survive a range of sensitivity tests. Time trend controls, state fixed and random effects, usage of a smaller dataset than the full three NFHS rounds, and different combinations of included socioeconomic and demographic variables yield similar results. Even when household wealth is excluded from the regression – which allows state-level economic growth to influence nutrition through household asset pathways, instead of restricting its impact to other intermediate mechanisms – the growth variable is insignificant. In a small minority of the tested models, the association between economic growth and stunting becomes significant, but the effect is small.

So why does this unexpected contradiction between impressive economic growth and persistently high stunting exist in India? There are three commonly advanced hypotheses in answer to this question, as the figure below illustrates.

Figure 64. Possible causes of weak growth impact on stunting.



The first possibility, mentioned in the above discussion, is that the unremarkable rise in aggregate Gini masks increasing economic inequality in "nutrition-sensitive" sectors: the benefits of economic growth are flowing disproportionately to the upper classes, and groups with a high risk of undernutrition are largely excluded from growth. In fact, the effect of recent growth on employment in India is contested; real wages appear to have stagnated in recent years (Harriss 2011). In addition, the impact of growth on stunting could be muted because it is not concentrated in poverty-reducing sectors, especially agriculture. Rates of growth in aggregate agricultural output and per-hectare productivity slowed to around 1-2% in the 1990s and 2000s, from about 2-3% in the 1980s (Vakulabharanam and Motiram 2011). If this hypothesis were true, we would expect to see little change in the prevalence and/or depth of poverty during the rapid growth period. Section C of this chapter, “Growth and Poverty Reduction”, explores this possibility in more detail.

A second hypothesis is that social inequality, especially pertaining to gender and caste, is obstructing the potential effects of economic growth. Maternal undernutrition and lack of control over household resources may be persistent, especially among groups at greatest risk of stunting, even in the face of rapid income growth at the household. Issues of inequality are explored in Section D, “Social Inequality”, below.

A final possibility is that, while economic growth is indeed enabling India’s public sector to finance more expansive, effective development programs that should theoretically improve child nutrition, implementation problems stymie the impact of these programs. This last topic is explored in Section E, “Food and Nutrition Policy”, as well as in more detail in Chapter 12.

C. Poverty Reduction

1. Income Poverty

To assess the relationship between recent growth and poverty reduction, accurate estimates of poverty are necessary. The prevalence of poverty in India, unfortunately, is a matter of heated dispute. There are three major issues that deserve discussion: the setting of the poverty line, data sources for estimating poverty prevalence, and the comparability of data over years.

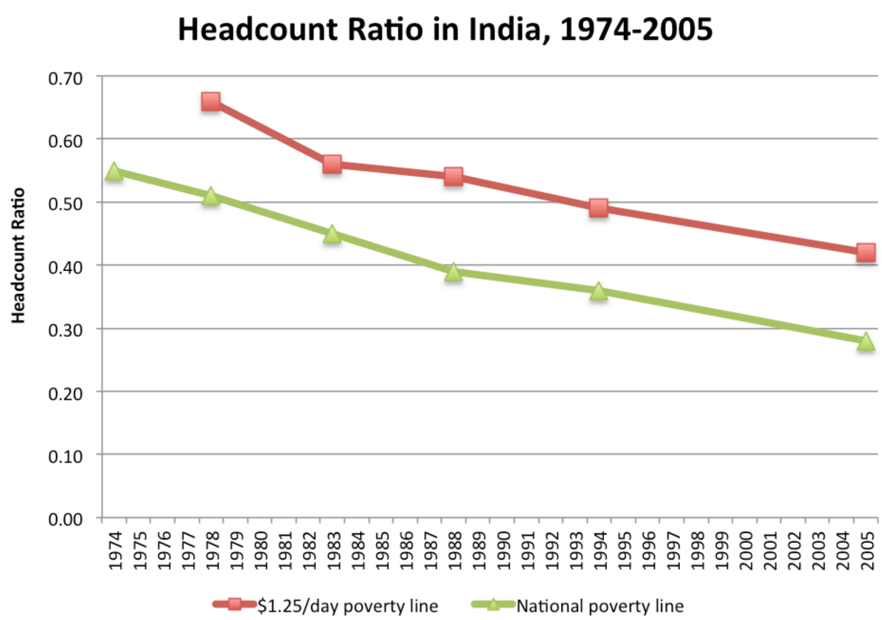
The current national poverty line is fixed based on the cost of a food basket meeting the norms of 2400 kcal per capita in rural areas and 2100 kcal per capita in urban areas. The line was first determined in the early 1970s, and subsequently updated simply by accounting for the change in the consumer price index. The current line stands at 26 rupees per capita/day for rural areas ($0.51/day) and 32 rupees per capita/day for urban areas ($0.63/day). Even adjusting for purchasing power, these lines are well below the World Bank's $1.25/day international extreme poverty line. As might be expected, the estimates of poverty in India vary widely depending on which line is used, an issue discussed at greater length below. A range of voices within civil society have argued for years that the current poverty line is far too low to meet basic needs. Although there have been recent governmental attempts at revisiting the question – most notably with the creation of the high-profile Tendulkar Committee on Poverty Estimation in 2009 by the current Singh administration – the line remains at the aforementioned level, mostly due to the fact that any revision would sharply increase poverty numbers and thus poses political difficulties for the government in power.

Which dataset to use when measuring nationwide poverty is also an issue of concern. Conclusions reached using National Sample Survey (NSS) data versus national accounts data differ greatly (Datt and Ravallion 2002). The NSS is a nationwide socioeconomic survey conducted on a continuous basis, thus allowing year-to-year comparison (and periodically, usually every few years, the NSS obtains an especially detailed set of data). For poverty estimation purposes, the NSS is much more preferable to macroeconomic accounts due to its more detailed nature, but has several important flaws. The NSS survey includes households only, while national accounts include consumption by nonprofit organizations as well. In addition, the latter source includes financial services and housing rents while the NSS does not. One may correct NSS-based consumption upwards in order to account for these exclusions, but the problem is that this revision should not be distribution-neutral; the higher consumption implied by the national accounts is clearly not divided equally between the poor and the non-poor. However, the exact degree of correction required is unclear, and in practice analysts usually assume the revision to be distribution-neutral, and thus underestimate the incidence of poverty in India.

The third problem is that the methodology for consumption recall in the NSS changed starting in 1990, making comparison with previous years problematic. Datt and Ravallion (2002) point out that, depending on which assumptions are used, NSS data suggests that rural poverty can either have decreased by ten percentage points or increased by two percentage points between 1993 and 1999.

Keeping these issues in mind, data from the National Sample Survey indicates that under the national line India had a poverty headcount ratio of 0.28 in 2005. This is considerably lower than the estimate given the international $1.25/day extreme poverty line, which would increase the headcount to 0.42 (World Bank 2011). The graph below shows the change in headcount ratio between 1974 and 2005 using both lines.

Figure 65. Headcount ratio in India, 1974-2005, under national and international poverty lines. Source: World Bank (2011).



A quick glance at the figure suggests that, whichever line is used, the pace of poverty reduction does not appear to have accelerated greatly in the recent period of rapid growth (i.e., the slope of the line has not become steeper). A variety of studies reinforce this impression.

First, Ravallion and Datt (1996) look at growth in the pre-reform period, using data from 1950 to 1991 to investigate the contribution of growth in different sectors and in different locales (i.e., rural vs. urban) on poverty reduction in India. They find that rural growth had a significant effect on both rural and urban poverty, but urban growth only affected urban areas, and that the agricultural and services sectors were largely responsible for poverty reduction in the country as a whole. Industrial growth had little effect.

Datt and Ravallion (2002) update their earlier work by examining the relationship between economic growth and poverty reduction in the post-reform years. Reviewing both National Sample Survey and national accounts, they conclude that poverty reduction proceeded at about the same rate in the 1990s as it did in the previous three decades. However, they note that the growth elasticity of poverty has diminished in magnitude. Between 1958 and 1991, a percentage point of growth was associated with about a 0.75 percentage point fall in the headcount ratio, and a slightly larger fall in the poverty gap and squared poverty gap indices. They calculate that, were this elasticity maintained during the 1990s, the rate of poverty reduction would have doubled. Overall, the growth elasticity of poverty is India since the late 1970s is quite modest, at around -0.65 (Harriss 2011).

Ravallion (2010) contrasts India's experience between 1993 and 2005 with that of Brazil and China during similar reform periods (he uses the same years for Brazil, and looks at the 1981-2005 period for China). He finds that the growth elasticity of poverty in the reform years in India, at -0.4, is far smaller than in the other countries; Brazil's elasticity over that period is -4.3, and China's -0.8. Put differently, as discussed in Part III, Brazil managed rapid poverty reduction despite slow growth, mainly by reducing inequality. China grew very quickly and by doing so mitigated some of its concomitant increase in inequality and still managed to reduce total poverty considerably. India, meanwhile, grew moderately but the worsening of its income distribution stood in the way of significant gains in poverty reduction. Ravallion (2010, p.6) notes that if "India had Brazil's elasticity…India's growth rate would have delivered a rate of poverty reduction of 15% per annum – well above even China's rate".

Datt and Ravallion (2002) assert that the geographical and sectoral pattern of growth in the 1990s is responsible for the disappointing poverty reduction performance. The states in which poverty is concentrated in India - primarily the large states of the north-central Hindi belt, especially Bihar, Uttar Pradesh, and Madhya Pradesh – grew more slowly than the middle-income states of the country. In addition, the growth elasticity of poverty in these states tended to be lower, especially in the nonagricultural sectors. A percentage point of growth in Bihar lead only to a 0.26 percentage point fall in poverty, in contrast to a 1.33 percentage point fall in Kerala. Using data from 15 states, Ravallion and Datt (2002) attribute the variation in the nonfarm sectoral growth elasticity of poverty across states to initial conditions – in particular, to improved female literacy, less rural-urban inequality in consumption, lower infant mortality, higher agricultural productivity, and less rural landlessness. This set of factors explains nearly 90% of the variance in elasticities observed across states.

Lanjouw and Murgai (2009) look at the nonfarm rural sector and poverty reduction in more detail. They note that rural sectoral transformation in India over the last two decades has been generally slow when measured in terms of labor force participation. They find that the share of labor participation in agricultural labor rose between 1983 and 1999, but appears to have fallen back to early-1990s levels by 2005. Meanwhile, the rural nonfarm sector has indeed become larger over the last several decades, but modestly, with growth concentrated in the 1999-2005 period. The share of rural employment in the nonfarm sector varies greatly across states, with Kerala having highest rate in the country at 77%. Countrywide, while it does appear that the rural poor are increasingly participating in the nonfarm sector, they generally do so as casual laborers or in self-employment, activities that are unstable sources of income. Access to more remunerative salaried nonfarm employment appears to be linked strongly to education, caste, and wealth levels. The expansion of nonfarm employment does seem to be pushing agricultural wages upward, but the overall growth in agricultural wages across India since 1990s has been fairly weak, and decelerating in recent years. As Lanjouw and Murgai point out, all these factors make the effect of rural nonfarm growth on poverty reduction in the past several decades ambiguous.

In addition, agricultural growth across India was itself considerably slower than in the secondary and tertiary sectors. Given the importance of agricultural growth to poverty reduction, this tended to attenuate the pace of poverty reduction in the country as a whole. Furthermore, Headey (2011) observes that, unlike in most developing countries, even what agricultural growth existed had a weak direct effect on undernutrition in India. This was likely due to Ravallion and Datt's (2002) earlier observation that agricultural sector growth in India has in recent years been concentrated in middle-income states, thus limiting the effect on poverty.

Ravallion (2010) further explores the role of initial inequalities as a key factor in determining the growth elasticity of poverty. He notes that China had achieved universal primary school gross enrollment by 1980, and four in five adults were literate by 1990. India has failed to reach the literacy target even in the present day – the adult literacy rate stood at 63% in 2006 – and universal primary school gross enrollment was not attained until 2003. The inequalities are even more pronounced when disaggregated by gender. For example, at the start of India's reforms, less than a third of adult women were literate; at the beginning of China's reform period, ten years earlier, more than half of women could read and write. Health inequalities are also prominent. The infant mortality rate in India in 1990 was twice that of China, at around 80 per 10,000, and life expectancy a full eight years lower (60 vs. 68). Ravallion also finds that what poverty reduction did occur in India in the 1990s was driven largely by growth in the services sector, with high asset inequality (as well as low growth) in agriculture a major factor for the weak poverty-reducing performance of this sector.

Headey (2011) raises the larger question of what factors determine whether economic growth is "nutrition-sensitive". Using both cross-country econometric and case study methods, he finds that generally economic growth is a necessary but insufficient condition for stunting reduction. When growth does improve nutrition, it does so by increasing food production, levels of female schooling, and health access, and by reducing fertility rates. The recent rapid growth in India has had only weak effects on these types of critical intervening variables.

Overall, it appears that economic growth has had non-negligible but limited effects on reducing the prevalence of poverty. What about the intensity of poverty – even if growth has not managed to pull many households *above* the poverty line, has it had greater success in pulling poor households *closer* to the poverty line? The poverty gap index, which estimates the gap between the average poor household's income and the poverty line (expressed as a percentage of the poverty line level) provides a means of exploring this question.

Figure 66. Poverty gap ratio in India, 1978-2005. Source: World Bank (2011).

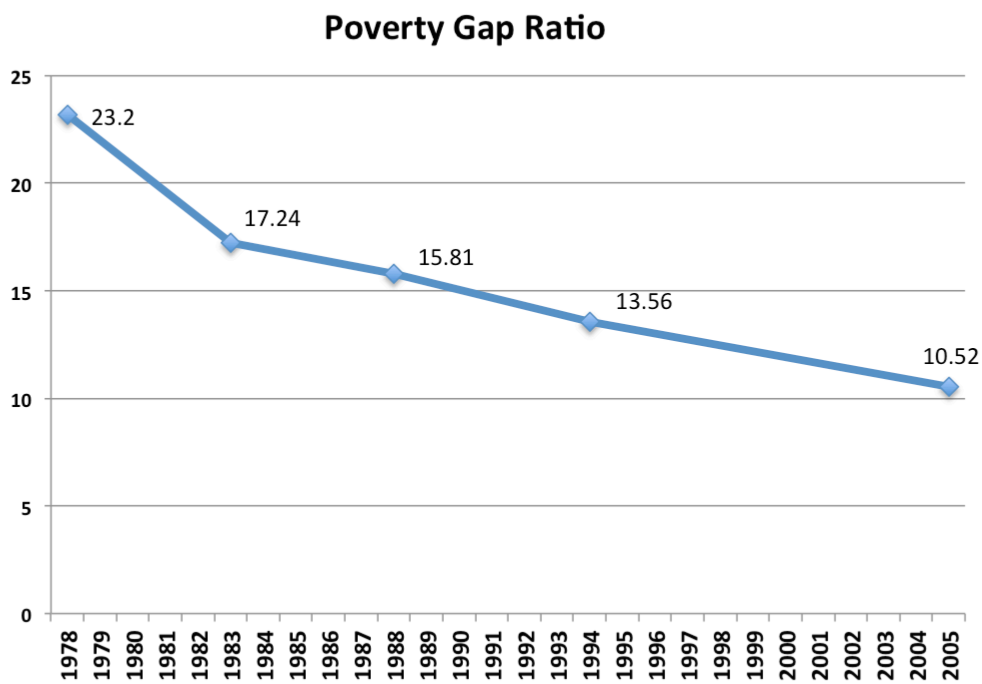


Figure 66 sends a similar message as the headcount ratio. The poverty gap has indeed declined in the rapid growth period, but the slope of decline is relatively flatter than in previous periods. The growth elasticity of the poverty gap between 1994 and 2005 is -0.402; that is, for every percentage point of growth in GDP per capita, the poverty gap ratio declined by about four-tenths of a percentage point.

2. Multi-dimensional Poverty

The preceding discussion has largely been based on income- and consumption-based conceptions of poverty, but alternative measures are available. Alkire and Santos (2010) have recently proposed a new multidimensional poverty index (MPI), one that incorporates indicators of education (as measured by years of school and child enrollment), health (child mortality and nutritional status, the latter as measured by underweight prevalence), and standard of living (electricity, drinking water, sanitation, flooring, cooking fuel, and major assets). Each of these three categories is weighted equally at 1/3rd of the total MPI, and each of the sub-indicators (or "dimensions") is weighted equally *within* the major categories[36], to construct an overall deprivation score for a household. Households that fall below a specified threshold in any given dimension are considered deprived in that dimension, and households deprived in at least 30% of the weighted dimensions are considered multi-dimensionally poor. Applying this method to the data from the 2005 NFHS-3, 55.4% of India's population would be considered multi-dimensionally poor. This figure, similar to that of Haiti or Cameroon, is considerably higher than even the $1.25/day international poverty line estimate.

The MPI methodology helps identify which aspects of poverty contribute most strongly to overall deprivation. In India's case, nutrition figures prominently, as would be expected given the very high rates of undernutrition reported earlier; 22% of multidimensional poverty in the country can be explained by nutritional deficiency alone. Child school enrollment and mortality are the next most important contributors to multidimensional poverty (explaining 12.8% and 14.1% respectively), illustrating that, following Alkire and Santos' approach, child welfare is the single most prominent aspect of poverty in India, although this is to some extent an artifact of the weight the authors give to these factors.

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[36] For example, child mortality is 1/2 of the value of the health category and thus 1/6 of the total, and sanitation is 1/6 of the standard of living category and thus 1/18th of the total.

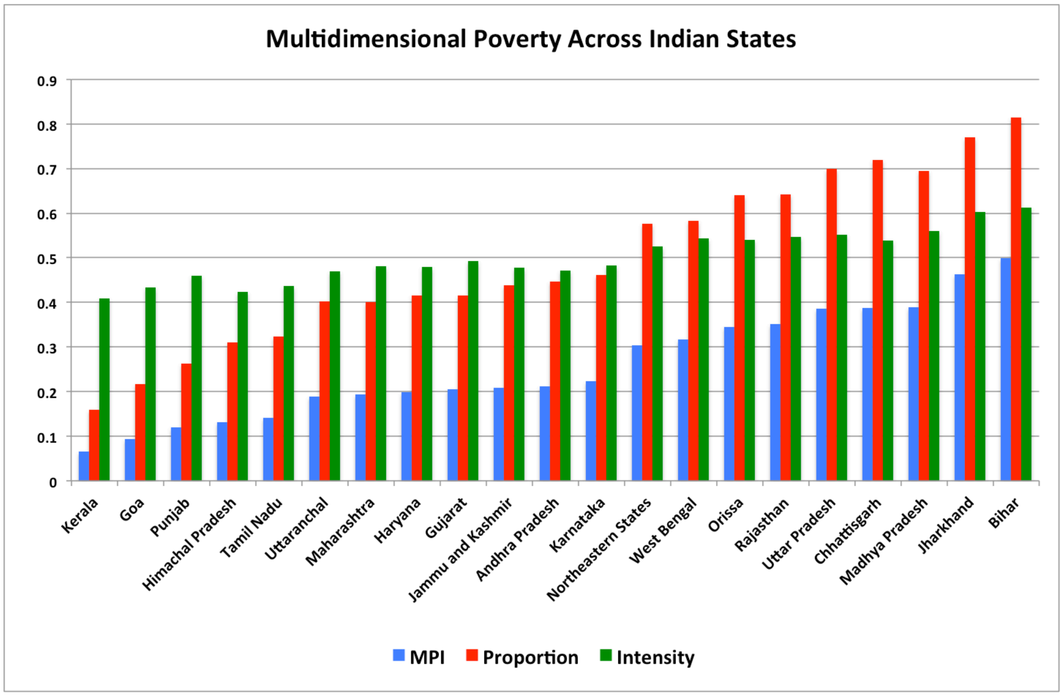
Alkire and Santos also identify wide spatial variation of poverty in India. The NFHS-3 data shows that the proportion of multi-dimensionally poor people is close to 70% of the population in the large states of Uttar Pradesh, Chhattisgarh, and Madhya Pradesh, and around 80% in Jharkhand and Bihar. In contrast, just 15.9% of people are multi-dimensionally poor in Kerala, the country's leading performer. Goa (21.7%), Punjab (26.2%), Himachal Pradesh (31.0%), and Tamil Nadu (32.4%) round out the list of the country's top-performing states; in every other state in the country, as least four out of every ten people are multi-dimensionally poor.

The MPI methodology measures the intensity of poverty as well as its proportion. Intensity is defined by Alkire and Santos as the average fraction of weighted dimensions in which a household is deprived among those in the sample which are multi-dimensionally poor. Thus India's aggregate intensity score of 53.5% suggests that the average poor household is deprived in just over half of the weighted dimensions.

It is worth noting that there is less variation between Indian states with respect to intensity of poverty than prevalence. For example, the average intensity of multidimensional poverty in Kerala is 40.9%, while that of Bihar, the worst-off state, is 61.3%. This range is considerably smaller than that of the proportion of poverty indicator discussed earlier. Figure 67 below shows the levels of multidimensional poverty proportion and intensity by state, along with the value of the multidimensional poverty index itself, which is a simple product of the proportion and intensity. States are arranged from lowest to highest in terms of

MPI; the northeastern states of Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura are combined into a single category.

Figure 67. Multidimensional poverty in India, 2004-05. Source: Alkire and Santos (2010).



The graph clearly shows the more dramatic variation across states with respect to the proportion (second, red) columns relative to the intensity (third, green) columns. Thus it appears that while there are a far smaller proportion of poor people in Kerala than Bihar, for example, those that *are* poor experience a similar character of deprivation in the two states.

Returning to the main point, a multidimensional measurement of poverty in India indicates more widespread deprivation than do income- or consumption-based measures. Further, many important correlates of undernutrition, including child mortality, school enrollment, and access to safe water and sanitation, are incorporated in the MPI (as is a nutrition indicator itself: underweight). Thus the MPI suggests that, while India's growth elasticity of income poverty is low (as discussed in the preceding section), the growth elasticity of the *kind* of poverty most relevant for child nutrition may be even lower.[37] In closing, however, it is worth noting that the MPI methodology is not without its detractors, who question especially the somewhat arbitrary weighting of the components of the index. Still, in light of the ongoing controversies about India's income poverty line and the surprising weak links between income growth and nutritional improvement, the MPI provides a means of defining poverty that is perhaps more directly relevant to stunting.

D. Social Inequality

The previous section explored the possibility that recent rapid economic growth in India is not leading to the expected decline in stunting because the poor are excluded from growth. The geographical and sectoral pattern of growth, as well as the influence of pernicious historical inequalities in health and education, appears to be largely responsible for this phenomenon of nutrition-*in*sensitive growth.

Gender inequality may be another important factor impeding the growth-nutrition link. As noted earlier, a variety of recent studies suggest that maternal knowledge and caregiving behavior is an important determinant of child nutritional status in India (Brennan and others 2004; Bhandari and others 2001; Griffiths and others

[37] Unfortunately, data to calculate the MPI for earlier periods (i.e., household-level panel data) is unavailable, so a "growth elasticity of multidimensional poverty" cannot be calculated.

2002; Harttgen and Misselhorn 2006); and, as discussed in Chapter 2, the literature as a whole has placed maternal well-being and autonomy at the center of debates of how to accelerate stunting reduction.

However, the pathways by which any given measure of maternal well-being influences child nutritional status in India is far from a resolved question, and indeed recent studies have yielded somewhat contradictory results. For example, using Andhra Pradesh state data from NFHS-2, Shroff and others (2009) found that mothers with the freedom to go to market were 41% less likely to have stunted children; those with greater access to money were 27% less likely. These associations persist when controlling for household wealth and maternal education. Yet other dimensions of autonomy tested by this study found no significant association with stunting. Further, analysis by Sinha (interview) of the NFHS-3 dataset, as well as of longer-term longitudinal datasets from single districts in Uttar Pradesh and Tamil Nadu, found no correlation between any measure of maternal autonomy or decision-making and child nutritional status, though maternal education remained significant. In Sinha's view, this may point to an inadequate framing of the autonomy concept within the NFHS questionnaire, but in any case the unexpected result suggests the need for more careful causal analysis of how and what type of intrahousehold power matters for child welfare.

In addition, the impact of maternal variables of stunting may be conditional on other factors. Borooah (2005) makes this point with respect to where a child falls along a height-for-age distribution. Using 1994 data from 33,000 rural households in India, he finds that maternal education does not have a significant effect on child growth in the lowest (most stunted) quintile, and its impact is most strongly felt in the middle quintile. In contrast, improvements in water and health service infrastructure had the most powerful impact in the lowest quintile. Borooah points out that if the dependent variable was analyzed in aggregated form – i.e., not divided by quintile – these effects would be masked, and the impact of a given factor on the well-being of the poorest households either under- or over-estimated, with important implications for policy. In this case, an effort to increase enrollment of girls in school may not have the expected impact on stunting on children at greatest developmental risk.

Maternal well-being factors can also work through unexpected pathways. For example, Parashar (2005) argues that community-level variables pertaining to maternal knowledge have an effect on household-level child welfare outcomes. Using data from the early 1990s, she finds specifically that the female literacy rate at the district-level has a significant effect on the probability that a child living with that district will be immunized, controlling for the level of education of the child's own mother. This suggests that changes at the district level exert positive externalities on even uneducated households, through knowledge dispersion and sharing.

Evidence related to higher-level gender equality issues – for example, female representation among political officeholders, which the literature review in Chapter 2 suggested may lead to better maternal and child health policy – is sparse in India. One key study is that of Chattopadhyay and Duflo (2001), who examine the impact of gender-based quotas for local political office – specifically, the leader (*Pradhan*) of the Gram Panchayat, the body responsible for overseeing rural blocks of 10,000 people. The results are somewhat unexpected. Utilizing a natural experiment that began in West Bengal in the late 1990s, they find that women elected officials tend to prioritize investments in drinking water, fuel generation, and road construction more than their male counterparts. In contrast, education investments appear less important to women politicians. Chattopadhyay and Duflo (2010) suggest that this may be because the mean educational attainment of elected women is lower than that of elected men, and this lack of personal experience with school leads them to de-prioritize the issue. Gram Panchayats with women leaders also seem to have better monitoring of health services (although, again, poorer monitoring of educational services). In addition, female leadership reduces diversion of resources to the home village of the Pradhan. These results remain even when controlling for political experience, re-election potential, and the effects of other caste-based quotas. Taken as a whole, the study suggests that women's participation in elected office does influence policy choice, but the implication for child nutrition is ambiguous.

The above paragraphs argue that the exact pathways between gender equality and child welfare are still not well understood. However, the importance of the link itself is clear. The most straightforward argument for the importance of women's welfare is drawn from a simple glance at the variation in women's nutritional status by state. In the states of Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, and Orissa more than four out of every ten women have a below-normal body mass index (i.e., are too thin for their height). In contrast, less than 20% of women are too thin in Kerala, Punjab, Delhi, and all of the northeastern states excepting Assam and Tripura (NFHS-3). Undernutrition among women, particularly during pregnancy and lactation, will have a direct and considerable impact on child nutritional status.

Social inequality matters as well. The NFHS results show that caste is a powerful determinant of nutritional status, and other studies provide evidence for the tenacity of inequality-justifying cultural institutions in India. A creatively designed recent game theory experiment in rural Uttar Pradesh is a good example. Fehr and others (2008) explored whether caste affiliation affects "spite" – that is, the willingness of a player to punish others even at cost to oneself – and find that spiteful preferences are "surprisingly widespread", particularly among higher castes. The researchers surmise that the strong influence of institutions – in this case, caste norms promoting the correctness of social inequality – are responsible for the results: high-caste players seek greater inequality, even when this inequality imposes moderate costs to their own payoffs. Higher-caste players are also significantly worse at reaching Pareto equilibria in cooperative games like Stag Hunt, presumably because coordination on the optimal outcome requires an acceptance of equality. The overall implication is that achieving win-win economic and political outcomes in India such as improved nutrition may be strongly constrained by deeply rooted norms of social discrimination.

E. Food, Nutrition, and Health Policy

The most important vehicles for addressing chronic child undernutrition in India are the three large-scale social programs: the Integrated Child Development Services Scheme (ICDS), the Public Distribution System (PDS), and the more recently instituted National Rural Employment Guarantee Scheme (NREGS). Outside of these three massive interventions, few public sector programs in the country have the coverage or budget to significantly impact stunting.[38] The following pages discuss ICDS and PDS, the two programs that most directly address maternal and child health, hunger, and undernutrition.

Since Independence, the Indian government has devoted an enormous amount of resources to the ICDS and (especially) the PDS. Despite this investment, the general consensus is that the programs have been poorly implemented, and the measured impact on child nutrition is negligible (Harriss 2011). The following pages describe ICDS and PDS and review their performance.

1. Integrated Child Development Services

The Integrated Child Development Services (ICDS) scheme is India's largest maternal and child nutrition program, reaching over 70 million children and 15 million pregnant and lactating mothers (GoI 2009). Through a network of over

[38] The Mid-day Meals Scheme (MMS) is another universal program whose objectives include improvement of child nutritional status. MMS provides free lunch to all schoolchildren, and is in fact the largest such program in the world, covering around 120 million children. However, MMS is targeted at school-age children; because the focus of this research is the under age-5 group, the program is not dealt with here.

one million local childcare facilities called Anganwadi Centers (AWCs), the program administers a wide array of interventions, including antenatal and postnatal care, growth monitoring, immunization, micronutrient supplementation, health and nutrition education, supplementary feeding, and preschool education. The AWCs serve as a single delivery point for all of these services.

Despite this impressive design, however, the impact of ICDS on undernutrition has generally been disappointing. Gragnolati and others (2006) review a series of evaluations of the program, many of which are unfortunately plagued with methodological shortcomings, especially the lack of control groups. A national-level study from 2000 that did include results from a control group found lower underweight rates in the ICDS population, but the results were not statistically significant (IIPS and ORC Macro 2000). Another analysis of NFHS-1 data found that boys in ICDS did have a 5% less likelihood of being underweight than non-ICDS boys, but these results did not hold for girls (Deolalikar 2004). Using propensity score matching, Das Gupta and others (2005) find no difference in nutritional outcomes between ICDS and non-ICDS children in the NFHS-1 and NFHS-2 data. Bredenkamp and Akin (2004) do find improved nutritional outcomes among ICDS children in Kerala, but no similar impact in Uttar Pradesh and Rajasthan, suggesting that differences in local implementation are important determinants of program impact.

Unpublished dissertation research by Jain (2011) looks at the more recent NFHS-3 data. First, she finds that, despite ICDS' near-universal presence in rural areas, only around one-third of rural children actually access ICDS services. Further, in the critical under-two age group, only about 6% of children receive supplementary nutrition from the program. However, she does find evidence of nutritional impact among this small group of children: they are around 1cm (0.4 z-score) taller than those who do not receive daily supplementary feeding, controlling for observables and using various techniques to deal with unobservables (propensity score matching, covariate matching, and difference-in-differences). The results are robust across specifications for girl children, but less so for boys. The overall message of Jain's work is that ICDS does have an impact where it is functioning well – but it is functioning well in few places.

That conclusion also sheds light on the generally unimpressive impacts reported by the other studies reviewed above. Other recent analyses highlight in more detail the weaknesses of the program that lead to such variable performance. Adhikari and Bredenkamp (2009) argue that one of ICDS' primary problems is the failure to design and implement an adequate monitoring and evaluation system. Although information from AWCs is regularly collected and transmitted to the state-level Department of Women and Child Development (DWCD), the data generally focuses on inputs (e.g., quantity of supplementary food, number of operational AWCs) and outputs (e.g., number of children enrolled, number of trainings conducted) rather than the outcomes that lie at the heart of ICDS' purpose: change in feeding and hygiene practices, child morbidity, maternal nutritional status, and so on. Child weight-for-age data is indeed gathered, but its quality is suspect (Ramachandran, interview). The anganwadi workers (AWWs) who administer the AWC services are also responsible for obtaining data, and are often overburdened, not formally trained in data collection, and not subject to external data checks. Furthermore, there are no mechanisms by which data is fed back into the program to improve effectiveness. While a few evaluations on ICDS have been conducted (i.e., those reviewed in the preceding paragraph), these have been limited in scope and often methodologically suspect. In the absence of rigorous research designs, interpretation of ICDS' impact on undernutrition is complicated.

What is known, however, is that ICDS falls well short of meeting its stated objectives even in terms of outputs. According to a nationwide evaluation, only around 45% of children registered to receive supplementary nutrition actually do (GoI 2007); the Jain study mentioned earlier finds coverage of children under two years old even worse. NFHS-3 results indicate that only about one-quarter of children under the age of three in the country receive *any* services from ICDS in the twelve months preceding the survey (Arnold and others 2009). Only 22 percent of pregnant women and 17 percent of lactating women access ICDS, and an even smaller proportion attend health and nutrition trainings (Biswas and Verma 2009).

ICDS also suffers from serious human resource management issues. The burden of nearly all activities at an AWC is placed on one anganwadi worker and sometimes an assistant. In addition to the regular responsibilities of growth monitoring, immunization, supplementary feeding, and health trainings, AWWs are often asked to assist with other activities, ranging from censuses to literacy programs to electoral tasks (Devereux and others 2008). As Biswas and Verma

(2009) note, vacancies in the administrative structure within ICDS are common, especially in remote areas where the risk of undernutrition is highest. As a result, AWWs have little backstopping or troubleshooting support.

The problem is partially one of scale. ICDS is an extremely large program, seeking to serve nearly 100 million people. Notwithstanding the labor shortages noted above, the scheme employs some two million frontline workers and spends between a third to a half of its budget on human resources. To increase its workforce even more will require restructuring of the management hierarchy, as the program already struggles to adequately supervise AWWs. A recent increase in budgetary allocation (discussed further below) will help to address some of these issues, but a radical revamping of the program in order to better manage this tremendous complexity – a revamping whose design is based on more rigorous monitoring and evaluation – is clearly required.

To summarize, the available data suggests that ICDS has not had a strong impact on improving child nutrition since its inception in the late 1970s. However, the reasons for this are less due to design flaws than to implementation problems. At all stages of the program cycle, the program has faced serious obstacles in carrying out its blueprint. The political economy factors driving these issues are discussed at length in Chapter 12.

2. The Public Distribution System

India's Public Distribution System (PDS) is the largest food aid network in the world. The PDS purchases staple crops from farmers across the country at “minimum support prices” and then sells them back to poor families at a heavily subsidized rate. The PDS began in the years just before independence, in the aftermath of the horrific Bengal famine of 1943, which claimed at least two million lives (Devereux 2000).

As Sen (1981) showed in his famous monograph *Poverty and Famines*, the extraordinarily high mortality of the Bengal famine was not due to a food production shortfall. The primary driving force was rather inflation: food prices skyrocketed due to wartime shortages and speculative hoarding of grains. To prevent similar catastrophes from occurring, the newly independent Government of India under Prime Minister Jawaharlal Nehru created a network of privately run, publicly supplied “fair price shops” across the country to serve as outlets for sales of subsidized staple foods. The PDS steadily expanded in the subsequent decades. The Indian government currently spends over $12 billion – close to 1% of total GDP – on the program, making PDS the single largest social protection initiative in the country. Close to 500,000 fair price shops presently exist in India.

The mounting cost of the PDS, as well as very high levels of diversion of food to corrupt bureaucrats, non-poor families, and middlemen involved in procurement, transport, storage, and sales, eventually led to calls for reform in the mid-1990s. In 1997, the PDS shifted from a universal to a targeted approach, wherein only families identified as having incomes below the poverty line (BPL) were offered the heavily subsidized price. Above the poverty line (APL) families were sold the grain at cost.

The policy change proved to be controversial. Critics questioned its effectiveness on grounds of both budgetary and programmatic efficiency. Targeting several hundred million families proved overwhelmingly complicated, and was made even more difficult by the fact that the official Indian poverty line is a subject of considerable debate, as discussed earlier. Many analysts accused the government of setting the poverty line too low, leading to exclusion of many poor families from the PDS (Patnaik 2010). A government-commissioned evaluation of the targeted PDS in 2001 noted that less than three-fifths of poor households were actually reached by the program, and only 43% of PDS food actually reached the poor, the rest lost to corruption and incorrect inclusion of non-poor families (GoI 2005). The costs for the targeted PDS proved to be even higher than for the earlier program, largely because the failures of targeting meant that huge grain surpluses accumulated in the government warehouses, increasing storage costs. As Chapter 12 details, in the early 2000s civil society activists seized on the incongruity between the existence of these surpluses and widespread hunger in the country, and set into motion a wave of public action that continues to this day.

Reform of the public distribution system is currently the subject of heated debate in India. As of this writing, the Congress-led United Progressive Alliance has introduced the "National Food Security Bill" (NFSB) onto the floor of Parliament. The NFSB would enact sweeping changes over the PDS (as well as ICDS), including increasing coverage, converting PDS benefits into legal entitlements, and setting up an ombudsman structure to respond to complaints of corruption. These reforms, nearly a decade in the making, were the result of concerted civil society action, as well as leadership from the highest levels of the Congress party. Again, the political narrative behind the drafting of the NFSB is detailed in Chapter 12.

* * *

Economic growth has in fact allowed India to considerably increase its budgetary allocations to social protection programs. However, the past few sections have argued that although India possesses an impressive policy blueprint for combating undernutrition, strong political economy forces prevent the effective translation of this blueprint into reality on the ground. In Chapter 12, I examine these forces in detail, and look at how efforts over the past decade have indeed succeeded in reforming these programs. First, however, I utilize the policy and political economy models of Part II to look at the determinants of stunting variation across states in India.

Chapter 11. Explaining Nutritional Variation Across Indian States

Chapter 10 observed that a great deal of internal variation in stunting rates exists across states in India, with the highest prevalences in the northern "Hindi belt" and Kerala and Tamil Nadu, in particular, being India's most impressive nutritional success stories. In this chapter, I look at the policy and political economy factors driving this variation by conducting an econometric analysis of the determinants of stunting across Indian states, drawing from the methodology presented in Part II's cross-country investigation.

A. The Policy and Political Economy Models

Before proceeding, a few caveats should be borne in mind. First, data is scarce. The only reliable state-level data points are from the three National Family and Health Survey (NFHS) rounds, conducted in 1992-93, 1998-99, and 2005-06; in addition, because anthropometric data from children ages 4-5 was not collected in 1992-93, the stunting measures used for all three rounds come from the age 0-3 group (unlike the age 0-5 group as in Part II's cross-country analysis). Second, a lagged variable approach to specification such as that used in Part II is not possible given the lack of annual data; in fact, the NFHS rounds are the best source for some of the independent variables. In the following specifications, variable values contemporaneous with the stunting observation are used. Although the threat of reverse causality should be explicitly kept in kind when interpreting the coefficient estimates, a glance at within-state stunting rates over the three rounds of NFHS does suggest that adequate variation exists in the dependent variable (see table below).

Table 24. Summary statistics for dependent variable, India models.

Variable		Mean	Std. Dev.	Min	Max	Observations
st2sd	overall	43.27143	9.192214	21.5	60.7	N = 77
	between		7.868247	25.33333	56.65	n = 30
	within		4.948671	33.13809	56.8381	T-bar = 2.56667

Finally, some of the variables used in Part II's policy and political economy models are not relevant across states in India. This issue is discussed at greater length below for each of the models.

In the first policy model, child stunting is theorized to be determined across Indian states as follows:

$$\eta_1 = \alpha_{21} + \gamma_{21,1}\xi_1 + \gamma_{21,2}\xi_2 + \gamma_{21,5}\xi_5 + \gamma_{21,6}\xi_6 + \gamma_{21,7}\xi_7 + \gamma_{21,11}\xi_{11} + \gamma_{21,12}\xi_{12} + \gamma_{21,13}\xi_{13} + \zeta_{19} \quad (21)$$

In other words, in this policy model, child stunting (η_1) in the age 0-3 group is a function of:

- **Government policies** pertaining to maternal/child health (ξ_2), environmental threats (ξ_6), and education (ξ_{12});
- **The environmental context** with respect to disease vectors (ξ_7) and the household production system (ξ_{11});
- **Household dependency ratio** (ξ_1);

- **Cultural gender norms** (ξ_5); and

- A country's **macroeconomic circumstances** (ξ_{13}).

It should be noted that the price variables that were included in Part II's model are absent from this India model, including domestic consumer food prices (ξ_3), producer agricultural prices (ξ_8), global market prices of food grains (ξ_4), global market prices of agricultural outputs (ξ_9), and global market prices of agricultural inputs (ξ_{10}). This is because there is little internal variation within India with regard to consumer prices of basic grains and producer prices for inputs and outputs, largely due to government intervention via the Public Distribution System, the Minimum Support Price levels set for grain procurement, and fertilizer subsidies.

In the second political economy model, child stunting is theorized to be determined across Indian states as follows:

$$\eta_1 = \alpha_{22} + \gamma_{22,1}\xi_1 + \gamma_{22,5}\xi_5 + \gamma_{22,7}\xi_7 + \gamma_{22,11}\xi_{11} + \gamma_{22,13}\xi_{13} + \gamma_{22,14}\xi_{14} + \gamma_{22,15}\xi_{15} + \gamma_{22,16}\xi_{16} + \zeta_{19} \qquad (22)$$

Where child stunting (η_1) is again a function of the environmental context with respect to disease vectors (ξ_7) and the household production system (ξ_{11}), the household dependency ratio (ξ_1); cultural gender norms (ξ_5); a country's macroeconomic circumstances (ξ_{13}); and, as in Part II, the variable ξ_{14} represents political ideology, ξ_{15} represents political interests, and ξ_{16} represents macro-political circumstances (i.e., stability).

B. Measurement

The table below summarizes the measurement variables used in the models above.

Table 25. Model and measurement variables, cross-state India analysis. Policy and political economy variables of interest are given in bold.

Variables from Model		Associated Measurement Variables		Label
η_1	Child long-term nutritional status	Y_1	Total stunting prevalence, children under age 3	st2sd
ξ_1	Household dependency ratio	X_1	Total fertility rate, women 15-49	fertility
ξ_2	Maternal/child health policies	$\mathbf{X_2}$	**Measles-containing vaccine (MCV) coverage**	**mvacc**
ξ_5	Cultural gender norms	X_5	Sex ratio (males/1000 females)	sexrt
ξ_6	Environmental threat policies	$\mathbf{X_6}$	**Population with access to safe water (%)**	**water**
ξ_7	Environmental context: diseases and vectors	X_7	Malaria risk category	malcat
ξ_{11}	Environmental context: household production system	X_{11}	Average annual rainfall (mm)	precip
ξ_{12}	Educational policies	$\mathbf{X_{12}}$	**Educational attainment of population (median years)**	**educ**
ξ_{13}	Macroeconomic circumstances	X_{13}	Log GDP per capita	loginc
ξ_{14}	Ideology/beliefs of policymakers	$\mathbf{X_{14}}$	**Executive/party stated ideological orientation, average of last 21 years**	**exid21**
ξ_{15}	Distribution of power as determined by political institutions	$\mathbf{X_{15}}$	**Years Congress has held power at state level over the last 21 years**	**cong21**
		$\mathbf{X_{16}}$	**Voter turnout (%) in federal elections over the last 21 years**	**voter21**
ξ_{16}	Macro-political circumstances	X_{17}	Religious fractionalization	relfrac

There are some differences between the measurement variables above and those used in Part II.

First, household dependency ratio is proxied by *total fertility rate per woman*, for which high-quality data is more readily available on the state level at the time of the NFHS surveys than for dependency ratio itself. The total fertility rate essentially calculates the number of children each woman surveyed would bear over a reproductive lifetime given the age-specific fertility rates calculated at the time of the questionnaire (IIPS and Macro International 2007). Women between the ages of 15 and 49 were the target group in each NFHS round.

The environmental context with respect to diseases and vectors is calculated by assigning each state to a *malaria risk category* between 1 and 5. The categorization is based on the incidence of reported malaria within all districts in the state.[39] The data, from 2004, comes from the National Vector Borne Disease Control Programme (NVCDCP 2012).

Because comprehensive information on land quality is not available across states, average annual rainfall across a state is used instead (calculated using an average of rainfall across various eco-zones in each state, weighted by the land area of

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[39] The categorization was based on the following approach. Each district with less than 2% incidence of malaria was given a score of "0"; each district with at least 2% but less than 5% incidence was weighted "1"; and each district with at least 5% incidence was weighted "2". These district scores were then summed and divided by the total possible score for each state (i.e., number of districts*2), giving a possible state overall score between 0 and 1. States with a zero overall score were placed in category 0; those with a score >0 and <.1 in category 1; those with ≥.1 and <2 in category 2; those with ≥2 and <3 in category 3; those with ≥3 and <4 in category 4; and those with ≥4 in category 5.

each eco-zone). The data source is the India Meteorological Department (IMD 2012).

The ideological orientation scale *exid21* is slightly modified to include a "-2" score for far left political parties, in India's case the Communist parties. Other scores are "-1" for center-left (which is assigned to the Congress party), "0" for centrist or lacking ideological positioning (in which most of the regional parties fall), and "1" for center-right/right. Note that the retrospective time frame is 21 years preceding the stunting observation, not 20, as adding the extra year allows the inclusion of another election in the case of all stunting observations; that is, it allows the 1971, 1977, and 1984 elections to be included. This 21-year retrospective also holds for the *cong21* and *voter21* variables below. Note also that, because India is a parliamentary democracy, the chief executive of the state is the leader of the party that gains the most seats in the legislature; thus the executive ideology variable should be interpreted to indicate "legislative ideology" as well.

Instead of an electoral competitiveness index along the lines of Part II, which would produce little variation within India, the *cong21* variable represents the number of years in the last 21 preceding the stunting observation that the Congress Party has controlled the state executive (i.e., the Chief Minister post). The importance of this last variable is supported by the analysis of Harriss and Kohli (2009), who note that variations in child undernutrition across Indian states correlate well to the degree of Congress power. Specifically, they divide states into three categories: 1) those that continue to be dominated by Congress

(Madhya Pradesh and Orissa); 2) states where Congress has been effectively challenged by a opposing political party (Andhra Pradesh, Gujarat, Karnataka, and Maharashtra); and 3) states where parties other than Congress are dominant (Kerala, Tamil Nadu, and West Bengal). Their thesis is that the challenge to Congress often results in greater representation among the lower classes and castes within which undernutrition is concentrated, with the consequence that pro-poor policies are more readily adopted. As noted, I replace their tripartite division with a simple measure of years of power in which a Congress leader has assumed the Chief Minister post in the 21 years before each stunting observation. All political data comes from the Election Commission of India (ECI 2012).

Instead of a democratization scale such as that in Part II, which again would produce little variation in India given shared political institutions across states, I use the *voter21* variable to look at the percentage of eligible electors casting votes for national-level representatives over the 21 years preceding the stunting observation. For the 1992 and 1998 observations, data from six previous elections each are used, and for the 2005 observation seven previous elections. National elections were held in 1971, 1977, 1980, 1984, 1989, 1991, 1996, 1998, 1999, and 2004.

To represent macro-political stability, I use in place of an ethnic variable the religious fractionalization variable *relfrac*, which is more relevant in the Indian context than ethnic differences. The variable is constructed by summing the squared proportion of Hindu, Muslim, Christian, Sikh, Jain, Buddhist, and "Other" groups in each year of stunting observation, and then subtracting the sum from one. The resulting figure can be interpreted as the probability that two randomly chosen people from the state would be of differing religions. Data comes from the NFHS datasets. Note that the conflict variable used in Part II is omitted from the model, as India has generally not experienced high-intensity conflict over the relevant time period (with the exception of the border areas of Kashmir and in certain Northeastern states; however, because conflict in these regions has been sporadic and not protracted, the variable is not included).

C. Estimation

The data above is used to estimate both pooled OLS and random effects specifications of the policy and political models above. However, it should be noted that the sample size is quite small, especially for the random effects models: 68 country-observations are used in the OLS specifications and 20 in the random effects specifications. Given the small sample size, and also because variation across states rather than variation across time is of primary interest, the pooled OLS specifications are preferred. Descriptive statistics are presented first, followed by correlations and bivariate graphs between stunting and each of the explanatories, and finally multivariate results.

1. Descriptive Statistics

Basic descriptive statistics for *st2sd* and each of the 12 independent variables are given below. As in Part II, the statistics are not population-weighted; each state is treated as an equivalent unit.

Table 26. Basic descriptive statistics, India models, unweighted by state population.

Variable	Obs	Mean	Std. Dev.	Min	Max
st2sd	77	43.27143	9.192214	21.5	60.7
fertility	82	2.758049	.6580488	1.77	4.57
mvacc	88	54.175	22.13119	10	92.5
sexrt	86	1073.101	53.02124	935.4537	1215.362
water	88	72.91932	17.48505	19.9	99.5
malcat	87	1.344828	1.568791	0	4
precip	87	1574.172	771.4724	494	3055
educ	84	4.033993	1.798588	1.352755	8.35378
loginc	82	9.250709	.4500441	8.111629	10.44013
exid21	87	-.6157636	.5025271	-2	.5238096
cong21	87	11.82759	5.572371	0	21
voter21	87	.5886111	.1108852	.2776573	.9196611
relfrac	84	.3190924	.1708403	.056841	.731222

Highlights from the table are summarized in the bullet points below.

- The mean stunting prevalence across all states and time periods (again, the NFHS rounds were conducted in 1992, 1998, and 2005) is 43.2, with the maximum of 60.7 reached by Uttar Pradesh in 1998. Kerala's low of 21.5 also came in 1998.

- Mean number of children per woman was well under three, although at least four state-years (Arunachal Pradesh in 1992, Meghalaya and Uttar Pradesh in 1998, and Bihar in 2005) exceeded four.

- The standard deviation on measles vaccination rate is very high, at over 40% of the mean value of 54.1% of the child population. Vaccination takes a strongly north/east versus south/west pattern, with Bihar, Uttar Pradesh, Rajasthan, and the Northeastern states having low coverage and Kerala, Tamil Nadu, and Maharashtra having exceptionally high coverage.

Himachal Pradesh and Sikkim in the north are outliers, with nearly 90% of children vaccinated in 2005.

- The male/female sex ratio is extremely high in all of India, with only one state – again, Kerala – with less than 1000 males per 1000 females in 2005, although a few others (Tamil Nadu, Chhattisgarh, and Andhra Pradesh) come close to parity. 21 of the 86 state-year observations (24%) are above 1100 males per 1000 females, an extremely high ratio. These states are all located in the north, led by Haryana, Punjab, and Uttar Pradesh (as well as Delhi, although the capital's ratio is strongly influenced by in-migration).

- For the mean state-year, nearly three-fourths of households had access to safe water, with many states achieving near universal coverage by 2005.

- Malaria risk is concentrated in a few states, notably Orissa, Chhattisgarh, Jharkhand, and the small Northeastern states. Rainfall varies widely across the country, with a general pattern of dry northern and western states and wet southern and eastern states.

- The median years of schooling is about four across state-years, although the standard deviation is high. Even in 2005, seven states had less than 2.5 median years of schooling, among them India's largest states: Uttar Pradesh, Madhya Pradesh, Rajasthan, Jharkhand, and Chhattisgarh (small Arunachal Pradesh completes the list). Income averaged about 11571 rupees per capita in constant terms (not shown in unlogged form).

- Over the last 21 years, the mean executive ideology was considerably to the left (-0.62), largely because of the dominance of Congress (considered center-left) in many states, as shown by an average value of 11.8 years of Congress rule over that time period. Voter turnout averaged close to 60%, with near-universal voting in the states where the Communist party is strong – West Bengal, Tripura, and Kerala – and extremely low in others, particularly Bihar.

The full dataset is reprinted in Appendix D.

2. Bivariate Analysis

Correlation Matrix and Collinearity Diagnostics

A correlation matrix between all variables is printed in the table below.

Table 27. Correlation matrix, all India state variables.

	st2sd	fertility	mvacc	sexrt	water	malcat	precip	educ	loginc	exid21	cong21	voter21
fertility	0.5227*	1										
mvacc	-0.4746*	-0.7253*	1									
sexrt	0.2553*	0.3078*	-0.1368	1								
water	0.1270	-0.1905	0.3600*	0.4543*	1							
malcat	0.2142	0.0392	-0.2887*	-0.2445*	-0.2228*	1						
precip	-0.3766*	-0.0625	-0.1246	-0.3083*	-0.4825*	0.3651*	1					
educ	-0.6145*	-0.5770*	0.6669*	-0.0532	0.0317	-0.3286*	0.1640	1				
loginc	-0.4326*	-0.4994*	0.7212*	0.1634	0.4215*	-0.1118	-0.0281	0.6917*	1			
exid21	0.1641	0.0976	0.1093	0.2300*	0.2546*	-0.1202	-0.4419*	0.0862	0.2345*	1		
cong21	0.0563	0.1342	-0.1654	-0.2559*	-0.2920*	0.3141*	0.0883	-0.0971	-0.0718	-0.1311	1	
voter21	-0.3544*	-0.2984*	0.1560	-0.2510*	-0.1735	0.0247	0.3018*	0.2641*	0.1971	-0.5464*	0.0547	1
relfrac	-0.3675*	-0.0329	-0.0300	0.0650	-0.1106	-0.0048	0.5699*	0.1535	0.1271	-0.3462*	0.0634	0.2463*

* Significant at the 95% level.

Most of the correlations between *st2sd* and independent variables are significant and in the expected direction. Exceptions are *water*, *exid21*, and *cong21*, none of which have significant correlations with the stunting variable, and *relfrac*, which is significant but in an unexpected direction: an increase in religious fractionalization is correlated with a fall in stunting. The next section looks at these bivariate relationships in detail.

Many of the independent variables are also quite well correlated with each other, raising the concern of multicollinearity. However, the results of collinearity diagnostics, given in the tables below, show that collinearity is not likely biasing parameter estimates; all variance inflation factors are below the threshold of 10.

Table 28. Collinearity diagnostics for India cross-state models.

Policy model

Variable	VIF	1/VIF
mvacc	4.54	0.220306
educ	4.11	0.243226
loginc	3.83	0.260888
water	3.34	0.298963
fertility	3.28	0.304969
sexrt	2.44	0.409760
malcat	2.06	0.485766
precip	1.88	0.532712
year	1.48	0.675927
Mean VIF	3.00	

Political model

Variable	VIF	1/VIF
precip	3.21	0.311523
relfrac	2.49	0.401965
exid21	2.35	0.425054
sexrt	2.24	0.446972
fertility	2.23	0.448554
loginc	2.12	0.470987
voter21	1.85	0.539275
malcat	1.64	0.610852
cong21	1.63	0.614185
year	1.53	0.652784
Mean VIF	2.13	

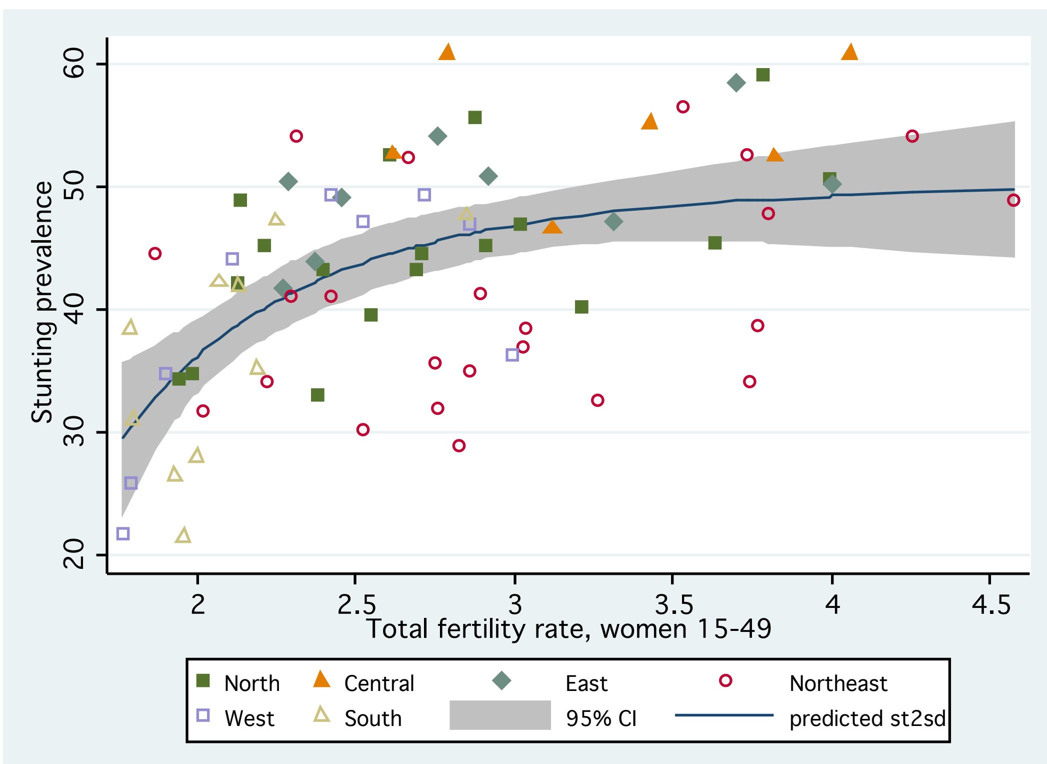
The following pages graph the bivariate relationships shown in the correlation matrix above, and examine for non-linear relationships. It should be reiterated that the bivariate relationships shown may be misleading, in that the variables of interest may be correlated with unobserved variables that are actually responsible for the correlation with stunting.

Bivariate Graphs

Fertility rate

Fertility rate is strongly and positively correlated with stunting. The relationship is somewhat curvilinear, but closely enough approximated by a linear variable to be used in such fashion in the following models (in order to preserve degrees of freedom given the small sample size). There is a moderate clustering by region, with southern states having the lowest fertility rates.

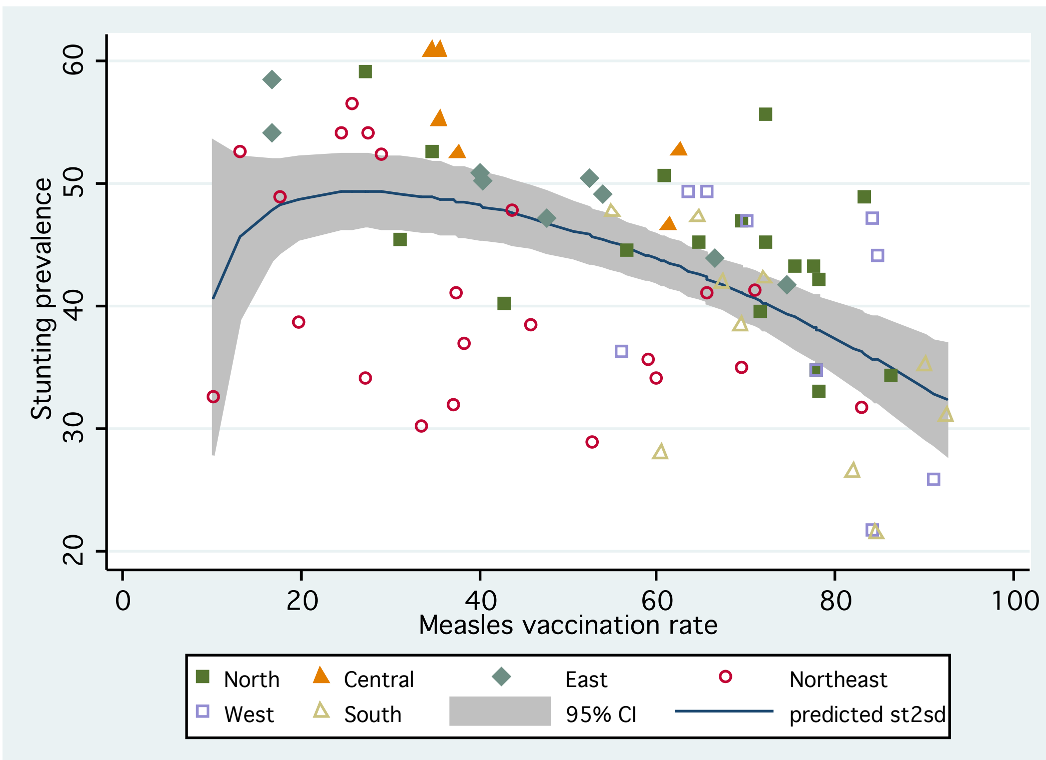
Figure 68. Total fertility rate vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Measles vaccination rate

Measles vaccination coverage has the expected negative and strong correlation with *st2sd*. The relationship is linear, especially when excluding the outlier on the extreme bottom-left (the state of Nagaland in 1992). There is again moderate regional clustering, with northern, southern, and western states at higher rates of vaccination coverage.

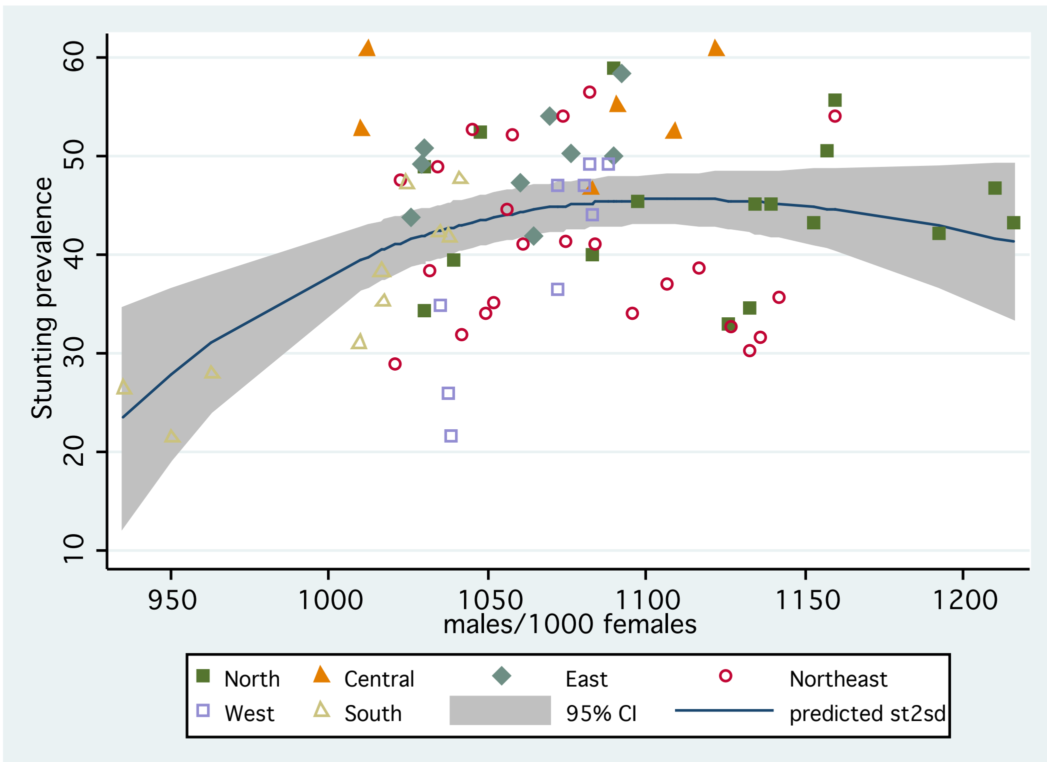
Figure 69. Measles vaccination rate vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Sex ratio

Sex ratio is moderately and positively associated with stunting. The relationship is roughly linear, with prominent regional clustering. The southern states at the bottom-left of the graph have the lowest sex ratios and the lowest stunting prevalence. Eastern, western, and northeastern states are roughly at the center of the graph, while northern states cluster at higher sex ratios.

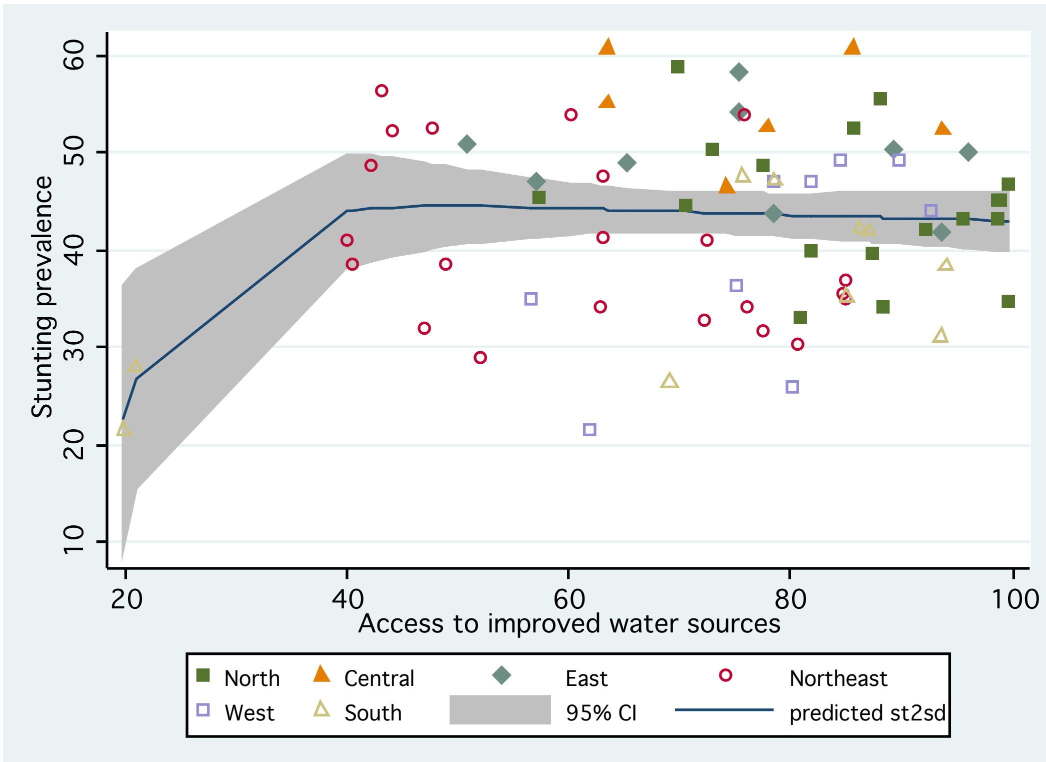
Figure 70. Sex ratio vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Access to safe water

As the graph below shows, there is little relationship between stunting and access to safe water across Indian states. The two outliers on the extreme left are, oddly, Kerala's observations from 1992 and 1998, when only around one-fifth of the households in the state had access to safe water. The state has rapidly improved its water infrastructure, however, and the 2005 coverage jumps to nearly 70%.

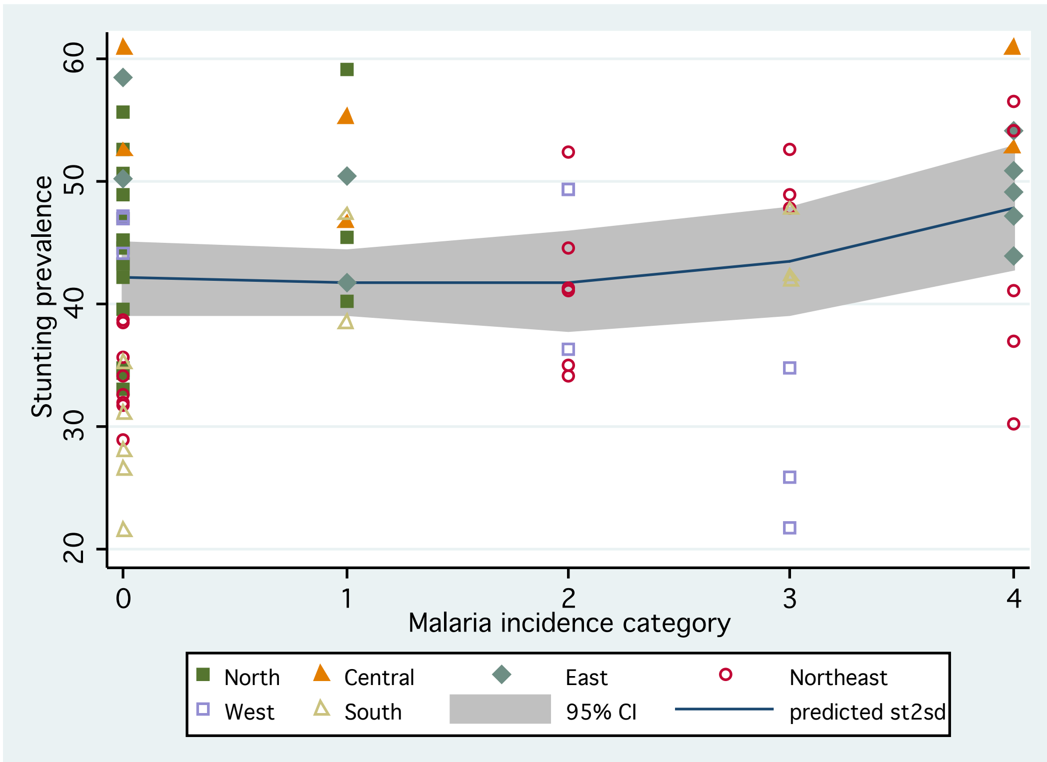
Figure 71. Access to improved water sources vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Malaria risk

At higher levels of malaria risk, the variable has the expected relationship with stunting prevalence, although the relationship is ambiguous at lower levels of risk. Unfortunately, the categorical nature of the variable prevents the construction of a meaningful quadratic term, and thus *malcat* is included only in linear form in the specifications below. As expected given the geographical nature of the variable, there is notable regional clustering.

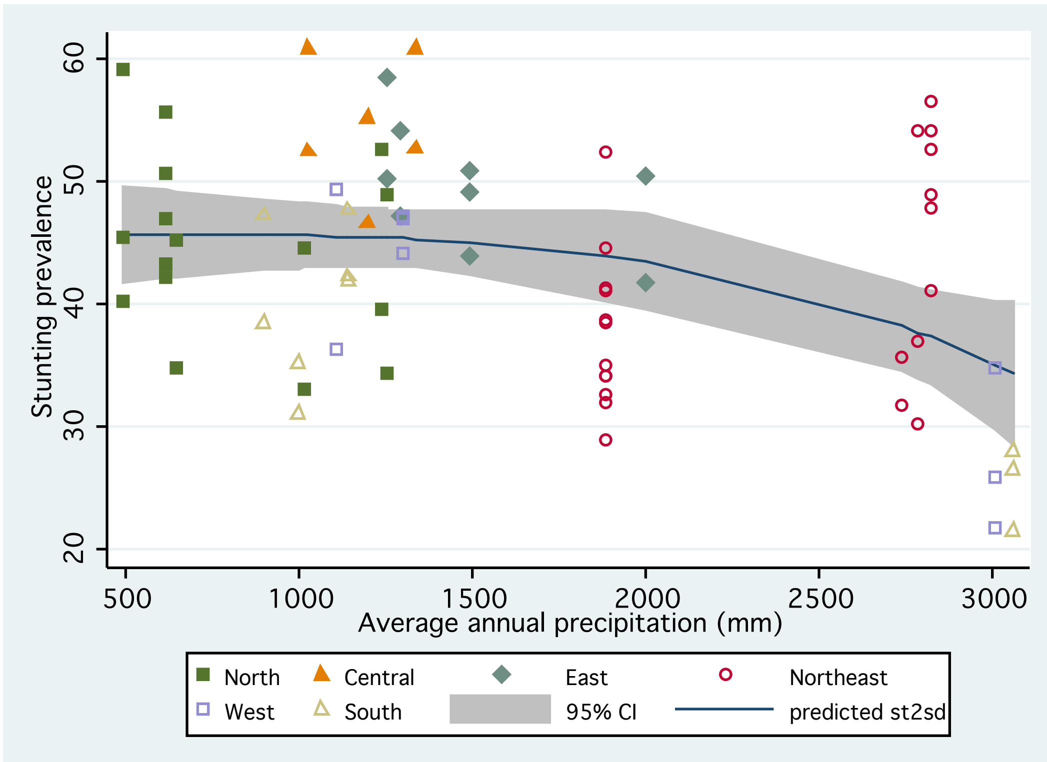
Figure 72. Malaria risk vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Precipitation

There is a strong negative correlation between stunting and average annual rainfall. The relationship is roughly linear, with the expected regional grouping. The six observations on the extreme bottom-left are data points from Goa and Kerala, the wettest states in India.

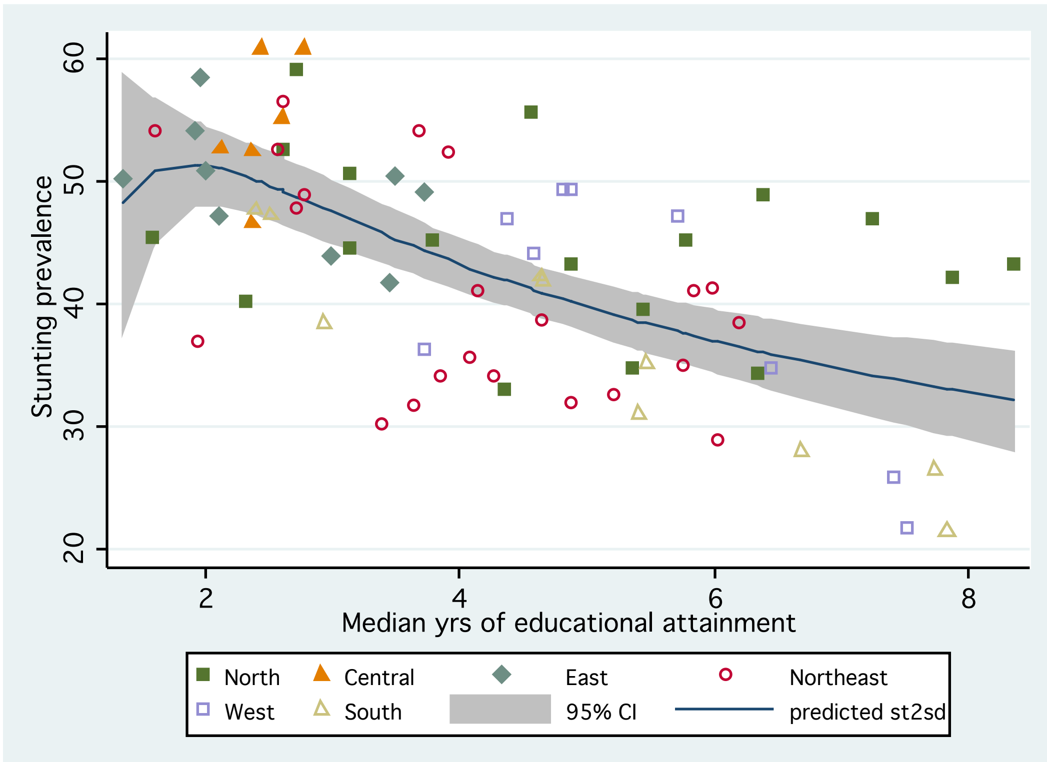
Figure 73. Precipitation vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Educational attainment

Educational attainment, as measured by median years of schooling, is strongly and negatively associated with stunting. The relationship is linear, and clustering is prominent within some regions (e.g., Central and East) but less so among others.

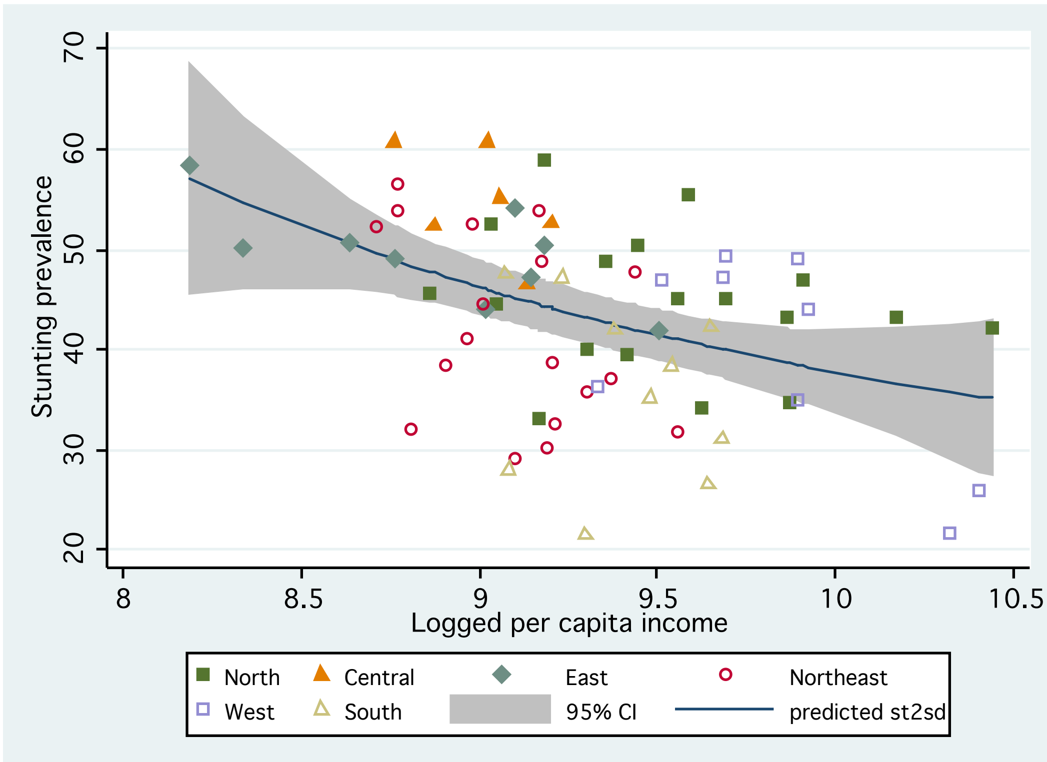
Figure 74. Educational attainment vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Per capita income

Log per capita income has the expected strong negative relationship with stunting. The association is clearly linear, and regional groups are evident.

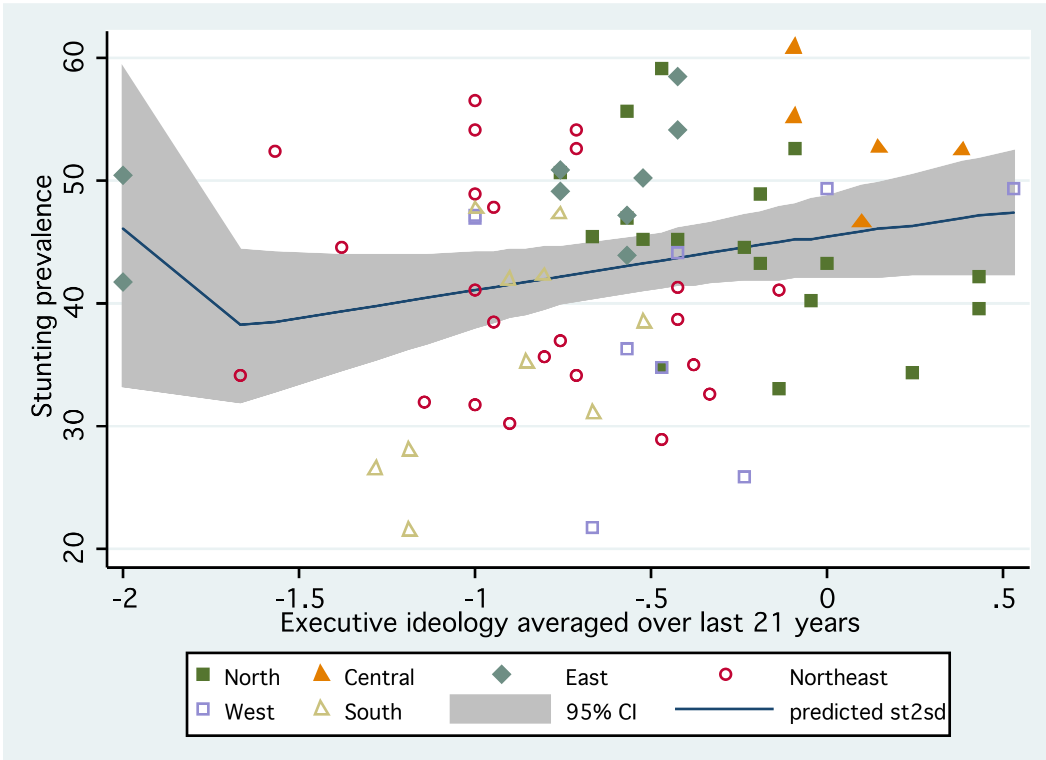
Figure 75. Log per capita income vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Executive ideology

The graph below indicates that executive/legislature ideology appears to have a positive relationship with stunting; that is, movement rightward is associated with greater stunting (the two outliers on the extreme left are West Bengal in 1992 and 1998; the state has had a Communist government since 1971). However, as shown in the correlation matrix at the beginning of this section, the bivariate association is not statistically significant at the 95% level. Interestingly, regional groupings are strongly prominent, with southern and northeastern (and to some extent western) states having more leftist governments, and the right stronger in central India.

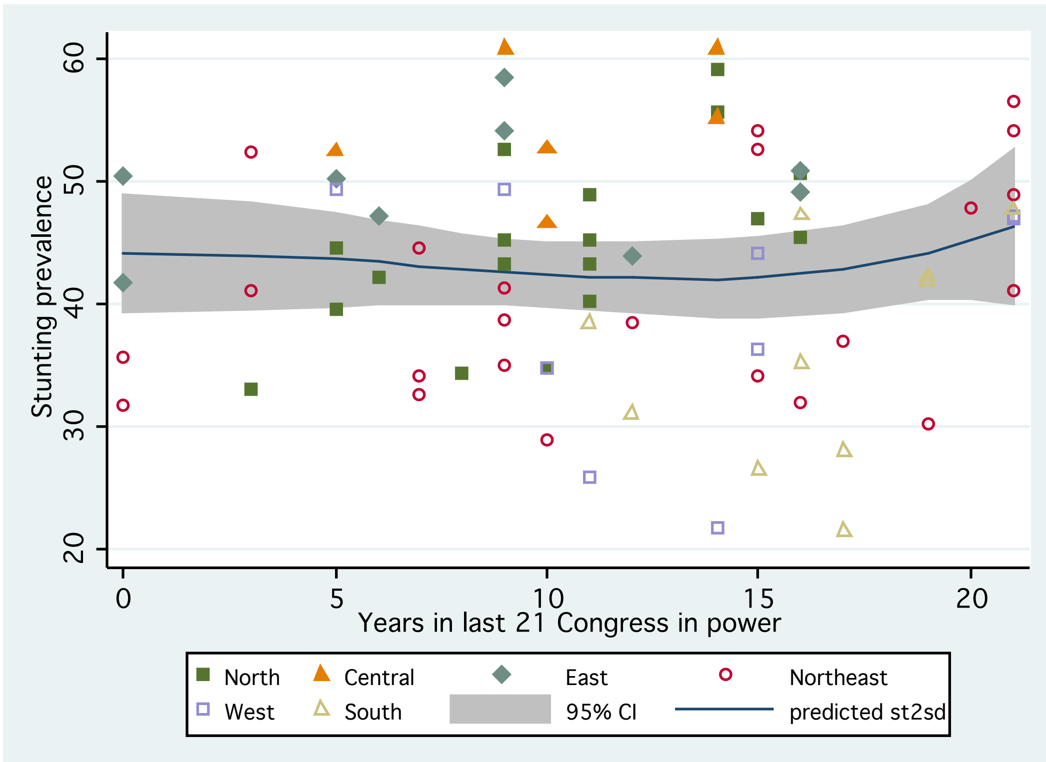
Figure 76. Executive ideology vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Congress power

The scatterplot and fit line below show that there is little bivariate association between electoral competitiveness, as measured by the number of years in the last 21 that Congress has been in power, and child stunting. Somewhat unexpectedly, the scatterplot shows little regional clustering; the electoral success of Congress appears to have varied across time within regions.

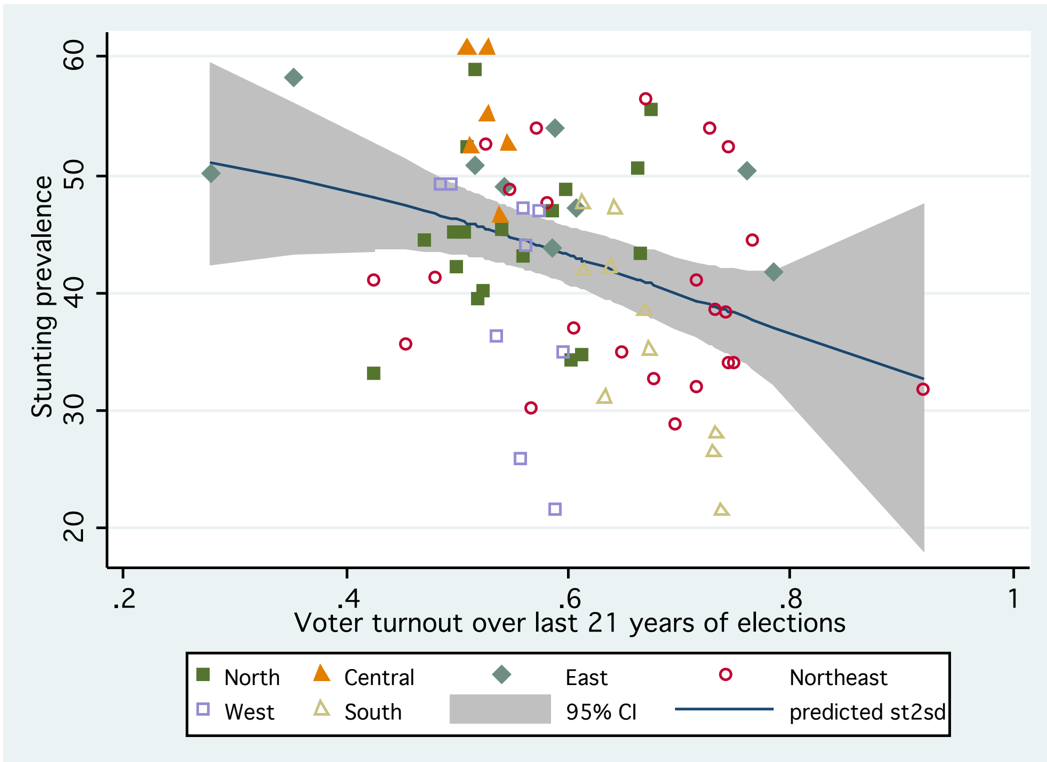
Figure 77. Congress power vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Voter turnout

In the graph below, voter turnout appears negatively correlated with stunting, but the bivariate correlation is statistically insignificant. In addition, the slope of the line is reduced considerably when the left (Bihar 1992 and 2005) and right (Sikkim 2005) outliers are excluded.

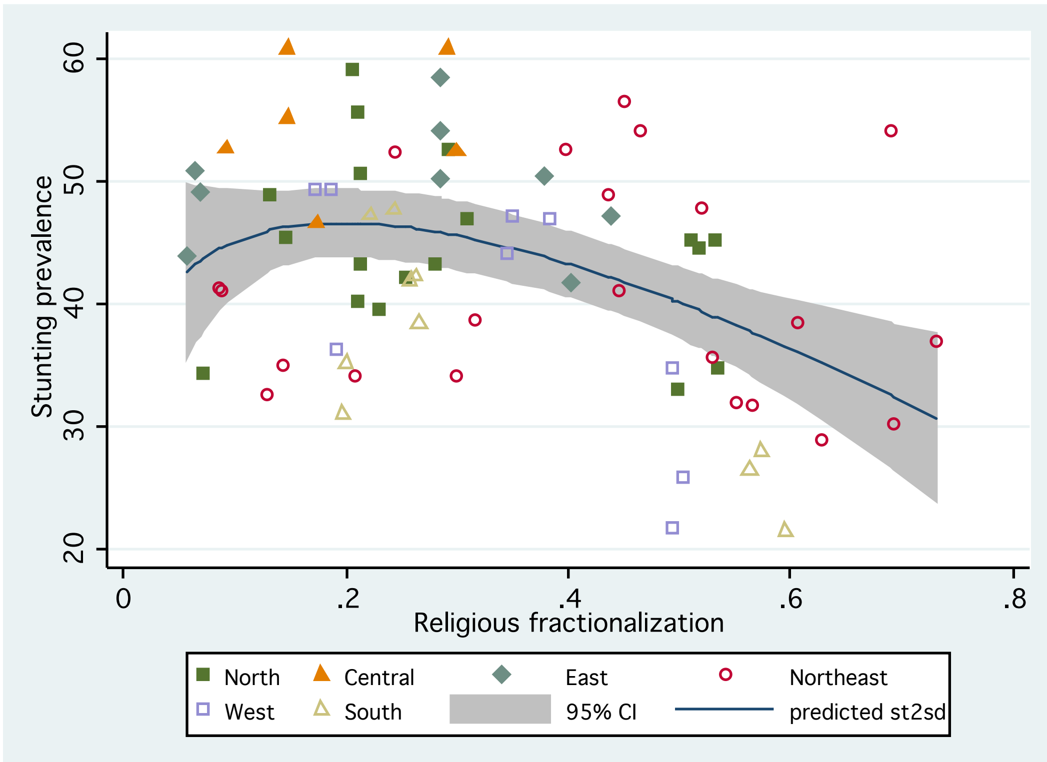
Figure 78. Voter turnout vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



Religious fractionalization

Religious fractionalization is strongly associated with stunting, although, as noted above, in an unexpected direction. States with a greater degree of fractionalization have a lower stunting prevalence. A moderate degree of regional clustering is apparent.

Figure 79. Religious fractionalization vs. stunting prevalence scatterplot with fractional polynomial trend line and 95% confidence intervals, across Indian states, grouped by region.



3. Multivariate Analysis

The following section estimates the coefficients for the independent variables described above in multivariate policy and political economy models; again, the two types of models are built on the same causal logic, but the political models replace the policy variables with their theorized underlying political economy determinants. As no variable above exhibited a strongly non-linear association with *st2sd*, the variables all appear in linear form. Four specifications are tested: 1) Policy Model, Pooled OLS; 2) Policy Model, Random Effects; 3) Political Economy Model, Pooled OLS; and 4) Political Economy Model, Random Effects. The choice of random effects over fixed effects is justified before each random effects section. All models use heteroscedasticity-robust standard errors. The results are given with either the policy or political economy explanatories of interest first in the list of independent variables. Note that a year variable is included in all regressions to control for unobserved time trend effects.

<u>Policy Model I, Pooled OLS</u>

The results for the pooled OLS policy model – with *mvacc, water,* and *educ* as the three key policy variables of interest – are discussed below.

The results are unexpected. None of the policy variables are significant – and neither is *loginc*, a surprise given its strong bivariate correlation with stunting (and strong multivariate association in Part II's cross-country models). Among the policy variables, the lack of association between *educ* and stunting is particularly unexpected; this result holds even when median female educational attainment (instead of median educational attainment averaged across men and women) or a measure of female literacy is inserted in place of *educ*. The strongest explanatory, by far, is fertility rate: one more child per woman is associated with a 4.3-percentage point higher stunting prevalence, controlling for the other variables. The geographical variables are also significant at the 95% level. A movement into one category higher malaria risk is associated with a nearly 1.7-percentage point increase in stunting, and a 100mm increase in average annual rainfall is correlated to a 0.4-percentage point fall in stunting. Despite the moderate associations of these latter two variables, the model as a whole has considerable explanatory power, with over 60% of the variation in *st2sd* across Indian states accounted for by this small set of variables.

Policy Model II, Random Effects

Next, the policy model is attempted with a random effects specification. The choice of random effects over fixed effects is justified following a Hausman test, the results of which are given in the table below. The null hypothesis that the difference in coefficients is not systematic fails to be rejected, and so a random effects model is chosen. This contains intuitive logic: random effects models are selected when some unobserved variables (relegated to the error term) are constant over time but vary across cases, and others vary over time but are constant across cases. The cross-state India exercise likely involves both types of omitted variables (e.g., deep-rooted cultural norms in the former category and incidence of drought or other natural disasters in the latter category).

Table 29. Results of Hausman test for fixed vs. random effects, Policy Model II, India.

	Coefficients (b) fixed	Coefficients (B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
mvacc	-.2487542	-.08718	-.1615742	.0778971
water	-.0000194	.0838716	-.083891	.0545727
educ	.6245482	-.3600372	.9845854	1.070968
fertility	5.622508	3.869994	1.752514	2.484769
sexrt	.1850784	.0001326	.1849458	.1101243
loginc	3.698056	-2.235776	5.933832	11.05082
year	.0398457	-.264528	.3043737	.4283346

```
                 b = consistent under Ho and Ha; obtained from xtreg
  B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        4.91
            Prob>chi2 =      0.6713
            (V_b-V_B is not positive definite)
```

Given that only 28 state units are included in the specification, the results of the random effects regression should be interpreted with care.

The exercise confirms the conclusions of the pooled OLS model. None of the policy variables are significant, and neither is logged per capita income. As with Policy Model I, the gender norms variable *sexrt* is not significant, another unexpected result given the bivariate correlation observed in the previous section. The magnitudes of association between the statistically significant variables *fertility, malcat,* and *precip* are similar to those of Policy Model I.

<u>Political Economy Model III, Pooled OLS</u>

I turn now to the political economy models. The results of the pooled OLS model are discussed first. Here, following the technique of Part II, the policy variables are removed and political economy variables corresponding to executive ideology, electoral competitiveness, and voter turnout are added, as is a religious fractionalization variable representing macro-political stability.

None of the political economy variables are significant. This is especially surprising with regards to the *voter21* variable, which exhibited a strong bivariate correlation with *st2sd*; this relationship appears not to hold controlling for the effects of other relevant variables. Again, fertility rate and the geographical variables are statistically significant, with the magnitudes of association similar to those found in the policy models. Log per capita income remains insignificant at the 90% level. Somewhat surprisingly, religious fractionalization maintains its counterintuitive negative association with stunting, although the magnitude of association is weak (but significant): a ten-percentage point increase in fractionalization (i.e., a ten-percentage point increase in the probability that two randomly selected individuals in a given state will be of differing religions) is associated with a 1.4 percentage point lower stunting prevalence. Again, despite the modest associations between three of the four significant variables and stunting, the strength of the model as a whole is strong, with nearly 62% of the variation in *st2sd* explained.

Political Economy Model IV, Random Effects

Finally, I examine the political economy model in a random effects specification. A Hausman test was again conducted, and the null hypothesis that the difference in coefficients between the fixed and random effects models is not systematic fails to be rejected, leading to the choice of the random effects model (Table 30below).

Table 30. Results of Hausman test for fixed vs. random effects, Political Economy Model II, India.

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
voter21	-1.040252	.4432794	-1.483531	3.88575
exid21	2.037875	.0382149	1.99966	7.717686
cong21	-.5515282	-.2179958	-.3335324	.62829
relfrac	62.28599	-8.850557	71.13654	25.89811
fertility	1.831561	4.846083	-3.014521	1.952868
sexrt	.1495972	.0175248	.1320723	.1237467
loginc	15.74938	-3.945124	19.6945	12.87861
year	-1.149724	-.2529646	-.8967599	.4330438

```
                 b = consistent under Ho and Ha; obtained from xtreg
   B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:  Ho:  difference in coefficients not systematic

              chi2(8) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =        6.14
            Prob>chi2 =      0.6321
            (V_b-V_B is not positive definite)
```

The results of the random effects model are discussed below.

There are two major differences from the pooled OLS model. First, *relfrac* becomes insignificant, raising the possibility that unobserved factors in the OLS model were biasing the coefficient of this variable. Second, the dummy variable for year becomes significant at the 10% level, raising the possibility that unobserved time-related factors are influencing stunting. However, the coefficient on year is small: the 6-year gap between NFHS-1 and NFHS-2 results in a 1.5-percentage point lower stunting prevalence, and the 7-year gap between NFHS-2 and NFHS-3 a 1.75-percentage point decline. Fertility rate and malaria risk are again significant in this specification, with the magnitude of association between this latter variable and *st2sd* slightly higher than in Political Economy Model III.

Discussion

The table below shows the results of all four regressions together.

Table 31. Regression results, all India models.

VARIABLES	(1) Policy OLS	(2) Policy RE	(3) Political OLS	(4) Political RE
voter21			-5.131	0.443
			(9.556)	(8.738)
exid21			-1.807	0.0382
			(2.267)	(2.363)
cong21			-0.0548	-0.218
			(0.174)	(0.212)
relfrac			-13.61*	-8.851
			(7.249)	(10.15)
fertility	4.310**	3.870**	4.559**	4.846**
	(1.878)	(1.845)	(1.717)	(2.019)
sexrt	-0.000642	0.000133	0.0291	0.0175
	(0.0207)	(0.0247)	(0.0216)	(0.0292)
malcat	1.696***	1.736**	1.846***	2.285***
	(0.590)	(0.767)	(0.567)	(0.785)
precip	-0.00422***	-0.00478***	-0.00331*	-0.00414*
	(0.00120)	(0.00153)	(0.00169)	(0.00240)
loginc	-3.730	-2.236	-4.367	-3.945

VARIABLES	(1) Policy OLS	(2) Policy RE	(3) Political OLS	(4) Political RE
	(3.192)	(3.834)	(2.732)	(3.461)
year	-0.279	-0.265	-0.0683	-0.253*
	(0.177)	(0.163)	(0.176)	(0.148)
mvacc	-0.0289	-0.0872		
	(0.0861)	(0.0866)		
water	0.111	0.0839		
	(0.0688)	(0.0622)		
educ	-0.566	-0.360		
	(0.660)	(0.768)		
Constant	625.5*	587.8*	186.9	562.7*
	(360.2)	(327.8)	(352.8)	(297.2)
Observations	68	68	68	68
R-squared	0.614	0.606	0.618	0.606
States		28		28

Some general conclusions can be drawn from the table above:

- First, the explanatory power of the models is strong, with all explaining over three-fifths of the variation in stunting.

- Next, it appears that fertility rate – theorized in this chapter to be a proxy for household dependency ratio, given the close linkage between the two in both conceptual and measurement terms – is the single most powerful determinant of stunting variation across Indian states. It is significant at the 95% level in all models, and at the 99% level in Model III, and the magnitude of effect is strong: one more child per woman is associated with a 4-5 percentage point higher stunting prevalence. This is in line with the cross-country results of Part II. However, it is important to note that endogeneity issues are of particular concern with fertility rate. A household's decision to have children may be influenced by the health of living children, prevailing or past socio-economic conditions, and other factors. Unobserved variables correlated to fertility rate, like quality of reproductive services, may also determine stunting outcomes directly.

- Malaria risk, taken here to be a proxy for environmental threats pertaining to disease and vectors, is also strongly significant, though the parameter estimates are of moderate magnitude. This result is somewhat unexpected given the coarseness of the scale (the states are classified into one of five categories) and its theorized lack of correlation with omitted variables. While there is obviously a general correlation between malaria risk and geography, in India that link is relatively weak: high malaria risk states of category 3 and 4 can be found in the central (Chhattisgarh), eastern (Orissa and Jharkhand), northeastern (Arunachal Pradesh and Assam), western (Goa), and southern (Karnataka) regions. Thus the likelihood that malaria risk is picking the effect of unobserved environmental or cultural variables linked to geography is low. It appears that the environmental factors that lead to malaria risk and other disease threats do have a significant effect on stunting.

- Precipitation also has a significant association with stunting in all models. However, the relationship is weak, and precipitation is likely correlated with a host of unobservable cultural and environmental variables following the same geographical pattern, so its effect must be interpreted as that of a general geographical proxy variable.

- Perhaps most surprising result of all is the lack of association between income and stunting in all of the models. Log GDP per capita was strongly significant in the cross-country models of Part II, but appears to have little explanatory power across states in India.

Finally, and most directly concerned with the scope of this research, none of the policy and political variables of interest are significant explanatories of stunting. In concert with the other results above, this points to two interesting conclusions. First, it appears that demographic and environmental factors not directly linked to educational or selected health outcomes (i.e., access to safe water and vaccination coverage, the latter of which is taken to be a proxy for maternal and child health services) are responsible for the variation in stunting across states and over the period between 1992 and 2005. Second, these demographic and environmental factors are not driven by the political economy forces we normally associate with pro-poor policy change, including party ideology, voter participation, and electoral competitiveness, as measured in this model.

The final section of the following chapter – a closer look at the experiences of Kerala and Tamil Nadu – provides a counter-point to these general conclusions; in these states, many of the variables found to be insignificant in the regressions above prove important. However, the regression results make a point for the whole of India that is similar to the message in the case study of Brazil: generally speaking, nutritional variation has not necessarily been, in the past, the outcome of nutrition-targeted policy interventions.

Chapter 12. Food, Nutrition, and Health Policy Reforms

Chapter 10 made the argument that the recent surge of economic growth in India has not had a strong impact on undernutrition because of three factors. First, the poor have been excluded, geographically and sectorally, from growth. Second, persistent social inequality mutes the effect of social gains, especially at the intrahousehold level. Third, political economy obstacles prevent the increase in resources available to the state from being translated into *effective* redistributive food, nutrition, and health programs – though ambitious programs do exist, and their potential for bringing about rapid stunting reduction is indeed great.

As stated in the introduction to Part IV, I approach the India analysis with the intention of focusing explicitly on food, nutrition, and maternal and child health policy. This chapter thus concentrates on the third topic listed in the previous paragraph: the question of which political factors explain the (partial) success of recent food, nutritional, and health policy reform efforts in India, in view of the geographically and historically broader failure of such reforms. I look at three types of reforms in particular: 1) expansion of the Integrated Child Development Services (ICDS) scheme, the largest maternal and child welfare program in the country; 2) overhaul of the Public Distribution System (PDS), the primary vehicle for delivering subsidized food grains to poor families; and 3) health and nutrition reforms in Kerala and Tamil Nadu, two of India's relatively better-off states in terms of child nutrition.

A. ICDS Reform

1. Political Obstacles

Although the proximate causes of ICDS' lack of impact on undernutrition are program quality issues like poor actual coverage, weak growth monitoring data, and overburdened staff, the ultimate reasons why these issues have not previously been addressed have to do with political economy (Swain 2009).

To begin, one of the chief strengths of ICDS is its holistic design, but from a political standpoint this is also one of its weaknesses, particularly considering that many of ICDS' interventions are preventative and not curative in nature. Effective implementation of any single intervention depends to some extent on committed lobbies, which across countries are rare in the case of preventative health services (McGuire 2010). As Dr. Arun Gupta, founder and national coordinator of the Breastfeeding Promotion Network of India (BPNI), noted in an interview, it has taken over twenty years of dogged lobbying pressure for breastfeeding promotion alone to obtain its current, moderate level of political attention (Gupta, interview). Similar statements could be made (for example) about treatment of severe acute malnutrition and childhood obesity, both of which have gained prominence in policy circles only recently despite being important contributors to the overall burden of disease in India for many years (Ramachandran, interview). However, many other interventions included within ICDS do not have political champions (Biswas and Verma 2009). For example, complementary feeding has received political attention because of the food fortification industry's strong lobbying efforts; meanwhile, there is little organized pressure to carry out such important changes as increasing the maternal/child health and nutrition worker force (or "anganwadi" workers, as they are called in ICDS) to ease the heavy workload at the child care centers – perhaps the single most pressing constraint on ICDS performance (Shiva and others 2012; Devereux and others 2008). Similarly, behavioral change and communication-type interventions obtain little political backing, not only among elected officials but also within the ICDS administration itself. There is simply little to be gained, either in economic or political terms, by individuals who doggedly pursue such critical reforms.

Further, as Dr. Vandana Prasad, a founder of the non-governmental Public Health Resource Network, pointed out in an interview, insofar as the two Ministries most responsible for child health, the Ministry of Women and Child Development and the Ministry of Health, have engaged the problem of undernutrition in past decade, they have done so by seeking "silver bullet" technical fixes to child undernutrition (Prasad, interview). For example, the issue of food fortification as a means to address nutritional deficiency is increasingly gaining attention within the Congress-led government, buoyed by the lobbying efforts of private sector manufacturers as well as multilateral organizations, especially UNICEF (Holla 2012; Gupta, interview).

While such interventions have been shown across countries to be cost-effective means of addressing specific nutritional deficiencies (Horton and others 2008), the focus on single-track solutions has complicated the effort to build political momentum to reform ICDS, which would necessitate an overhaul of a wide range of interventions, most of which lack advocates as committed and well-resourced as UNICEF or Dr. Gupta's BPNI (Garg and others 2012). Dr. Prasad noted that the weak observed impact of ICDS on reducing undernutrition rates is likely due to the fact that rarely do all of ICDS' components work well in the same location. One may find skilled and committed local administrators that have managed to improve one aspect – for example, the supplementary feeding program or perhaps breastfeeding promotion – but without the synergistic action of all components working together, the effect on stunting will be small (Gragnolati and others 2005).

A second political problem with ICDS is that a good deal of its potential impact is realized through affecting the household care environment, terrain that many policymakers consider to be outside the purview of public policy (Prasad, interview; Sharma and others 2012). In fact, as Dr. Gupta noted, policymaker knowledge of care issues like breastfeeding – even within the Ministry of Women and Child Development and the Ministry of Health – is surprisingly weak; most policymakers take for granted that adequate breastfeeding practices are commonplace in India. They also tend to believe that the state has little role to play in influencing such types of intra-household decision-making (Gupta, interview). Thus reform of some of ICDS' most critical components is rarely discussed at higher political levels (Adhikari and Bredenkamp 2009; Garg and others 2012).

There is a demand-side aspect to this problem as well. Multiple evaluations have noted that one of the key problems with ICDS is a lack of community participation (Swain and Sen 2011; Prasad, interview). The type of behavioral change that ICDS is trying to bring about is often seen by households themselves as a family, not a public policy, issue. Offered little tangible benefit – for example, in the form of cash entitlements – to participate in the program, there has historically been little pressure from the household for ICDS reform. Compounding the problem is that chronic undernutrition is difficult to perceive for families, particularly in areas where the stunting rate is so high that low height-for-age can seem normal (Sinha, interview).

2. Reform Efforts

Despite these many obstacles, ICDS reform has been slowly gathering momentum over the past decade. Following the initiation of the "Right to Food" public interest litigation in 2001 – discussed at greater length below in the PDS section – the Supreme Court of India has issued a series of interim orders to universalize and improve the quality of ICDS (Kannabiran and others 2012). The Court's unprecedentedly interventionist decisions direct the Government of India to construct 800,000 additional AWCs between 2004 and 2008, ensure supplementary nutrition for all families under the poverty line, quadruple the per-child budget for ICDS, and provide hot cooked meals in all ICDS projects (Biswas and Verma 2009); again, the forces driving such judicial activism are discussed below in the "PDS Reform" section.

Even more surprisingly, many of these targets have been met, largely as a result of strong support from Prime Minister Manmohan Singh and the head of the

Congress Party, Sonia Gandhi. The current Eleventh Five Year Plan, running from 2007 to 2012, increased ICDS funding to almost $9.5 billion, a 430% increase over the previous Tenth Five Year Plan (Planning Commission, Government of India 2008). The allocation for each of the 160 million children in India eligible for ICDS services remains low, at about $1/month/child over the life of the plan, but overall the movement towards greater political relevance for ICDS is undeniable.

Program design changes are also being made. In the wake of the widely publicized Gragnolati and others (2006) and other critiques, ICDS is more closely focusing on children under the age of two. Resources are increasingly concentrated on non-food interventions rather than exclusively the supplemental nutrition program, including breastfeeding and behavior change communication. The amount of ICDS workers per anganwadi center will soon increase to two. In two hundred high-undernutrition districts, new maternal and child health interventions are being piloted within the existing structure. Other reforms await attention. The monitoring and evaluation system remains weak, and policymakers and bureaucrats still face few real consequences to poor functioning of ICDS (Haddad 2009). Overall, however, the current reforms represent important and unprecedented steps towards an authentic and sweeping overhaul of ICDS.

There are several reasons why these changes have been possible despite the daunting political obstacles discussed in the previous section. First, reform advocates have done well to translate the complexity of undernutrition etiology into straightforward policy messages. There is general agreement among both public health technical experts and health-related activist groups about what should be prioritized to rapidly reduce stunting, especially a sharp focus on improvements in infant/young child feeding and better access to basic prenatal and postnatal services (Paul and others 2011). Taking the lead in this progressive consensus is the Right to Food Campaign, a loose network of economists, lawyers, public health professionals, and long-time anti-poverty activists, among which the highest-profile members are the development economist Jean Drèze and the human rights lawyer Biraj Patnaik.

This messaging consensus has helped to create a clearer sense among political elites that, at least from a health (if not a household food security) perspective, undernutrition can indeed be reduced by carefully designed policy intervention. As Dr. Gupta of the Breastfeeding Promotion Network of India stated in an interview, "Most of us know what needs to be done, including the Prime Minister" (Gupta, interview) – a reference to Manmohan Singh's often-quoted words during his 2009 Independence Day Speech:

> It is our ardent desire that not even a single citizen of India should ever go hungry….It is also our national resolve to root out malnutrition from our country. In this effort, special care will be taken of the needs of women and children. We will endeavor to extend the benefit of ICDS to every child below the age of six years in the country by March 2012.
>
> (Singh 2009)

Singh has made similar statements in various speeches since, and demonstrated his commitment to the issue by creating a special Prime Minister's National Council on India's Nutrition Challenges in 2008 to advise on policy issues, a body that includes all the key food- and health-related Ministries as well as representatives from civil society (Biswas and Verma 2009). The origins of Singh's commitment to nutrition appears to be rooted in a long-standing concern with the distributive consequences of economic liberalization, as evidenced by his writings and speeches both before and after his ascension to head of state, in which he asserted the importance of expanding India's social safety nets (Singh and others 2003; Singh 2008). Nutrition in particular entered Singh's discourse after the creation of the Sonia Gandhi-led National Advisory Council (NAC) in 2004, an in-house social policy think tank comprised of high-level government officials, technical experts, and long-time activists, described at greater length in the following section.

It is also no accident that Singh's 2009 Independence Day speech above mentions malnutrition and ICDS in close proximity to one another. For all of its flaws, ICDS has been a touchstone for the undernutrition dialogue, a means to focus all of the disparate viewpoints on the better functioning of a single program. Thus in other countries the recognition of a particular micronutrient deficiency, for example, as a pressing problem might lead to a debate about whether a new intervention is needed, on what scale, whether the logistical requirements are feasible, and so on. In India, the same issue quickly becomes a discussion of how to integrate the required new services into ICDS. Given the schizophrenic environment of ideas around addressing child undernutrition, with different messages coming from domestic civil society, industry, and multilateral organizations, having a coherent vehicle of implementation to focus on has helped sustain political attention.

Second, advocates have managed in at least a limited sense to get around the political incentives problem – that is, the reality that elected officials generally do not see child nutrition programs as a useful means of gaining votes or building their base of political support (Gupta, interview). One way they have done so is simply by virtue of coherent messaging, sustained over decades, finally yielding access to the ears of high-level policymakers, most importantly through institutionalized bodies like the special Prime Minister's nutrition council mentioned above (Biswas and Verma 2009); many of the major reforms mentioned above began after the creation of the nutrition council in 2008.

Another way that activists have attracted political attention for ICDS reform is by arguing for a cash entitlement to be part of the program – specifically, maternity benefits for expecting and new mothers. This is a conscious effort by the Right to Food Campaign to increase the electoral appeal of ICDS (Sinha, interview). Such an approach is currently being piloted in 50 districts. In addition, the National Food Security Bill (NFSB), as of this writing being debated on the floor of Parliament, includes within its provisions a 1000 rupees/month allowance to all women for the three-month periods before and after childbirth; the NFSB, one of the Congress-led government's major second-term legislative goals, is discussed at length in the following "PDS reform" section. In any case, the inclusion of a cash entitlement within ICDS reform has indeed managed to garner headlines and policymaker support where previous proposals have not, presumably because of the perception that entitlements can bring electoral support (Gupta, interview). In addition, maternity entitlement provision gives ICDS workers a vehicle to simultaneously introduce other household care environment interventions (e.g., breastfeeding promotion and other types of behavior change communication), which, as noted above, are often seen by policymakers as having to do more with family rather than state responsibilities.

Civil society efforts have been bolstered by the increasing engagement of multilateral organizations with the child nutrition issue in India. A senior World Bank official asserted that the expansion of nutritional programming into other government branches is one of the main priority areas for upcoming years (Kathuria 2009). This could include continued work through PDS and NREGS in addition to the Bank's long-standing relationship with ICDS. Officials at the World Bank, CARE, and USAID all emphasized in interviews that a multi-sectoral, multi-Ministry approach would be necessary to significantly diminish undernutrition rates (Kathuria 2009; Kumar 2009; Babu 2009).

While all of the above is promising, the reform effort does bring with it certain risks. First, the government body in charge of ICDS – the Ministry of Women and Child Development – is approaching reform in what is called "mission mode" (Ministry of Women and Child Development 2008). This approach, in contrast to regular reform processes, would more rapidly reshuffle administrative structures, increase budget lines, and expand human resources. There are some advantages to mission mode: it focuses government attention on ICDS, and also dictates that funds are non-fungible and provided directly to districts, both of which minimize the potential for diversion.

But mission mode is a short-term concentrated approach when long-term sustained commitment may be more important for addressing child stunting and other chronic maternal and child health issues. The fear of activists such as those in the Right to Food Campaign is that if the reforms do not result in observable impact, the program will be evaluated as a failure, and political will to sustain funding will diminish (Sinha, interview). Indeed, some of ICDS' less visible problems have been left out of mission mode planning entirely, as their solution would have less to do with increased resources than with extensive overhaul in the way interventions are carried out.

The best example of this is the extremely flawed procedure of growth monitoring and nutritional screening presently in place (Prasad and others 2012). The priority of the screening system is to find severely acutely malnourished (i.e., wasted) children for treatment, but fails to do so for the following reasons. First, the initial screening is based on weight only; the anganwadi workers are not trained in height measurement, nor do they have the necessary equipment to perform this task. The workers then refer children who are severely *underweight* to nutritional rehabilitation centers (NRCs), where equipment does exist to assess wasting. However, all children who are severely underweight are not necessarily severely wasted – especially because if they have been undernourished for a long period of time, they are more likely to be stunted, and many stunted children will not be identified as having low weight-for-height (i.e., be wasted) simply because they are shorter. So two errors are made here. First, a significant amount of children are denied assistance because there are currently no protocols for treatment of severe underweight, and severely *stunted* children are neither treated nor identified. Second, a large portion of the total child population that *is* severely acutely malnourished is missed in the initial weight-based screening at the anganwadi centers. Prasad and others (2012) compare NFHS data with more detailed information from the Integrated Health and Nutrition Program, a seven-state nutritional screening and treatment initiative, to assess the extent of the error. They conclude that 36-44% of severely acutely malnourished children are missed by the overall screening process, and 58-75% of those who are referred to the NRC for being severely underweight are not identified as SAM and thus sent back to communities without any form of treatment at all, despite their poor nutritional status.

The consequences of such egregious screening errors on aggregate child welfare are unknown, but likely to be massive. The larger point is that addressing this issue is not a question of simply pumping in more resources, but rather requires a careful, protracted rethink of the screening system. Mission mode planning also fails to address other conspicuous gaps in ICDS: the lack of high-quality take home rations for mothers and children between 7 and 24 months; the need to develop multiple crèche models, adapted for different workplace conditions, for the many mothers who must take their children to their jobs; and better convergence with health services available through non-ICDS mechanisms (Sharma and others 2012; Kazmi and others 2012).

This last point deserves a bit of elaboration. One of the major problems with the Indian government's approach to undernutrition has been an over-reliance on

ICDS to address the problem. We have seen that such over-reliance has the advantage of focusing political attention and coordinating interventions, but for rapid stunting reduction to take place, programs that clearly fall outside the remit of ICDS are also needed. Currently, few mechanisms for coordinating efforts across the Women and Child Development, Agriculture, and Health Ministries – to name only the most important – exist (Kathuria 2009). ICDS, by identifying families with young children, can potentially serve as an access point for families to avail themselves of services provided by these other Ministries. Of particular interest are the National Rural Health Mission (NRHM) and Integrated Management of Neonatal and Child Illness (IMNCI) program, both of which emphasize expanding the corps of community-based health workers and increasing the number of primary care and nutritional rehabilitation centers (Brown and Vaitla 2008).

Despite all of these challenges to improving ICDS, as of this writing it appears that momentum for major changes continues to build. One of the major lessons of the ICDS experience of the past decade is that the active engagement of disciplinary professionals and civil society activists with political economy issues – that is, a conscious effort to alter the incentives and constraints encouraging or preventing reform efforts of key political actors, especially the executive branch and relevant Ministerial leadership – is an important reason for forward movement (Biswas and Verma 2009). Dr. Vandana Prasad, a pediatrician and national convener of the Public Health Resource Network, recalled in an interview that for the first two decades of her career she believed that her role as a public health technical expert was to provide high-quality evidence to assist the policymaking process. She eventually came to the realization, however, that even the most technical issues – and even the most technical agencies within government – are political in nature, and thus participation in organized advocacy was essential to assure that evidence is rationally translated into policy.

B. PDS Reform

Following the re-election of the Congress-led United Progressive Alliance (UPA) in 2009, Prime Minister Singh and Congress party leader Sonia Gandhi turned their attention to reform of the country's Public Distribution System. PDS has been since independence the government's single largest social protection budgetary outlay, consuming around 1% of GDP. Following heavy criticism of the program's inefficiency following the 1990s liberalization reforms, PDS shifted from universal coverage to a two-tier targeted approach in 1997, with "below poverty line" (BPL) families receiving staple food grains at highly subsidized prices and "above poverty line" (APL) families able to buy the same foods at the cost of government procurement.

The targeted approach created its own problems. A 2005 nationwide evaluation of the program by India's Planning Commission found that inclusion and exclusion errors were ubiquitous, with fewer than 60% of BPL households covered by PDS (Government of India 2005). Narrow targeting also did little to address the program's infamous leakage problems. The study found that 36% of the total budget of the program was siphoned off at some point in the supply chain and another 21% actually went to APL households (Government of India 2005). The 2004-05 National Sample Survey found similar results, showing that consumers bought only about 46% of the grain that States procured from government PDS storage facilities, the rest diverted either by government functionaries, transport agencies, or the "fair price shop" retailers responsible for distributing the food grains. The diversion ratio varies greatly from state to state, with Tamil Nadu the best performer (around 7% lost along the supply chain), and some of the northern Hindi belt states the worst, especially Bihar, Jharkhand, and Rajasthan (between 85-95% lost) (Drèze and Khera 2011).

As in the case of ICDS, however, a combination of civil society action, judicial activism, and political leadership has paved the way for important reforms in PDS. The movement for reform first gained momentum in 2001, when a severe drought hit India's northwest state of Rajasthan. Several deaths from starvation were widely reported in the national media. Meanwhile, because the shift to a targeted PDS several years earlier lowered the number of families accessing the system, the grain stocks held by the central government expanded greatly, reaching 50 million metric tons by 2002. A civil society organization called the People's Union for Civil Liberties (PUCL) filed public interest litigation with India's Supreme Court, asserting that the Indian government had a legal responsibility to release the grain stocks for emergency response. Specifically, the PUCL cited Article 21 of the Indian Constitution, which charges the state with protecting the "right to life" of its citizens (Government of India 2009a). The litigation argued that the right to food is a fundamental aspect of the right to life, and thus should be covered under Article 21.

Over ten years later, the case has not yet concluded. However, since the original writ, the focus of the litigation has broadened. The PUCL was joined by a host of other organizations concerned with hunger and undernutrition – among which included the prominent Human Rights Law Network, the National Commission for the Protection of Child Rights, the National Federation of Indian Women, and the National Conference of Dalit Organizations – leading to the creation of the Right to Food Campaign (RtFC) as a coordinating body for this new network. The litigation, now popularly known as the "right to food" case, has become a focal point for activist efforts to force public action against hunger in India.

In addition, while the case is ongoing the Supreme Court has released a set of Interim Orders directing the government to improve the operation of PDS. The Interim Orders have included injunctions to ensure the following (Supreme Court of India 2001, 2003, 2005, 2006a, 2006b, 2011):

- Proper functioning of all fair price PDS shops (July 2001);
- Expansion of government food-for-work programs, emergency relief for those unable to work, and provision of prepared lunches for all children in Government primary schools (May 2003);
- Initiation of a 500 rupee maternity benefit for mothers under the poverty line and creation of grievance redressal mechanisms for PDS (May 2005);

- Expansion of PDS rolls and a mandate to overhaul the clearly faulty targeting methodology (February 2006);
- Creation of a Central Vigilance Committee to investigate corruption within PDS (June 2006);
- Computerization of PDS databases to improve food grain delivery (August 2010);
- Increased allotment of grains for the 150 poorest districts (May 2011).

The Court has taken other action in addition to these Orders. Specially appointed Commissioners monitor whether political and administrative authorities are in compliance with the Interim Orders, and have a further responsibility to hear and respond to grievances from citizens (Commissioners of the Supreme Court 2010). A strong Right to Information Act passed in 2005 further increases the ability of citizens to monitor and evaluate government response to these orders. The Supreme Court orders have in effect began the process of transforming the discretionary PDS (and ICDS) policy into a legal entitlement, and attempted to enforce a framework for transparency around this entitlement (Dand, interview).

The Supreme Court's willingness to take such a strongly interventionist stance is worth a closer look. The interpretation of Article 21 of the Indian Constitution – the guarantee of a right to life – as implying an enforceable right to be free from hunger is far from straightforward. To justify such an interpretation, the Court has relied extensively on Part IV of the Constitution, "Directive Principles of State Policy", for support. Part IV lists a broad array of socio-economic rights as the primary goals of state functioning, and the Court has often used these directive principles in famous cases like *Olga Tellis v. Bombay Municipal Corporation* and *Unni Krishnan v. State of Andhra Pradesh* to argue that without ancillary rights such as the right to adequate housing (*Tellis*) and free education (*Krishnan*), the right to life is unable to be achieved (Supreme Court of India 1985; Supreme Court of India 1993).

Such interventionism is highly controversial, with critics of the Court asserting that the original intent of the framers of the Constitution in separating civil and political rights and socio-economic rights was to allow justiciability for the former but not the latter. The Supreme Court has instead argued that directive principles impose positive obligations on the government to create supportive legislation, and in fact, in one important precedent – the *Minerva Mills v. Union of India* case – the majority opinion included the statement that the Constitution "gives primacy to directive principles *over* fundamental rights in case of conflict between them" (emphasis added) (Supreme Court of India 1980). In recent years, the Supreme Court has acted repeatedly on this theory of "harmonious construction" between fundamental rights and directive principles. The content of rights has been defined with reference to directive principles, and principles enforced with reference to rights (Kundu and Jain 2004).

While this stance is tied to some degree to the individual progressive leanings of the Justices of the Supreme Court, there are deeper historical reasons why such activism is embedded in the body. The period of judicial interventionism first began with the end of the Emergency, the 21-month period in the mid-1970s when

Prime Minister Indira Gandhi severely curtailed civil liberties and political rights. Before this time, the Court had little record of progressive adjudication. During the Emergency itself, for the first time in India's post-colonial history, the independent power of the Court was severely restricted. Decisions like *Unna Krishnan* and others typified the surge in judicial assertiveness after the Emergency was ended in March 1977, and there is a general scholarly consensus that the Court in its activism was attempting to reestablish its independence and guard against the future manipulation of the judiciary by the executive (Sathe 2003). The interventionism has outlived the threat, and the Court remains a powerful force in influencing both executive and legislative action. The implications of this historically contingent sequence of events for ICDS and PDS have been enormous.

In addition to strident action by the members of the Right to Food Campaign and judicial activism, historically contingent political circumstances also contributed to food policy reform. In 2003, the Congress party, which had been India's dominant political force from independence until the national election victory of the Bhartiya Janata Party (BJP) in 1996, lost several key state elections. The party rank-and-file were generally pessimistic about Congress' chances in the 2004 national elections, and the leadership was willing to consider more ambitious redistributive policy proposals as a campaign strategy, including PDS reform. In doing so, Congress created a compelling narrative of rural distress to contrast with the BJP's message of "India Shining", an advertisement of the country's rapid economic growth during the BJP's tenure in power (Macauslan 2008).

Although it is uncertain to what degree the populist campaign platform affected the elections, the Congress alliance unexpectedly won, buoyed by shrewd coalition making with leftist and regional parties. Sonia Gandhi created (and assumed the leadership of) the National Advisory Council and, as noted earlier, populated the body with economists, civil society activists, and high-profile government officials, enjoined with the task of transforming the UPA's Common Minimum Program (essentially their election manifesto) into policy. The membership of the NAC, with only a couple of exceptions, has a decidedly progressive cast, and their recommendations since have generally reflected this leaning.

Following the UPA's re-election in 2009, the NAC took the lead on the government's second-term flagship social initiative, the National Food Security Bill (NFSB). The NFSB, as of this writing being debated on the floor of Parliament, is an ambitious combination of reforms of existing programs and new, smaller initiatives. Various aspects of PDS, including targeting, prices, and benefit allotment quantities, would be changed radically.

The current NFSB proposal is to replace the below poverty line/above poverty line system with a three-tier structure of "Priority", "General", and "Excluded" households, with the implication being that "Priority" households are those below the poverty line, "General" are non-poor but would still have access to partially subsidized food grains, and "Excluded" would not be able purchase from the PDS system. The bill stipulates that a minimum of 46% of rural households and 28% of urban households must fall under the "Priority" group – a tacit way of acknowledging that India's actual poverty prevalence is closer to the 42% figure suggested by the international poverty line than the 28% suggested by the national poverty line (Patnaik, interview). The "Priority" group is able to purchase food grains under the "3/2/1" system: 3 rupees/kg for rice, 2 rupees/kg for wheat, and 1 rupees/kg for millets. These prices represent a considerable drop from the previous BPL rates under PDS. Additionally, PDS grains would be available on an individual basis at 7 kg/month, instead of the 35 kg/month household allotment (irrespective of size) that had been in place. While there is much debate about whether these reforms go far enough in addressing PDS' problems, the changes are in scope much greater than any reforms proposed since the creation of the two-tiered PDS in 1997.

In summary, the debate around PDS reform has gained a higher political profile since the election of the UPA government in 2004, spurred by judicial and civil society activism, the latter largely led by the constellation of organizations comprising the Right to Food Campaign. There are also some encouraging signs that ground-level reality is also changing. A look at National Sample Survey data from the 2009-10 finds that 41% of grain at national level was being diverted, still very high but lower than the 54% found five years earlier (Drèze and Khera 2011). A survey conducted recently of 1,200 poor households in nine states – Andhra Pradesh, Bihar, Chhattisgarh, Himachal Pradesh, Jharkhand, Orissa, Rajasthan, Tamil Nadu, and Uttar Pradesh – finds even more cause for optimism. They find that BPL households are able to obtain 84% of the food grain allotments to which they are entitled (Khera 2011). Drèze and Khera (2011) note that the disparity between this figure and that of the NSS data – which persists even when the NSS data from only the nine states above are considered – could signify improvements that have taken place in the last couple of years, or could indicate that most of the current diversion in PDS is actually occurring with entitlements intended for above-poverty line households. In either case, there does seem to be a positive trend with respect to PDS functioning.

A final word, however, should be said about some of the risks within the PDS reform process. In an interview, the economist and former NAC member Jean Drèze discussed these at length. The largest problem is the danger of over-centralization with the NFSB. Many Indian states have already embarked on their own PDS reforms, especially with respect to targeting, and these efforts could be weakened by the new bill. Some states – most notably, Tamil Nadu, Andhra Pradesh, Chhattisgarh, Himachal Pradesh, Rajasthan, and Orissa – have either (re)universalized their PDS or on the path to do so. Such a step has two important benefits: one, it eliminates the logistical task of accurate targeting, formidable even in India's smaller states; and two, it protects PDS from future rollback by preserving a large political constituency of beneficiaries (Drèze, interview). The latter point is important at the federal level as well. Although India's poor number in the several hundred millions, they are by most measures the electoral minority. Recent years have seen an increase in India's annual budget deficit, and the voices for scaling back social programs are growing louder, particularly within the Ministry of Finance and the Planning Commission (Sinha, interview). Although PDS would appear to be safe under the current UPA administration, its status as the government's single largest social outlay will eventually make it a target for fiscal hawks. A universal PDS, in which all or nearly citizens have a stake in cheap food, is less vulnerable to this threat.

The new NFSB, however, does not provide states with the flexibility to adopt different targeting frameworks. Additionally, the actual methodology used for targeting is based on "inclusion criteria", a set of seven qualitative "deprivation" characteristics to be determined through a new census.[40] Possessing a given number of characteristics – the exact number has not be determined yet – will qualify households under the "Priority" category. As Drèze (2011a) has pointed out, this method can lead to significant exclusion error. He, and the Right to Food Campaign, has argued in the absence of a universal approach for the NFSB to adopt "exclusion" instead of inclusion criteria – i.e., characteristics that would clearly indicate that a household is wealthy. All other households would automatically be enrolled in PDS. So far, this recommendation has not been adopted.

Finally, there is no guarantee that the NFSB will be passed by Parliament in its current form, although the momentum is strongly in the direction of reform. Several factors make the outcome uncertain. First, the UPA coalition is less

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[40] The characteristics are: 1) living in a one-room house made of mud, straw, or other non-durable materials; 2) having no adults between the ages of 16 and 59; 3) female head of household with no adult males between 16 and 59; 4) having a disabled household member and no able-bodied members; 5) being part of a Scheduled Caste or Scheduled Tribe; 6) no literate adults above age 25; and 7) being landless and obtaining a major part of income from manual casual labor (Drèze 2011b).

unified than at any point in its thus-far seven-year rule. The Left parties, strong supporters of redistributive social programs in the past, exited the coalition following the re-election in 2009, decreasing internal pressure to push through the NFSB (Sinha, interview). Congress' largest current ally, the Trinamool National Congress, has also broken with the coalition in late 2011 over the famed "Lokpal" anti-corruption bill and Prime Minister Singh's proposal to increase foreign direct investment in the retail sector. Second, the reforms suggested by the NFSB necessitate an increased expenditure of $6 billion annually, and influential fiscal hawks within government, especially Finance Minister Pranab Mukherjee, Planning Commission Deputy Chairman Montek Singh Alhuwalia, and Agriculture Minister Sharad Pawar, have hinted at their displeasure with the NFSB (Sharma 2012; Mittal 2011). At a time when India's growth estimates are being revised downward, the rupee is rapidly deteriorating as a result of capital flight, and annual fiscal deficits are creeping upwards, these viewpoints carry even more weight.

The final outcome of PDS reform likely depends most on the UPA's calculations for how electorally useful the bill will be in the next elections. There is a perception that the "big ticket" legislation of the UPA's first term, the National Rural Employment Guarantee Scheme (NREGS), helped the coalition greatly in the 2009 elections (Drèze, interview; Patnaik, interview). There is little empirical evidence to confirm or refute this fact, but as Drèze noted, the notion has "become true by repetition". The NFSB may serve the same purpose in the 2014 elections, as evidenced by the recent well-publicized editorial debates about whether the primary factor driving the NFSB is Congress' for a "poll sop" (Chowdhury 2012; Neogy and Bhardwaj 2011). However, as discussed further in the following section on NREGS, the political conditions that enabled the passage of NREGA in 2005 have changed. Congress no longer relies on the "common man (*aam aadmi*) being left behind in the wake of growth" narrative as a means to build support, mainly for the reason than the fact that they are the ruling power, and thus can reap the political benefits of claiming credit for growth (Sinha, interview).

Still, PDS reform is for the first time in India's history an electorally relevant issue at the federal level, while alters greatly the political economy of reform. The topic has been influential in the rise and fall of governments at the state level, most notably in Tamil Nadu, Andhra Pradesh, and Chhattisgarh, but never with respect to national elections. It appears likely that leadership by the Singh-Gandhi government, continued civil society activism, and judicial pressure will continue to keep PDS reform at the top of the policy agenda, and some form of the NFSB will soon be passed in the legislature. The larger point is that, given the repeated failure to reform both PDS and ICDS over the past few decades, the current changes are strikingly radical. A decade ago, meaningful progress to overhaul the two programs would have seemed highly unlikely, but a fortunate confluence of factors has indeed borne fruit. Perhaps most importantly, the understanding of PDS and ICDS entitlements by citizens not just as benefits but also as legal rights appears to be deepening (Devereux and others 2008). As Sejal Dand, adviser to the Commissioners of the Supreme Court on the right to food case, pointed out in an interview, the recognition of rights is less a problem than the impediments to realizing those rights – for example, caste and gender discrimination, labor demands that prevent families from pursuing complaints to the extent permitted by the law, and the simple reality that in many areas the grievance redressal mechanisms do not work well. In a nation where social inequality is justified by powerful cultural and religious norms, this self-avowal by the poor of the rights of the individual is indeed a profound change.

C. Health System Reform in Kerala and Tamil Nadu

Kerala's total stunting prevalence from the 2005-06 National Family and Health Survey for under 5-year old children is 25.6% and Tamil Nadu's is 30.9%, first and third rank among Indian states (IIPS and Macro International 2007). Their respective *severe* stunting rates of 6.5% and 10.9% hold the same rank within the country. These prevalences are not low in global terms – similar to that of present-day Togo (in the case of Kerala) or Vietnam (in the case of Tamil Nadu) – but compared to the countrywide total and severe stunting prevalences of 48.0% and 23.7%, these two states have done exceptionally well in protecting children from chronic undernutrition.

No anthropometric data to look at change over time exists, but available indicators suggest that Kerala and Tamil Nadu had similar rates of poverty and undernourishment to the all-India average in the early 1970s (Drèze and Sen

2002). Thus the improvement in nutrition likely occurred over the last few decades, and mostly in the 1970s and 1980s.[41] Sweeping health system reforms – and in the case of Tamil Nadu, an explicit focus on child nutrition – initiated during this period have been the most powerful force behind Kerala and Tamil Nadu's exemplary performance. The sections below examine the structure and impact of the two states' health and nutrition systems, and describe the political forces driving reform.

1. Kerala

Kerala has long been lauded for its policy emphasis on maternal and child health, and the results as manifested in welfare outcomes are impressive (Drèze and Sen 2002). The available data suggests that child mortality declined slowly and steadily from Independence, and then began to sharply fall starting in the mid-1970s (Bhat 1990). The under-5 mortality rate now stands at 14 deaths per thousand children, by far the lowest rate in India and comparable with developed world figures (Government of India 2011). The maternal mortality rate is at 18 deaths/10000, again the lowest in India (Government of India 2009b).

These achievements are the result of a comprehensive primary health care

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[41] Since 1992, Kerala's stunting rate for under 3-year olds has declined by only 1.5 percentage points, from 28% to 26.5% (note again that data for under-5s was not collected in the 1992 and 1998 NFHS rounds). No stunting data for Tamil Nadu exists from the first round of the NFHS in 1992, but the state saw only a 4.1 percentage point stunting decline among under-3s, from 35.2% to 31.1%, between 1998 and 2005. By the former year, Tamil Nadu already had the 4th lowest rate among Indian states.

network reaching throughout the state. Maternal health services are particularly extraordinary, with 94% of pregnant women receiving at least three antenatal visits, 89% receiving tetanus toxoid injections, and 97% receiving or buying iron and folic acid tablets. These three variables are excellent indicators of maternal care, and all are exceptional figures even by developed world standards, well above the India averages (IIPS and Macro International 2007). A full one hundred percent of villages have a primary health care center within five kilometers (Baru 2010).

Maternal and child nutrition services also have extensive coverage over the Keralan population. By 1988, the supplementary nutrition program (SNP) provided caloric and protein supplements to about one-fifth of all pregnant and lactating women and preschool children in the state. At 500 kilocalories and 25 grams of protein per mother and 300 kilocalories and 15 grams of protein per child, the nutritional value of the supplements are considerable (Kerala Department of Social Welfare 2012).

The well-functioning SNP in Kerala is in addition to a Public Distribution System whose usage is much more widespread than in other Indian states. This was especially the case in the period when most of the gains in child nutrition were achieved, in the 1970s and 1980s. Data from the 42nd round (1986-87) of the Indian National Sample Survey (NSS), a continuously running, nationwide questionnaire gathering a wide range of economic, welfare, and demographic information, shows that 51% of all rice and 92% of all wheat consumed in rural areas of Kerala were obtained through the PDS. The figures for India as a whole, in contrast, were 17% and 13% respectively. During this period, access to the PDS was nearly universal in Kerala, with around nine in every ten households obtaining food from the system. Usage among the poor was especially high, with the lowest quintile procuring close to two-thirds of their staple food needs from the PDS. Kannan (1995) notes that all of these social protection programs taken together amounted in 1986 to a public transfer equivalent to about one-fifth of household income, with the PDS and the rural employment programs accounting for over half the total share. Given that the average household size at that time was around five members, the total value of the benefits was about the per capita income of a single family member.

The synergy between health and education is also important, as the high rate of female literacy contributes to the widespread use of health services (Sandiford and others 1995). By 1980, Kerala had already achieved universal primary enrollment with gender parity due to a decades-old policy on education (Chakrabotry 2005), and female literacy was an incredible 93% in the NFHS-3 survey, nearly forty percentage points above the all-India figure. Econometric analysis of cross-sectional data collected in Kerala and districts bordering the state in 1979 and 1980, at the peak of the health service expansion period, suggest that female literacy and access to health personnel were the strongest determinants of child survival. It is worth noting that female literacy and health personnel access are themselves likely linked to Kerala's high population density, as compared to other Indian states; the high density facilitates educational and health service provision by the state (Bhat and Rajan 1990).

The combined effect of high educational achievement and widespread health services also drove fertility decline in Kerala, which itself pushes the stunting rate downward, as evidenced by the results of both Part II's cross-country regressions and the India cross-state regressions of the previous chapter. Kerala's steep drop in fertility was concentrated between the mid-1970s and 1990. Bhat and Rajan (1990) argue that this decline was not characterized by the traditional demographic transition model, wherein increases in per capita income, higher opportunity costs of childbearing as the ability of females to participate in the labor force improves, and a secular decline in child mortality all encourage families to decrease family size. They point out that growth in this period was relatively slow in Kerala, female unemployment rates remain very high (and thus opportunity costs of childbearing remain low), and fertility rates appear to have fallen at a much quicker pace than child mortality. Rather, using data from the 1961, 1971, and 1981 censuses, the authors instead show that fertility decline is more strongly driven by improvements in female literacy and contraceptive availability. This finding may also help explain the lack of correlation between growth and nutrition performance across Indian states, as evidenced by the regression results of Chapter 11: interactions between non-income factors (in this case, educational attainment and health service availability) may be affecting stunting not through direct pathways, but by working through other variables like fertility (which is indeed the most strongly significant correlate of stunting variation in the regression models).

Why did issues of public health come to attain such political primacy in Kerala? The answer – as in Tamil Nadu – has to do largely with populist challenges to one-party rule. In Kerala, the Communist Party of India (CPI) has held power for 27 of the last 45 years, alternating control of the state with a Congress Party pushed leftward by the CPI's challenge (ECI 2012). With the exceptions of West Bengal and Tamil Nadu, in no other Indian state has Congress' dominance been challenged so consistently since Independence. The issue of equitable access to basic health services was very early on politicized, as electoral campaigns took on a highly populist character (Amrith 2009).

The class grievances had their beginnings in anti-caste mobilizations. The roots of Kerala's strong trade unions, which would form the core of the CPI membership, can be found in the anti-Brahmin Sri Narayana movement of the late 19th and early 20th centuries (Casinder 1995). The movement, centered in the princely state of Travancore, was focused on ending caste discrimination. Because its core membership was comprised of factory workers in the coir industry, however, the struggle eventually came to encompass economic as well as social equality, and Kerala's first trade unions were born. In addition, the success of Catholic missionaries in converting lower-caste Hindus throughout the 19th and early 20th century pushed Kerala's princely leaders to undertake broad-ranging anti-caste reforms. By Independence, Kerala had a wide variety of cross-caste social movements pushing for the common goal of better public services, particularly in health and education.

Party rule – and as a result, public policy – was, however, highly unstable in Kerala until the early 1970s; no elected government survived to complete a term between the first post-Independence elections in 1948 and 1970. The reasons had largely to do with the intensity of Kerala's political competition, which necessitated coalition rule. As Jeffrey (2008) argues, party leaders were unable to manage the fractious environment due to a lack of the requisite experience to make the "compromises and adjustments" necessary to hold coalitions together. Accumulated experience and the individual skill of party leadership following the 1970 elections would finally permit more stable administrations, starting with the tenure of the CPI head Achutha Menon in that year; each Keralan government since has managed to finish their term.

The state's history of leftist mobilization, abetted by the formal political parties, had produced by the early 1970s a plethora of citizen's groups pushing for maternal and child health rights (Heller 1996; Heller 2000). In a much-quoted analysis of the period, Mencher (1980) speaks of vociferous popular reactions to in-operational and badly functioning health services. Because of the fragile nature of coalition governance, individual Members of the Legislative Assembly were pressured by their parties to deliver public goods, for fear of government collapse (Jeffrey 2008). The pace of policy change quickened throughout the 1970s and 1980s, beginning with extensive land reforms, expanding to redistributive social programs for disadvantaged castes and the extremely poor, and eventually reaching to extraordinarily high per capita investments in basic education and health (Singh 2011; Franke & Chasin 1989; Heller 2005).

2. Tamil Nadu

Tamil Nadu's maternal and child health record is almost as impressive as that of Kerala. The under-5 mortality rate (U5MR) in Tamil Nadu is currently less than half the all-India average, at 33 deaths per 10,000 children (Government of India 2011). Again, the gap is the result of changes in the past few decades; in the early 1970s, the U5MR in Tamil Nadu was very near the India rate. The percentage of births attended by skilled health personnel is another good indicator of maternal and child health service availability. In Tamil Nadu, the figure presently reaches 84%, about twice the rate for the country, and higher than any other state except Kerala, where health facility births are universal (IIPS and Macro International 2007).

A focus on public health lies at the heart of Tamil Nadu's health system performance. In contrast to much of India, where curative services have dominated health budgets, the Tamil Nadu government has for decades prioritized public and environmental health measures. Gupta et al. (2009) point out that administrative decisions, and not simply health spending, are the key to the state's success. In fact, public health spending in Tamil Nadu in 2005 was just below the all-India figure at approximately 200 rupees ($4) per capita. Private health spending per capita was over one-fifth lower than in India as a whole, and total spending in Tamil Nadu came to just over 800 rupees ($10) per person.

Instead, the most important factor in the performance of Tamil Nadu's health system was the government's decision decades ago to keep public health and medical services administratively separate. This stands in contrast to the central government policy, first adopted in 1967, of combining the two areas under a common seniority system. Although the intention was to improve coordination, the clinical personnel came to dominate health policymaking, and the result was the relative neglect of preventative and environmental health measures in favor of single-focus campaigns (e.g., malaria eradication) that in reality had far less potential to reduce the total burden of disease and mortality (Gupta et al. 2009). The states, however, had discretion in organizing their own health systems, and Tamil Nadu chose not to follow the central government's recommendation, and instead established a separate Directorate of Public Health.

Again, this stands in contrast to federal policy. The National Health Policy of 2002 continues the history of central government neglect of public and environmental health, stating that these are not included in the direct mandate of the Ministry of Health. There is in fact no focal point for dealing with public health issues within the Ministry, and the public health experts that do work in the Ministry are rarely in program planning or management roles (Gupta et al. 2009). In addition, the central government financially incentivizes states to adopt federally identified health priorities by funding the initial stages of new large-scale, usually single-issue, programs. Overall, data from 2005 indicates that states spend more than four times more on curative services than on primary health care.

The consequences for chronic undernutrition are clear. Although there is some debate on whether "catch-up growth" is possible, the general feeling in technical circles is that nutritional insults that occur during the first thousand days of a child's life (that is, during pregnancy and up until age two) are irreversible. Thus stunting reduction demands preventative, not curative, action – and by focusing on public health within their health policy over four decades, Tamil Nadu has greatly improved the quality and coverage of their preventative services.

This dichotomy between prevention and curative treatment further explains the political neglect of ICDS all over the country until recently. As mentioned earlier, ICDS is located within the Ministry of Women and Child Development, not the Ministry of Health. While in one sense this suggests a political acknowledgement that maternal and child health are important enough to deserve their own ministerial focus, the reality is that (again, until recently) the Ministry of Health has always maintained a much more prominent political profile. The result is that the Ministry of Health's priorities have become the country's health priorities write large, and so it is unsurprising that stunting has only recently become a concern.

How did public health come to prominence on the political agenda in Tamil Nadu? Once again, a long history of political mobilization appears to underlie this commitment, and as in Kerala, the focus on public health has become so embedded in the political dialogue as to survive changes in government.

Tamil Nadu's history of social reform can be traced back to the Self Respect Movement of the 1920s, a powerful group calling for the end to caste discrimination and political domination by upper-caste Brahmins (Srinivasan 2012). The movement evolved into a potential political force, and led to the emergence of lower-caste parties as challengers to Congress; since the late 1960s, various factions of the Dravida Munnetra Kazhagam (DMK) party have dominated Tamilian politics. Health care provision (in addition to educational access) became a primary area of competition between these factions themselves, as each vied for the mantle of 'people's representative' (Visaria 2000). As in Kerala, caste and class grievances became tightly intertwined, and what may have begun as anti-discrimination sentiment slowly morphed into a call for economic rights, specifically for basic services from the state (Srinivasan, interview).

The issue of child nutrition specifically also became politicized in Tamil Nadu to an extent not seen in other states, in large part due to the personal championing of a universal mid-day meals scheme for schoolchildren by former Chief Minister M.G. Ramachandran, perhaps the most popular politician in the history of the state, in the early 1980s. The scheme was so successful, both operationally and politically, that it would two decades later be scaled up to federal level by the central government. Within Tamil Nadu itself, the program became so popular that rival parties adopted and even expanded the program upon assuming power, as occurred with primary health care services generally in both Tamil Nadu and Kerala (Harriss-White 1991).

In contrast to other states, the Public Distribution System in Tamil Nadu remains universalized – no above poverty line/below poverty line distinction exists – and its redistributive impact is immense. In a study of three villages, Harriss-White (2004) found that the PDS provided nearly 40% of rice calories for poor peasants, and nearly three-quarters for agricultural laborers. The midday meals scheme has similar progressive effects. She argues from her case study that the two programs, like the services at primary health centers, have because of their profound effects on the welfare of lower-class voting lobbies become politically untouchable, despite their mounting fiscal burden.

In addition to domestic political incentives, and unlike the other reform experiences examined in this research – both in Brazil and in India – the focus of Tamil Nadu on nutrition was also strongly influenced by international interests, particularly the United States Agency for International Development (USAID) and the World Bank. In 1980, the Bank and its sister lending institution the International Development Agency (IDA) began the pilot stage of what would become of the world's largest nutrition interventions, the Tamil Nadu Integrated Nutrition Program (TNIP). The initiative combined anthropometric monitoring, nutritional supplementation, and curative services under a single umbrella, and internal evaluations showed that it had succeed in reducing undernutrition by nearly 30% (Harriss-White 2004).

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Some caveats to these brief case studies are in order. First, it should be noted that, the experiences of Kerala and Tamil Nadu notwithstanding, the evidence that political competition leads to greater provision of public goods across Indian states is not straightforward. For example, Chhibber and Nooruddin (2004) find that states with multiparty competition spend less than those with two-party competition, likely because in multiparty elections caste-based pluralities are more actively sought by parties, whereas in two-party contests more broad-based appeals are required; thus *more* competition does not always lead to more pro-poor policy. In this study's own regressions of Chapter 11, we saw that political competition, either measured in terms of Congress' power or in voter turnout, was not a significant predictor of stunting.

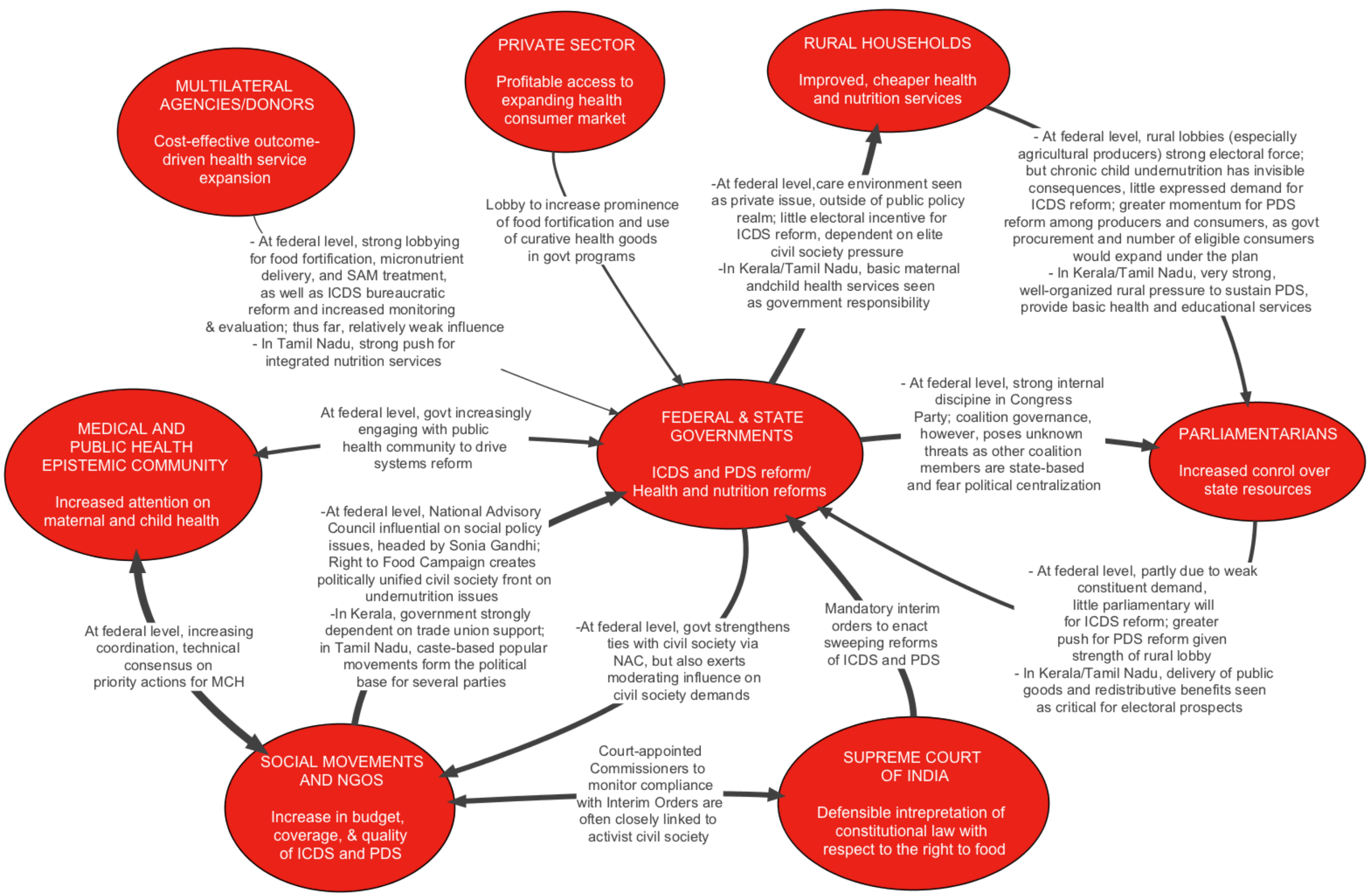
Second, the interaction between caste and class is not always likely to follow the pattern of Kerala and Tamil Nadu, in which caste mobilization evolved into a call for economic rights – a call made politically significant by the electoral strength of the poor and the well-functioning democratic systems of these two states. In contemporary India, caste-based political mobilization has often been a means for clientelist leaders to effectively build vote banks, as in the case of the lower-caste Bahujan Samaj Party in Uttar Pradesh today, rather than serving as a stepping-stone to state accountability to the lower class. Still, a kind of positive feedback process between collective action of the poor to reform institutions and the evolution of institutions to permit more collective action seems consistently to be a powerful catalyst for pro-poor public action (Srinivasan, interview), as we have seen in Brazil as well.

D. Political Actor Map

Figure 80 below summarizes the links of influence between the political stakeholders involved in the reforms mentioned in the previous three sections. As discussed at length, ICDS and PDS reform has been driven by a strong coalition of civil society organizations and public health professionals with unique access to the highest levels of the UPA government. The Singh-Gandhi government has in turn been willing to create forums, especially the National Advisory Council, in which the views of civil society can directly influence the formulation of social policy. Meanwhile, health and nutrition policy reforms in Kerala and Tamil Nadu are the result of class-based mobilization and a seemingly permanent embedding of 'basic services' issues in the political dialogue. Policymakers in these states face formidable pressure to sustain and expand redistributive policies.

Despite the considerable electoral strength of rural households throughout India – as evidenced by a lowest quintile voter turnout rate that regularly exceeds that of the highest quintile (Stepan and others 2011) – there have been few instances of rural communities themselves participating in the call for ICDS reforms. Rather, change has been pushed by their well-connected elite proxies in civil society, particularly in New Delhi. The consequence of such indirect democracy, however, is that few parliamentarians have taken on the cause of ICDS reform themselves. The same, however, is not true for PDS; reform of the kind proposed in the NFSB would increase government procurement from producers and expand the amount of consumers eligible to purchase at subsidized prices. As a result, parliamentary support for PDS reform within the UPA coalition has been strong. This type of electoral pressure – a recent development at the federal level for any kind of redistributive program – has been omnipresent in Keralan and Tamilian politics for decades with respect to health and nutrition services.

Figure 80. Policy reforms political actor map.



The progress of federal reforms depends strongly on Singh's government continuing to privilege the views of the NAC and the Right to Food Campaign. This could be a fragile situation if India's fiscal deficits continue to mount and members of the UPA coalition begin to oppose the expansion of federal initiatives on grounds of the risk of over-centralization of power. Exactly such cracks in the unity of the coalition have begun to appear in recent months around other proposed initiatives around trade liberalization and anti-corruption legislation (Bhabani 2012; Kumar 2012).

The next section analyzes the PDS, ICDS, and Kerala/Tamil Nadu narratives presented in the preceding sections within the structure of the process-tracing hypotheses of Chapter 4.

E. Process-Tracing the Political Economy of Reforms

The previous sections discussed in narrative form the political forces associated with sweeping reforms in the Integrated Child Development Services (ICDS) and Public Distribution System (PDS) schemes in India over the past decade, as well as health and nutritional policy reforms in Kerala and Tamil Nadu, mainly in the 1970s and 1980s. In this section, I locate these narratives in the framework of the four formal hypotheses presented in Chapter 4, and use the process-tracing approach to confirm or refute each individual hypothesis.

1. Mass Movements

The first hypothesis states that mass movements in which the rural poor directly participate and exert political force were a strong mechanism by which policymakers were pressured to enact food, nutrition, and health policy reforms. There are four causally linked steps that need to be confirmed for the hypothesis as a whole to be accepted.

"Step 1: Mass movements existed in India during the reform periods and prioritized food, nutrition, and health policy reforms in their political agenda".

This step is confirmed for the Kerala and Tamil Nadu health and nutrition reforms, but the evidence is weaker for the ICDS and PDS reforms. An anti-caste movement with its origins in the 19th century princely state period was the precursor to the trade unions and leftist political parties that exerted such profound influence on Kerala's social policy in the post-Independence period. The leftist parties made access to basic health and education services a centerpiece of their populist platform, and by doing so permanently ensured that political legitimacy of *any* ruling party depended on preserving these state obligations. A similar process occurred in Tamil Nadu, albeit with a more recent beginning. Anti-brahmin movements that began in the 1920s, most prominently the "Self-Respect Movement", quickly became a formidable electoral force in free Tamil Nadu. Caste politics focused on the tangible state benefits available to upper castes but not to lower castes and untouchables, including access to health services and educational facilities, and by doing so laid the groundwork for the class-based populist campaigns that would follow. This step is thus confirmed for the Kerala and Tamil Nadu reforms.

The contemporary picture is more difficult to assess. The ongoing Maoist rebellion in central India, the cross-class anti-corruption movement led by the Gandhian activist Anna Hazare, and the various agitations for sub-state secession across the country do fall under the category of people's movements. It is also true that the rise of these movements is occurring at the juncture of two major changes in India's rural political economy (and thus are relevant to child stunting in the country): on the one hand exclusion of the poor from the economic sectors experiencing the most rapid growth, as detailed throughout the previous chapters, and on the other the increasing importance of the rural vote in national elections (Corbridge and others 2011). More generally speaking, democracy in the country has taken great strides in the past two decades, both in terms of the strengthening of formal institutions and the increasing density of associational links in society (Heller 2011).

However, it cannot be said that there are truly mass movements that have specifically mobilized around the issues of ICDS and PDS reform; instead, the reform push is largely an elite project of the group of organizations that comprise the Right to Food Campaign. Although the Campaign seeks to mobilize poor households themselves for large-scale action, as of the present moment it is mainly comprised of progressive professionals in health, law, and economics, as well as middle-class activists. While these elites are indeed allied with poor people's organizations, as discussed below, the RtFC cannot be said to be a mass movement of poor households as such.

Summary: The first step – and thus the hypothesis as a whole – is rejected for the ICDS and PDS reforms. The first step is confirmed for the Kerala and Tamil Nadu experiences.

"Step 2: Such mass movements wielded political power, either through a potential to influence electoral processes or other means. The institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permitted such movements to wield power".

The mass movements in Kerala and Tamil Nadu did indeed yield political power. Both Kerala's trade unions and Tamil Nadu's anti-caste movement gained legitimacy in the decades before Independence as the political voice of the lower castes, and this prominence allowed them to transition from social movement to organized political party. As noted in the previous section, they shaped the institutional environment as much as the institutional environment "permitted them to wield power"; decades of activism led to a caste- and later class-focused political dialogue substantively absent in nearly all other Indian states. While it was true that gender relations in (especially) Kerala were unique in India even prior to the rise of the leftist movements (Jeffrey 1993), the intentional political focus on maternal health and education created – in a positive feedback cycle working through female literacy, inclusion in the labor force, and political participation – even more political incentive to sustain and expand state services for girls and women.

Summary: This step is confirmed for the Kerala and Tamil Nadu narratives.

"Step 3: Policymakers were seen to react to mass movements' political power, not simply in discourse but also in substantive action".

The mass movements were able to express their power effectively through elections, and the social welfare policies enacted in both states can be convincingly and directly linked to the demands of the movements. In addition, because the Communists in Kerala and the various factions of the DMK in Tamil Nadu readily took on a populist identity, the political campaigns of the two states increasingly focused on health and nutrition issues as the decades passed. Legitimacy of rule continues to be closely tied to state performance in providing the poor with services.

<u>Summary</u>: This step is confirmed for both Kerala and Tamil Nadu.

"Step 4: Substantive action involved enacting and effectively implementing food, nutrition, and health policy reforms linked to mass movement demands".

The universalization of basic health services in both states – manifest in excellent maternal and child health indicators – was a direct result of the electoral pressure applied by mass movements. In Tamil Nadu, extraordinary political attention was also paid to child nutrition, and this may better be attributed to ideological and international influences, as discussed further below. However, this step is confirmed with respect to health services for both states.

Thus the hypothesis that mass movements were a strong mechanism by which policymakers were pressured to enact reforms in Kerala and Tamil Nadu is confirmed. The same hypothesis is rejected for ICDS and PDS reform. In summary, democratization – characterized not only by electoral participation, but also by mass mobilization between elections – helped transformed health and nutrition policy into a politically significant issue in Kerala and Tamil Nadu. At the federal level, chronic hunger and undernutrition did not attract political attention before the 2000s (Drèze, interview). This is slowly changing, although at the vanguard are not mass movements but rather elite-led civil society.

2. Elite/Poor Alliances

The second hypothesis states that alliances between politically powerful elites and the rural poor (or their representatives) were a strong mechanism by which

the Right to policymakers were pressured to enact food, nutrition, and health policy reforms over the past decade.

"*Step 1: Such alliances existed in India during the reform periods, and they prioritized food, nutrition, and health policy reforms".*

Alliances between elites and the rural poor around ICDS and PDS do exist in present-day India: the Right to Food Campaign is a network of organizations led by health professionals, academics, and lawyers, but which has strong relationships with local and regional activist groups throughout the country. As the previous hypothesis noted, the Campaign does not yet have mass direct representation from the rural poor at the federal level, but many of its constituent organizations act are indeed rural-based and active in local-level issues involving poor people's socio-economic rights.

Such alliances were not prominent in the Kerala and Tamil Nadu experiences, especially given the class-based character of political contestation in the two states. One might say that political leaders in the Communist and DMK parties intentionally built their electoral base among poor communities to foster such alliances, but the intention of this hypothesis is to explore alliances between the rural poor and urban elites outside of formal political parties; rather, the role of parties and leaders are more pertinent to the next two hypotheses.

Summary: Step 1 is confirmed for the ICDS and PDS experiences, and rejected for the Kerala and Tamil Nadu narratives.

"Step 2: Such alliances wielded political power. The institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permitted such alliances to wield power".

For historically contingent reasons – namely, the personal connections that the leadership of the Right to Food Campaign has built over decades with high-ranking officials of the Congress Party, and especially Sonia Gandhi – the elite/poor alliance around ICDS and PDS reform does yield considerable political power. This power is most directly expressed through the heavy representation of the Campaign and its allies in Sonia Gandhi's National Advisory Council, a body that has been at the center of social policy debates since the rise to Congress back to power in 2004.

Summary: Step 2 is confirmed for the PDS/ICDS reforms. The rejection of Step 1 above for the Kerala/Tamil Nadu reforms leads to the rejection of this hypothesis as a whole, and thus the current Step 2 is not considered for the two states.

"Step 3: Policymakers responded to the demands of these alliances, not only in rhetoric but also in substantive political action".

The response of policymakers to alliance demands was again partially the result of historically contingent opportunity. In short, Sonia Gandhi and the UPA was looking for a campaign issue to contrast with the BJP's "India Shining" narrative, and the RtFC and its allies gave them one: persistent hunger and poverty in the face of growth, inequality that could and should be addressed by aggressive public action in the form of rights-based legislation.

And yet the campaign was only able to capitalize on these "lucky" contingencies because of their members' preparation. Take the example of Dr. Gupta's Breastfeeding Promotion Network of India. For over twenty years, BPNI has been doggedly advocating for a greater emphasis on breastfeeding, organizing meeting after meeting with Members of Parliament, various Ministries, the Planning Commission, and other important actors. When the time of considering the shape of ICDS reform came, the organization's tenacity and reputation for honesty gained its ideas a place at the table. The same story could be told about the push for PDS reforms, and in general the legislative push for a National Food Security Bill.

Summary: Step 3 is confirmed for ICDS and PDS reform.

Step 4: "This substantive action entailed enacting and effectively implementing food and nutrition policy reforms linked to alliance demands".

This chapter's narrative emphasized that the Right to Food Campaign has been tremendously influential in bringing about reform of ICDS and PDS in India over the past decade, both in terms of policy change (legislative reform of ICDS and PDS) and on-the-ground program performance (especially the improving record of PDS). Their accomplishments could not have occurred without the rise of Sonia Gandhi's Congress to power in 2004 and the interventionist decisions of the Supreme Court in the right to food case; but neither could reform have happened without extremely well organized, persistent, shrewd civil society action.

It is worth asking, in closing, why has this elite/poor alliance succeeded so profoundly when others in the past have failed. I suggest three answers to this question. First, the movement has been extraordinarily successful in keeping its membership unified around the central objective of reducing hunger and undernutrition, rather than splintering along lines of ideology or identity. The failure to maintain such cohesiveness undermined many potentially powerful rural movements in India's past. For example, farmers' movements in the years of the Green Revolution gained strength, but divisions developed around the issue of agricultural market liberalization in the early 1990s, largely because some producers would be hurt and others benefit from reform. Lower-class rural movements have often also been vulnerable to fissures of caste, roughly along the lines of labor-providing "Scheduled Castes" and "Scheduled Tribes" and the labor-employing "Other Backward Castes", group identities established by the

Indian government itself after independence (Vakulabharanam and Motiram 2011; Mahajan 1999).

The Right to Food Campaign has, to date, defused these potential threats in various ways. First, the campaign is strongly focused on individual rights rather than group entitlements, and has in fact criticized the newly proposed targeting system (discussed at length in the previous chapter) on the basis that, by using qualitative inclusion criteria to demarcate the "legitimately" deprived, it will create divisions among the poor (Drèze 2011b). The campaign itself utilizes language strongly evocative of the international human rights discourse, and by doing places the spotlight on the individual child, woman, and man rather than rely on the hazy terminology of the "poor" or "disenfranchised" or the only slightly less abstract and more divisive categories of caste and tribe.

Second, the campaign's leadership has recognized that a network composed of highly opinionated professionals from a wide array of disciplines requires a conscious effort to prevent differences from developing. As Dr. Vandana Prasad of the Public Health Resource Network said in an interview, the movement has developed conflict resolution and consensus building processes, and has tried to avoid depending on a "charismatic leadership" model in favor of a more inclusive decision-making process. Perhaps most importantly, the campaign's members have slowly built trust among each other by keeping debates transparent. Finally, the members of the network do share a common set of beliefs that could be roughly described as social democratic, Gandhian, and evidence-based. These shared ideas provide coherence to discussions on the direction of the movement.

Finally, the campaign has utilized a diversity of approaches to achieve their objectives, ranging from engaging with the media, seeking the support of champions within government, and supporting the judicial and legislative process by serving in advisory and watchdog roles. The value of such diversity is that opportunity begins to appear in many forms, through a supportive Minister here, a series of investigative articles there (Patnaik, interview). In addition, as the campaign gains power and confidence, decisions are being taken more strategically, based indeed on a conscious analysis of political economy. For example, the economist Jean Drèze – one of the highest profile members of the RtFC – recently resigned from Sonia Gandhi's influential National Advisory Council in order to send the message that the draft NFSB was considered by the campaign as far too weak. This action, however, was taken in the context of knowing that two other RtFC allies remained on the Council, which insured that the campaign's voice would continue to be heard by the Congress leadership (Sinha, interview).

In summary, the overall elite/poor alliances hypothesis is confirmed for the recent ICDS and PDS reforms, and rejected for the Kerala and Tamil Nadu case studies.

3. Personal Ideology

The third hypothesis states that the personal values and ideas of key actors were important contributors to the ICDS/PDS and Kerala/Tamil Nadu reforms.

"Step 1: In their formal and informal discourse, policymakers in India evinced ideas, beliefs, and values consistent with the goal of enacting substantive food, nutrition, and health policy reforms".

The personal ideologies of Prime Minister Manmohan Singh and Congress Party President Sonia Gandhi played important roles in pushing through reform. Ms. Gandhi was influential in including a strong redistributive policy component within Congress' Common Minimum Program in 2004 – the party's election manifesto and subsequent policy "to-do" list – as well as creating (and chairing) the National Advisory Council and pushing for the National Food Security Bill as a means to reforming PDS and ICDS.

Manmohan Singh himself, though viewed by some as a fiscal conservative, also deserves more credit than he usually receives for prioritizing redistributive social programs. His emphasis on undernutrition in major speeches was previously noted, but evidence of his progressive leanings is found even when examining the policy shift with which he is most strongly associated, the liberalization reforms of the 1990s, when Singh was Finance Minister under the P.V. Narasimha Rao government. The careful style and slow pace of those reforms were designed to reduce the risk of social instability (Manor 2011). The gradualism of Rao and Singh was of course driven by political self-interest – they had no desire to confront powerful interest groups with a stake in the License Raj – but also by ideas and personality. As Narasimha Rao was, Singh is a liberal social democrat at heart, evinced by both his 1990s unwillingness to impose "shock therapy" on the Indian economy to avoid forcing the burden of dislocation on the poor, and his

2000s (often quiet) championing of the redistributive role of the state in a time of rapid growth.

The ideological position of the Supreme Court is also relevant. The extraordinary "Interim Orders" released by the Supreme Court played a major role in pushing through the recent food and nutrition policy reforms, as discussed earlier. Such judicial activism is not unprecedented in India. The current decision is only the latest in a progression of steadily more radical judgments handed down by the Supreme Court over the last several decades. The surge in judicial assertiveness after the end of Indira Gandhi's Emergency period – manifest in at least three decisions pertaining to socioeconomic rights that interpreted the court's constitutional powers in very broad terms[42] – has been attributed to a general reformist judicial backlash against the future threat of executive authoritarianism, and an attempt to recover some of the legitimacy lost by the courts during the Emergency. The judiciary's activism has now reached the point that their unorthodox role as an institutional watchdog over social policy enacted by the other branches of government is generally (grudgingly) accepted by the political establishment.

However, in the view of one Commissioner of the Supreme Court assigned to the right to food case, Biraj Patnaik, the actions of the Court are less due to the ideological proclivities of the current members or a reaction to Indira Gandhi's

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[42] As mentioned earlier: Minerva Mills Ltd. vs. Union of India (1980), Olga Tellis vs. Bombay Municipal Corporation (1985), and Unni Krishnan vs. State of Andhra Pradesh (1993).

dominance than an objective and accurate recognition of what the constitutional role of the Court should be in India. In Mr. Patnaik's opinion, the issue centers on the enormous gap in India between the legal entitlements of individuals and actual practice, a gap explained largely by entrenched social discrimination. By taking such an interventionist stance in (for example) the right to food case, the court provides a necessary counter-balance to the executive's historical unwillingness to risk fomenting social unrest by confronting discrimination head-on (Patnaik, interview).

Whether the Supreme Court of India is fulfilling or exceeding its constitutional role, it cannot be disputed that the Court has proved again and again over the past three decades that it is, in terms of social legislation, one of the most progressive high judicial bodies in the world. Of course, the fact that the Court's decisions were backed by a powerful social movement and have received widespread, almost exclusively positive coverage from the major media provided "political cover" for the Court to act (Patnaik, interview). But the repeated willingness of the Court's judges to confront the state on social policy matters, whether due to individual ideology or the institutional nature of the organ itself, is unique, and cannot be easily explained as the result of impartial interpretation of the Indian Constitution.

Personal ideology also played a role in food policy reforms in Tamil Nadu, as regards with the institution of the midday meals scheme by M.G. Ramachandran. MGR, as he was known, frequently quoted his own experience with hunger as a child in justifying the enormous outlay from the state government on the meal programs (Harriss 1991). However, the majority of the other Tamil Nadu policies that are the focus of this study, especially basic health services, did not have particularly prominent political champions. In addition, the personal ideological commitment of among Communist party leaders in Kerala is hard to distinguish from the general party platform, and more broadly from a populist electoral strategy. Because the focus of this hypothesis is on individuals' own expressed ideas as distinct from the ideology of their parties, the hypothesis is rejected for Kerala, as well as for Tamil Nadu.

Summary: Step 1 is confirmed for the ICDS/PDS reforms, and rejected for Tamil Nadu and Kerala.

"Step 2: Policymakers had little political incentive to state or act upon these ideas, beliefs, and values –there was no political gain to be had by doing so".

Singh's government certainly did have political incentive to advance a redistributive agenda in 2004: the party ran on an 'excluded common man' platform to discredit the opposition BJP claims of legitimacy deriving from India's rapid economic growth. Yet, as noted above, evidence of Singh's commitment to social safety nets pre-dates the 2004 campaign. Sonia Gandhi's own focus on redistributive measures is also fueled by more than political opportunism: in the years since 2004, she has continually pressed for ambitious social reforms, particularly regarding the PDS and the National Food Security Bill, despite strong opposition from fiscal hawks within her government.

Summary: Step 2 is confirmed for the federal ICDS/PDS reforms.

"Step 3: The institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permitted such individual ideas, beliefs, and values to be translated into political action".

Manmohan Singh and Sonia Gandhi's overall policy approach of 'inclusive growth with strong social safety nets' played an important role in food and nutrition policy reform over the past decade. The UPA coalition's focus on social programs during their tenure was not only electorally expedient, but also driven by the personal commitment of the party leadership.

A couple of other points about the source of political ideas should be made in closing the discussion of this hypothesis. Along with pressure applied by civil society and the ideologically driven leadership of key policymakers, the recent willingness to entertain the possibility of food and nutrition policy reforms in India has been driven by what could be called a "cognitive change" among the policymaking community. In the introduction of this study, I noted that chronic child undernutrition is difficult to problematize politically, for various reasons: it is often an invisible problem, even at the household level; the families of undernourished children are weak political actors; the interventions required to combat stunting are multifarious and require complex coordination between government agencies; and a long-term commitment, longer than that of electoral cycles, is necessary for substantive progress.

And yet, in India, child undernutrition has indeed come to be considered one of the country's major social problems, as evidenced in discourse like the Prime Minister's address quoted earlier, as well as in the frequency of mention the issue gains in major media outlets. There are several reasons why this change is occurring.

First is the influence of epistemic communities, particularly experts in the nutrition and public health fields. The release of the WHO Child Growth Standards in 2006 and the subsequent reanalysis of NFHS-3 data put the international spotlight on India as the epicenter of global child undernutrition, as discussed in Chapter 1. Advocates in the Right to Food Campaign quickly seized upon the shocking data from NFHS-3 to argue the point that the country's liberalization-fueled growth had left the poor behind; undernutrition became a symbol of inequality. According to one interviewee, the subtle narrative of "the country has to bear the brunt of poverty together" that helped justify state ineffectiveness for decades was no longer convincing (Prasad, interview). There were clear winners in the rapid growth period, and the nutrition data seemed to suggest that there are also clear losers.

Also important in spurring policy action was the fact that nutrition technical messaging became clearer, thanks in large part to high-profile research like the World Bank's work on ICDS reform (Gragnolati and others 2006), the series on maternal and child nutrition in the pages of the highly influential international health journal *The Lancet* in 2008 (Black and others 2008; Victora and others 2008; Bhutta and others 2008; Bryce and others 2008; Morris and others 2008), the International Food Policy Research Institute's India State Hunger Index (Menon and others 2008; von Grebmer and others 2008), and – by highlighting "optimal" child care practices like exclusive breastfeeding during the first six months of life – the WHO Growth Standards themselves (Gupta, interview; Ramachandran, interview). These publications and others like them effectively confronted the multi-sectoral complexity of undernutrition's causation by focusing on systematic impact evaluation of interventions across sectors.

Another important factor is the increasing engagement of the media with food and nutrition policy (and perhaps also the higher literacy rates that permit higher readership) (Patnaik, interview). The relationship between media activity and government response is well documented, as discussed by Drèze and Sen (1988) as part of their argument for why post-independence India has been able to prevent famine. Besley and Burgess (2002), in an oft-cited paper, also looked at whether government responsiveness is associated with media activity across states in India between 1958 and 1992, and find that, controlling for a wide range of socio-economic and demographic factors, newspaper circulation is strongly and robustly associated with PDS provision; a one percent increase in circulation leads to a 2.4 percent increase in public food distribution per capita. Partially because of civil society's efforts, and partially because the UPA governments have made redistributive policies the centerpiece of their legislative agenda, hunger and inequality issues have commonly appeared in newspaper headlines since the 2004 elections (Patnaik, interview).

Summary: The hypothesis is confirmed for the recent federal level reforms around ICDS and PDS, and reject for the Kerala and Tamil Nadu experiences.

4. Party Ideology

The final hypothesis states that party ideology constructed by ideational influences was a strong force driving policymakers to enact food, nutrition, and health policy reforms over the past decade.

"Step 1: Party ideas and values were consistent with the goal of creating a policy environment favorable to food, nutrition, and health policy reforms."

The Congress Party was founded on, and continues to espouse in its rhetoric, a social-democratic ideology. Its policy focus, as stated in the party manifesto and in the statements of its leadership, is strongly on the basic needs of the poor, including food, nutrition, and health entitlements (Congress Party of India 2009).

Similarly, the policy platforms of the DMK factions in Tamil Nadu as well as the Communist Party in Kerala (and Kerala's Congress Party, which is ideologically to the left of other state Congress delegations) are highly redistributionist in character, the result of decades of contestation in heavily populist state political arenas.

Summary: Step 1 of the party ideology hypothesis is confirmed for both the ICDS/PDS reforms and the Kerala/Tamil Nadu reforms.

"Step 2: The party had little political incentive to express or act upon these ideas and values. The party's expression of these ideas and values was consistent over time."

The policy performance of both Congress and the various DMK factions with respect to these ideals is, however, inconsistent over time. Rather, the degree to which reform efforts have been pursued appear, with a few exceptions, to have been more strongly correlated to electoral opportunism and the ideology of current party leadership rather than a robust party ideological core. While PDS and ICDS reform efforts at the federal level have been discussed several times over the past decades, it was not until the ascent of Singh and Gandhi to power in 2004 that substantive action took place.

In contrast, the Communist parties in Kerala have run since Independence – across many changes in leadership – on a consistently redistributive platform, with a heavy emphasis on expansion and improvement of basic health and education services. Kerala's high voter turnout among the poor and history of social mobilization certainly creates a political incentive for such a platform. However, despite the state's mounting fiscal deficits in recent years and external pressure from lenders to reduce the size of government, the Communists have resisted any rollback of social programs.

<u>Summary</u>: Step 2 is rejected for Congress at the federal level and the DMK factions in Tamil Nadu. The step is confirmed for the Kerala case.

"Step 3: The institutional environment – formal and informal political, sociocultural, and market norms, as well as state bureaucracies and organizations – permitted such party ideas and values to be translated into political action".

The ideologies of Kerala's leftist parties were indeed translated into a focus on providing basic services for the poor. The institutional environment facilitated policy action. Gender equality, a deep history of anti-caste mobilization, and trade unionization were especially important. More equitable gender norms than in other Indian states had the consequence of pushing women's issues to a higher profile on the political agenda. Anti-caste mobilization, beginning a hundred years before Independence, slowly developed into a powerful trade union movement and eventually class-based political organizations.

In summary, the party ideology hypothesis is confirmed for the Kerala case, and rejected for the federal-level and Tamil Nadu reforms.

The results of the four hypotheses tests above can be summarized in chart form (Table 32).

Table 32. Results of hypotheses tests, India reforms.

REFORMS	HYPOTHESIS	Step 1	Step 2	Step 3/4	Result
ICDS: Federal, 2000s	Mass movements				REJECTED
	Elite/poor alliances	■	■	■	CONFIRMED
	Personal ideology	■	■	■	CONFIRMED
	Party ideology	■			REJECTED
PDS: Federal, 2000s	Mass movements				REJECTED
	Elite/poor alliances	■	■	■	CONFIRMED
	Personal ideology	■	■	■	CONFIRMED

REFORMS	HYPOTHESIS	Step 1	Step 2	Step 3/4	Result
	Party ideology	■			REJECTED
Kerala: Health Policy, 1970s/1980s	Mass movements	■	■	■	CONFIRMED
	Elite/poor alliances				REJECTED
	Personal ideology				REJECTED
	Party ideology	■	■	■	CONFIRMED
Tamil Nadu: Health and Nutrition Policy, 1970s/1980s	Mass movements	■	■	■	CONFIRMED
	Elite/poor alliances				REJECTED
	Personal ideology				REJECTED
	Party ideology	■			REJECTED

The chart illustrates that the forces propelling change in the recent federal level reforms differed from those underlying the accomplishments of Kerala and Tamil Nadu. A combination of elite/poor alliances – that is, the network of organizations that comprise the Right to Food Campaign – and ideologically-driven leadership from the top ranks of the Congress Party and India's Supreme Court drove the long-awaited improvements in the Integrated Child Development Services Scheme and the Public Distribution System. In contrast, mass movement pressure pushed the widespread provision of basic health services in Kerala and Tamil Nadu, as well as the specific focus on child nutrition in the latter state. The fact that Kerala's political dialogue is well to the left of most other Indian states was not only the historical outcome of mass movement action, but now also, in a positive feedback cycle, contributes to the continuing influence of these movements. A pro-poor populism is the political norm in both Kerala and Tamil Nadu.

* * *

The chapters of Part IV have looked at why, on the one hand, high stunting rates prevail in so much of India despite high rates of economic growth, and, on the other, how major food, nutrition, and health policy reforms have occurred, recently at the federal level and over the past few decades in Kerala and Tamil Nadu. I suggested in Chapter 10 that geographical and sectoral exclusion of the poor from growth, persistent social inequality, and a weakly functioning social safety net were responsible for the country's high stunting prevalence. In Chapter 11, I performed cross-state regressions to show that demographic and environmental factors were the most powerful determinants of variation in stunting in India. In Chapter 12, I argued that the historical failure of food and nutrition programs to reduce undernutrition was due to a range of political economy constraints, including the political irrelevance of ICDS and endemic corruption with PDS. I then asserted that the recent dramatic wave of policy action at the federal level to reform the programs was the result of civil society pressure and committed leadership within both the executive and judicial branches. I also looked at the historical success of Kerala and Tamil Nadu in reducing stunting, and concluded that mass movement pressure succeeded in deeply embedding class-focused issues, especially around the delivery of basic services, in the political arena.

In closing, it is important to state that food and nutrition policy reform in New Delhi will not automatically lead to stunting reduction among India's rural poor; the kind of electoral accountability that has been institutionalized in Kerala and Tamil Nadu would also be needed to transform radical reforms into nutritional impact. In early January 2012, the results for the nationwide “Hungama” survey were released, and the nutrition situation in the country appears to have shown little improvement. Hungama, conducted by the non-profit Naandi Foundation in one hundred of the poorest districts of the country,[43] found a stunting prevalence among preschool children of 58.8%, with 34% severely stunted, both truly distressing figures. This data is not comparable with the countrywide (all-district) NFHS-3 data from six years ago, but the results are cause for concern nonetheless: Hungama covers about one-fifths of India’s child population (Naandi Foundation 2012).

Despite this distressing picture, it is also no exaggeration to say that political priorities at the federal level in India have indeed dramatically changed in the past decade, not just with regards to nutrition, but around poverty and inequality generally. Issues like diversion of resources due to bureaucratic corruption and lack of enforcement of minimum wage laws, to name just two, which were once accepted by policymakers with a shrug of the shoulders have been become political flashpoints (Drèze, interview). As Biraj Patnaik, Commissioner to the Supreme Court on the right to food case, noted in an interview, just five years ago the idea of hunger being a “top ten” political issue in India would have seemed laughable (Patnaik, interview). The pace of change has truly been breathtaking, but there is much work to be done.

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[43] The districts are in Bihar, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, and Uttar Pradesh.

Conclusion. Comparing Theory, Quantitative Analysis, and Case Studies

I began this study by presenting a curious empirical puzzle. Globally, few countries have managed to make rapid progress against chronic child undernutrition (Chapter 1). The reasons for such weak performance are many: the complex etiology of stunting, which necessitates a variety of interventions across sectors and is not amenable to narrow technocratic solutions; the invisibility of stunting's symptoms, to policymakers and households themselves; the lack of political voice among the poor rural households at greatest risk for undernutrition; and the dissonance between the time frame of stunting's consequences and electoral cycles.

And yet, in a few countries and regions of the world, stunting has in fact dramatically declined. I set out to understand the reasons for these successes, and investigate whether such reasons are generalizable across contexts. In this final chapter, I review the research as a whole, and compare results from the quantitative cross-country and cross-state econometrics with the qualitative case studies from Northeast Brazil and the federal- and state-level reforms in India.

I start by returning to the conceptual framework first shown in Figure 8 of Chapter 4, reprinted below. Recall that the figure was constructed from a review of the literature, both of the determinants of child undernutrition at the household and policy levels (Chapter 2) and of the determinants of pro-poor political action

(Chapter 3). The household literature highlighted growth in rural incomes, improved maternal knowledge and gender inequality, and improved public health conditions as the proximate causes of improvement in child nutritional status. Policies pertaining to direct nutrition interventions, food prices, smallholder agricultural productivity and agricultural labor wages, social protection (especially cash transfers), basic health services, and female school enrollment were identified as the most critical in stunting decline, although the magnitude of their impact varied greatly across countries.

The political economy literature, meanwhile, was roughly bifurcated into interest-based and ideas-based theories. Interest-based theories emphasized the role of self-interested power-maximization in shaping the behavior of key policymaking actors, especially the executive, the bureaucracy, and societal pressure groups. Ideational theories focused rather on how values and beliefs, some shaped by durable social and political norms and others by the personal experience of individuals, influenced the decisions of actors. Many authors in the literature also highlighted the role of historically contingent factors, including macroeconomic circumstances, the perception of crisis, and deep historical legacies (e.g., colonialism) in creating the bounds for policy action.

Building on this literature and the UNICEF conceptual framework on the determinants of child undernutrition, the conceptual framework for this study was presented:

I began the analysis in Part II by constructing two closely related reduced-form econometric models, one focused on policy determinants and the other on political economy factors, to measure some of the key relationships implied by the conceptual framework (Chapter 5). I then estimated cross-country specifications using data from 143 countries, largely from the 1990s and 2000s (Chapter 6).

I found that educational attainment and income growth are indeed strong correlates of lower stunting. An additional year of schooling is associated with a

1.8 to 2.6-percentage point drop in stunting. Income growth matters especially for poor countries: doubling GDP per capita leads to a 6.6 to 8.7 percentage point fall in stunting. However, the other policy predictors anticipated by the literature, including maternal and child health policy, safe water, and subsidies to food producers and consumers, failed to have a significant and robust association with child nutrition. Other variables more difficult for policymakers to control are also strongly significant predictors of stunting. Malaria risk, a proxy for health-related environmental threats, is especially important at the lower end of the range (as countries move from moderate to low risk). Demographic factors are also important. A five-unit increase in dependency ratio equals a one percentage point increase in stunting, suggesting that young populations strain available resources and increase the risk of undernutrition (this result, as well as that for malaria risk, is reinforced by the cross-state India regressions in Part IV). Other control variables highlighted as key determinants of nutrition in the literature were not important in this study's cross-country regressions; sex ratio (a measure of gender equality), global agricultural input and output prices, and macroeconomic volatility had little effect. In the political economy model, the ideology of the executive, the level of democratization, and electoral competitiveness had no significant correlation with stunting. Conflict and ethno-linguistic fractionalization were indeed associated with nutritional status, but only weakly.

These results are surprising, particularly given the relatively large sample size, strong data quality, use of lagged values to deal with reverse causality, and employment of a reduced-form model to reduce the threat of endogeneity-biased parameter estimates. Yet, as discussed further below, when considered together with the results of the case studies, they reinforce the overall conclusion of this study that no 'silver bullet' policy or political solutions to chronic undernutrition exist: there are indeed viable pathways to dramatic reductions in stunting, but these pathways are not strongly generalizable across contexts and can often involve indirect, unexpected policy and political solutions.

This contention is further supported by two observations about the nature of the cross-country dataset. First, variation in stunting rates *does* actually exist, both across and within countries over time. Thus the dearth of strong generalizable correlates of nutritional variation is not the result of a lack of good change: something is indeed driving positive developments in child nutrition. Second, despite the individual weakness of many of the variables used in the model, the overall explanatory strength of both the pooled and random effects specifications used in Part II is extremely high, accounting for between 70-80% of variation in stunting. Thus the included variables do, together, comprise a powerful framework for explaining the phenomenon of stunting (and, given their prominence across specifications as well as in the literature, are unlikely to be only picking up the effects of omitted variables): we have indeed identified the "right" variables. But the simultaneous fact of their collective strength and individual weakness suggests, again, that the influence of each differs across observations in the dataset.

I then turned in Part III to a political economy analysis of one of the world's greatest nutritional success stories, Northeast Brazil, where stunting fell 90% in just over three decades. Whereas in the mid-1970s over half of all preschool children in the region were stunted, as of 2006 this prevalence had been reduced to just under six percent. I adopted a “top-to-bottom” approach to the Brazil analysis vis-à-vis the conceptual framework, beginning with temporal variation in stunting and working my way through policy drivers and ultimately the political forces underlying policies. I began by separating the country’s post-1974 (the year of the first reliable stunting observation) history into five distinct periods characterized by pace of stunting reduction and prevailing political economy conditions: 1) moderate reduction in the fast economic growth military period (1974-80); 2) no reduction in the recession military regime (1981-85); 3) no reduction in the hyperinflationary period (1986-93); 4) very rapid reduction, Cardoso democratic (1994-2002); and 5) very rapid reduction, Lula democratic (2003-07).

I began by looking at the first three of these periods in Chapter 7. I found that stunting did fall appreciably in between 1974 and 1980, driven almost solely by absolute pro-poor growth and slowly improving health services; there was little redistributive effect during this time. Though mildly effective regional development mechanisms did exist, the nutritional gains did not arise from policies targeted at the Northeast specifically. Rather, a focus on export-oriented industrial development for the nation as a whole lifted the incomes of the poor. Some focused efforts to improve rural health services in the early 1970s did eventually have an impact on child mortality and fertility rate in the areas of the country where these were most problematic, especially in the Northeast, and this also played a key role in stunting reduction.

Most of the remarkable decline in stunting prevalence in the Northeast occurred during the Cardoso and Lula administrations, however. I conclude in the historical narrative of Chapter 8 and the process-tracing analysis of Chapter 9 that the synergistic effect of orthodox economic reform and inequality-reducing social protection policy was responsible for the nutritional gains. President Fernando Henrique Cardoso's unflinching personal commitment to macroeconomic stabilization and his adroit statecraft in overcoming the entrenched political opposition to inflation control played a major role in the 1990s in reducing poverty. His successor, President Luiz Inácio "Lula" da Silva, built on this success by expanding social protection programs that were pivotal in reducing the country's strikingly high level of income inequality.

The top-to-bottom approach to the Brazil case study revealed that the key to stunting reduction in the Northeast was not in fact linked to a "political economy of nutrition". Rather, improvements in nutrition came about as an unintended positive externality of Cardoso's pursuit of stabilization and Lula's focus on inequality. Both leaders had to overcome imposing political obstacles on the way to realizing these policy objectives, but these obstacles had little direct connection to nutrition itself. The message is that policy design around nutrition can itself benefit from a "top to bottom" conceptual approach, wherein the priority should be to identify which policies (including those outside the nutrition field) have the greatest potential for reducing stunting rapidly given the prevailing economic and health conditions in a country, rather than assuming a priori that a specific set of narrowly focused interventions are necessary. The successful execution of such high-impact policies still depends on skillful navigation of political economy opportunities and constraints, but the sometimes intractable problems of food and nutrition policy reform – political invisibility, the need for long-term commitment, logistical complexity – can be avoided in this way, at least in the short-term.

Such political problems around food and nutrition policy are a large part of the reason why India, the subject of Part IV, has been unable to significantly reduce stunting despite its recent burst of economic growth. In Chapter 10, a review of the literature and of secondary data finds that three factors are responsible for the persistence of child undernutrition in the country: geographical and sectoral exclusion of the poor from growth, stubborn inequality-perpetuating social institutions (especially pertaining to gender and caste), and the reality that the country's massive food and nutrition programs have historically been plagued by corruption and clientelism, ambivalent and often incompetent implementation, and general political irrelevance. The result is that, as of 2005, nearly half of India's children remained stunted, and a quarter severely so: devastating statistics for a nation that contains nearly a fifth of the world's children.

However, there is considerable variation in stunting prevalence across states in India, and this provides an opportunity to investigate the determinants of such variation using the policy and political models built in Part II. I do so in Chapter 11, and reach very similar results as in the cross-country econometric estimation exercises in Chapter 6, although the small sample size suggests that the conclusions be accepted cautiously. Again, the explanatory power of the models is strong, with around three-fifths of the variation in stunting accounted for by the included variables. Policy factors are again, surprisingly, very poor predictors of child nutritional status – and this time, even educational attainment and income have no significant correlation with stunting. Fertility rate (used in place of dependency ratio) and malaria risk are again the most powerful explanatories, particularly the former. In contradiction to the large literature arguing that political economy factors in India are important causes of variation in social welfare, I find no association between electoral competitiveness, voter turnout, or party ideology and stunting prevalence, once controlling for demographic and environmental variables. Sex ratio, used as a proxy for norms around gender equality, also has no effect – again, an unexpected result given the wide variation in sex ratio across Indian states, its strong bivariate correlation with stunting, and the extensive past literature tying exactly this proxy variable to the differences in child health outcomes across states.

The cross-state results send the same message as the cross-country analysis: the forces driving a particular experience of variation differ across political units, though a generalizable set of factors appear to underlie good change in child nutrition. In Chapter 12, I turn to some of these "particular experiences", focusing on the positive reforms around food, nutrition, and health policy that have occurred in India, and analyze the reasons for their occurrence. I look at three reform experiences in particular. First, at the federal level, I describe the radical changes of the last decade in two of India's most expansive social programs: the maternal and child health-focused Integrated Child Development Services scheme and the food subsidy Public Distribution System. I then turn to two of India's top nutritional performers, Kerala and Tamil Nadu, and look at the health and nutrition policies that are responsible for their relatively low stunting prevalence. In contrast to the Brazil chapters, I focus on food, nutrition, and health policy reforms themselves and their political determinants, rather than starting from the phenomenon of lower stunting and working down to policies.

The reforms themselves are profound. The world's largest food aid network, India's Public Distribution System, is currently undergoing a massive overhaul that will improve food grain access by the poor and create, for the first time in the program's history, a system of oversight and grievance redressal to arrest the diversion of resources. Budgetary commitments for another "world's largest", the Integrated Child Development Services scheme, have more than quadrupled in India's most recent five-year plan, and the new design of the program focuses more strongly on the first thousand days of a child's life, introduces new entitlements such as maternity benefits, and increases the amount of community health worker resources on the ground. In Kerala and Tamil Nadu, access to basic health services, especially maternal and child health care, is nearly universal – reaching coverage levels close to those in the developed world – and of a relatively high quality, in stark contrast to the gaping holes in rural health infrastructure in most of the rest of India. In Tamil Nadu, a specific focus on child nutrition has led to massive budgetary outlays on food and health interventions targeted at under-5s.

I find that these changes are the result of several forces working in concert. One is a well-organized alliance between elite activists and representatives of the rural poor: the remarkably effective Right to Food Campaign, a cross-disciplinary social movement of activists and academics. The Campaign has extraordinary links with the highest levels of power, especially with the leadership of the Congress Party, cultivated over decades of policy advocacy. The movement found political opportunity in the form of Congress' return to power in 2004, buoyed especially by the commitment of the party's leaders, Sonia Gandhi and Manmohan Singh, to redistributive social programs. In addition, a cognitive change among policymakers has been both a driver and a result of reform: there is now widespread recognition, manifest in mass media and in policy debates, that child undernutrition is one of India's gravest problems. This change is the result of both domestic and international technical advocacy, as well as the increasing engagement of mass media with nutrition and food security issues.

The political forces responsible for reforms in Kerala and Tamil Nadu are somewhat different than those operating at the federal level. In both states, deep-rooted historical mass mobilization against caste discrimination eventually evolved into powerful class-based political organizations. The political dialogue in both states is characterized by policy populism, with a remarkably constant and intense focus on the delivery of basic services to the poor, especially in the health and education sectors. Unlike in the rest of India – at least until recently – elections are won or lost on the basis of social policy; food and nutrition policy specifically is especially politicized, particularly in Tamil Nadu.

* * *

Taken as a whole, what are the overall implications this body of research? I contend that the most powerful message is this: **improvements in most or all of the policy and political variables in the conceptual framework are necessary for poor countries and regions to attain developed-world nutrition levels, but the determinants of marginal improvement at any given level are not consistent across political units.** This study has pursued generalizable answers, but rather reached the conclusion that while our broad conceptual understanding of the policy and political causes of chronic undernutrition is defensible, our operationalization of this understanding depends strongly on correctly diagnosing the political opportunities in each given context.

To argue this point, and in closing this study, I return to two theoretical dichotomies critical to the understanding of how good change happens with respect to the political economy of child nutrition: the role of interests versus ideas in bringing about change, and the pattern-based versus historical approach to analyzing change.

These dichotomies are admittedly less real than they are heuristic. Clearly interests and ideas both matter in policy formulation, and the econometric results as well as the Brazil and India case studies have shown us that the relative contribution of each is very difficult to ascertain in any kind of objective sense. Just as clearly, patterns of political behavior – on the part of policymakers as well as other societal interests – are identifiable and useful, but the role of historical contingency is permitting or restricting actions also appears to be critical. Yet there is value in presenting the arguments for both sides of each debate: by doing so, we may better understand how to integrate the approaches to gain analytical traction – that is, to produce the "truest" explanation of events.

We have seen in both the Brazil and India case studies that the interests of policymakers were influenced by the political power of the poor or their representatives, in electoral or other bargaining forums. In Brazil, the Workers' Party strongly pushed the political debate towards issues of poverty and inequality and propelled the redistributionist Lula administration to power. In India, the desire to capture the poor vote led Congress to include food and nutrition policy reform on its platform in the 2004 elections, and the perceived electoral impact of these reforms has sustained the will for further food and nutrition-related legislation in its second term. In Kerala and Tamil Nadu, mass movements have firmly, and perhaps irrevocably, placed issues of public service delivery into the locus of political contestation. Especially in the context of deepening democratization, in which both Brazil and India are immersed, the ability of the poor to express their interests matters immensely to address chronic undernutrition.

However, the effect of democratization on policy reform varies greatly across contexts. We have seen in Brazil and across Indian states that the degree of party competition matters less than the ability of parties and mass movements to create a class-based dialogue. Having a viable challenger that poses a consistent electoral threat to a dominant party can help towards this end, as can the increased participation of poor voters; but neither of these is a guarantee that issues around poverty will become electorally important. Rather, legacies of mobilization matter deeply, as in the case of the Worker's Party in Brazil and anti-caste (later class-based) movements in Kerala and Brazil.

The type of political participation matters as well. Without 1) a active engagement in intelligent public debate, which informs preferences in the voting booth, and 2) a genuine recognition of oneself as a rights-holder vis-à-vis the state, the value of democracy is restricted to the exercise of choosing leaders periodically, without strong accountability between elections (Sen 1999; Heller 2011). We have seen in the case of India that civil society is indeed helping fuel debate about the status of the poor during India's present high-growth period. The second issue above is being addressed by the transformation, largely as a result of judicial intervention, of existing discretionary benefits like PDS and ICDS into entitlements that are explicitly rights-based. The movement towards authentic rights-based accountability has been slow and subtle, but it could be argued – and in my view, *should* be argued – that the Indian state is under more pressure in the present time to protect the lives and livelihoods of the poor than at any point in its independent history.

We have also seen in the Brazil and India histories, however, that personal ideology is as important as interests. What has mattered in driving the federal reforms in both countries is not so much a partisan leftist government coming to power, but rather a mix of social progressivism and economic pragmatism. All three of the federal political administrations looked at in the case studies, those of

Cardoso, Lula, and Singh, exhibit this mix. Each government pursued or maintained macroeconomic stability through orthodox means and deepened economic liberalization while simultaneously expanding the social safety net. It should also be noted this dual-track approach necessitated a departure from fiscal conservatism; all three administrations were willing to pay the cost of greater social protection, and saw both economic growth and increased borrowing as a means to do so. Neither does the Tamil Nadu experience contradict this narrative: the DMK factions in the state are less progressive than they are populist, and the form of populism in which they engaged (or are forced to engage by mass movements) has powerful implications for food security, nutritional, and health outcomes. Kerala is the one case study location where a strongly ideologically leftist party, the Communists, has shaped social policy, but even here the Communists have alternated rule with the center-left Congress.

The ideological commitment of leaders does not exist in an epistemic vacuum, and we have seen in the case studies evidence of cognitive change among the policymaking community not entirely arising from personal interests. In Brazil, nearly a decade of learning from failed attempts to control hyperinflation – learning not just about policy prescriptions, but also about political strategies to implement such politics in the face of entrenched opposition – finally led to a realistic and effective approach in the form of the Plano Real in 1994. Spurred especially by the land reform movement, the issue of inequality slowly became central to the country's political dialogue, catalyzing the rise of the Workers' Party and the election of Lula in 2002. In India, domestic advocacy from the

Right to Food Campaign and international pressure from multilateral organizations, especially the World Bank, has pushed nutrition issues to prominence on the political agenda. Further, a broader cognitive change in society on issues like inequality – issues broader than child undernutrition – is indeed a prerequisite for the recent ICDS and PDS policy reforms profiled in Chapter 12 to show results on the ground. For ICDS reforms to function at the district level, for example, local government functionaries will have to adopt a culture of accountability, both to mandates coming from above (e.g., through acceptance of monitoring and evaluation system) and to rights-based claims from "below", i.e., from the public they serve (Swain and Sen 2009). As daunting as the task of problematizing child undernutrition may have been, the process of institutional change around millennia-old norms of equality, rights, and accountability may be even more difficult, although the experiences of Kerala and Tamil Nadu show that it is possible.

The interests versus ideas conversation leads us into the second debate: if both interests and ideas matter, is analysis of policy change best limited to a narrowly historical approach, a surrender to the reality of "just one damned thing after another", in the famous phrase of Arnold Toynbee? Or are there patterns to be discerned – if not laws – that could prove to be of analytical value in other contexts, and perhaps even have predictive power?

Again, this study suggests evidence for both sides of the debate. The key message of the econometric studies has already been stated: the conceptual framework is reasonably accurate (patterns matter) but the road to change may differ greatly from one place to another. A similar message arises from the two case studies. General mechanisms played an important role in producing the policy shifts that reduced stunting in Brazil and led to sweeping reforms in India, but certainly historical contingencies appear to have been crucial in permitting or sustaining the impact of these general factors. For example, it appears that the strength of the poor, as a voting bloc in democratic elections and as active rights-seekers between elections, is essential to compelling policy change. But because the willingness of governments to take their constitutional and legislative rules seriously is both a prerequisite and the outcome of such political strength, a detailed historical narrative is necessary to determine how the empowerment of the poor, policy change, and other factors (e.g., leadership committed to rule of law, macroeconomic shocks with political consequences) actually interacted. The Kerala and Tamil Nadu narratives indicate that there may be some commonalities within an institutional context – for example, the ability of an anti-caste movement to evolve to consider class issues – but the pathways by which these changes happen may be very different across political units.

Similarly, the ideological preferences of individual leaders could be seen as the outcome of highly contingent factors, including personal experiences, scholarly training, and so on. Yet it could also be argued from the Brazil and India narratives that the political climate in both countries – especially weak economic growth and deeply entrenched income and social inequality – lent appeal to a particular ideology, that of economic liberalism and social progressivism. In other words, Cardoso, Lula, and Singh could be seen less as idiosyncratic individuals than as carriers of a certain ideology, the demand for which already existed in the voting public, waiting to be expressed. The historical counter-argument would be that, while this ideology may be present in many political leaders, only a few are skillful enough at their craft to produce policy results.

In the end, one is left with the conclusion that what matters is the interaction of interests and ideas, laws and contingencies; to focus on one side of the dichotomy in isolation is to cheat either history, on the one hand, or the social-scientific study of political economy, on the other. The econometric models suggest the same: the universal framework is accurate, but context matters.

In closing, I admit that the great hope of this research, perhaps like too many a doctoral thesis, was to find generalizable mechanisms underlying the political economy of child nutrition – in other words, to privilege patterns. In the end, however, I have learned that the study of good change does not lend itself to nice, neat answers. History matters deeply. In the process, however, I have also learned that reliable conceptual frameworks and structured tools enable one to ascertain exactly which aspects of history matter in any given place, and perhaps provide clues as to which may matter in another place. In any case, learning how to live with the question well, rather than striving to be content with a final answer, is what perhaps pulls us – researchers and policymakers both – closer to being agents of good change ourselves.

APPENDIX A: Stunting Prevalence Observations in the WHO Database on Child Growth and Malnutrition

country	year	age group	st3sd (severe stunting)	st2sd (total stunting)
Afghanistan	1997			0.532
Afghanistan	2004	.5-5	0.318	0.593
Albania	1997			0.204
Albania	2005	0-5	0.116	0.270
Algeria	1992	0-5		0.235
Algeria	2005	0-5	0.054	0.159
Argentina	1994	0-5		0.071
Argentina	2004	.5-5	0.018	0.082
Armenia	1998	0-5	0.063	0.151
Armenia	2005	0-5	0.043	0.182
Azerbaijan	2000	0-5	0.103	0.241
Azerbaijan	2006	0-5	0.135	0.268
Bahrain	1989	0-5		0.139
Bahrain	1995	0-5		0.136
Bangladesh	1991	.5-5	0.437	0.767
Bangladesh	2007	0-5		0.450
Benin	2001	0-5	0.173	0.391
Benin	2006	0-5	0.237	0.447
Bolivia	1981	0-5		0.486
Bolivia	2008	0-5	0.078	0.272
Bosnia-Herzegovina	2000	0-5	0.046	0.121
Bosnia-Herzegovina	2006	0-5	0.057	0.118
Brazil	1996	0-5	0.039	0.135
Brazil	2006	0-5	0.015	0.071
Burkina Faso	1992	0-5	0.187	0.407
Burkina Faso	2006	0-5	0.238	0.445
Cambodia	1996	0-5	0.334	0.586
Cambodia	2008	0-5	0.173	0.395
Cameroon	1991	0-5	0.170	0.363
Cameroon	2006	0-5	0.169	0.364
Chad	1996	0-5	0.249	0.450
Chad	2004	0-5	0.269	0.448
Chile	2001	0-5		0.028
Chile	2002	0-5		0.025
China	1992	0-5		0.376
China	2005	0-5	0.034	0.117
Colombia	1965	0-5		0.381
Colombia	2004	0-5	0.035	0.162
Cote d'Ivoire	1998	0-5	0.127	0.315
Cote d'Ivoire	2006	0-5	0.195	0.401
Czech Republic	1991	0-5		0.031
Czech Republic	2001	0-5	0.006	0.026

country	year	age group	st3sd (severe stunting)	st2sd (total stunting)
DPR Korea	2000	0-5		0.510
DPR Korea	2004	0-5		0.431
DR Congo	2001	0-5	0.252	0.444
DR Congo	2007	0-5	0.246	0.458
Dominican Republic	1991	0-5	0.070	0.212
Dominican Republic	2007	0-5	0.026	0.101
Ecuador	1986	0-5		0.402
Ecuador	2004	0-5	0.083	0.290
Egypt	1978	.5-5		0.438
Egypt	2008	0-5	0.161	0.307
El Salvador	1975	.5-5		0.562
El Salvador	2002	0-5	0.063	0.246
Equatorial Guinea	1997	0-5	0.196	0.387
Equatorial Guinea	2004	0-5	0.137	0.350
Ethiopia	2000	0-5	0.318	0.574
Ethiopia	2005	0-5	0.283	0.507
Gambia	2000	0-5	0.084	0.241
Gambia	2005	0-5	0.106	0.276
Ghana	1998	0-5	0.130	0.313
Ghana	2008	0-5	0.109	0.286
Guatemala	1995	0-5	0.297	0.554
Guatemala	2002	0-5	0.269	0.543
Guinea	1994	.25-5		0.353
Guinea	2007	0-5	0.207	0.400
Guinea-Bissau	2000	0-5	0.167	0.361
Guinea-Bissau	2008	0-5	0.092	0.281
Guyana	2000	0-5	0.048	0.138
Guyana	2006	0-5	0.079	0.182
Haiti	1994	0-5	0.189	0.372
Haiti	2005	0-5	0.104	0.297
Honduras	1987	0-5		0.433
Honduras	2005	0-5	0.096	0.299
Indonesia	2000	0-5	0.158	0.424
Indonesia	2007	0-5	0.21	0.401
Iraq	2000	0-5	0.094	0.283
Iraq	2006	0-5	0.121	0.275
Jamaica	1978	0-5		0.166
Jamaica	2007	0-5		0.037
Jordan	1990	0-5	0.057	0.205
Jordan	2009		0.018	0.083
Kazakhstan	1999	0-5	0.039	0.139
Kazakhstan	2006	0-5	0.068	0.175
Kenya	1993	0-5	0.175	0.402
Kenya	2008	0-5	0.144	0.352
Kuwait	2001		0.013	0.04
Kuwait	2009		0.013	0.038
Laos	2000	0-5	0.252	0.482

country	year	age group	st3sd (severe stunting)	st2sd (total stunting)
Laos	2006	0-5	0.207	0.476
Lebanon	1996	0-5	0.055	0.172
Lebanon	2004	0-5	0.098	0.165
Lesotho	2000	0-5	0.3	0.53
Lesotho	2004	0-5	0.203	0.452
Liberia	1999	0-5	0.231	0.453
Liberia	2006	0-5	0.207	0.394
Libya	1995	0-5		0.207
Libya	2007	0-5	0.105	0.21
Macedonia	1999	.5-5	0.026	0.08
Macedonia	2005	0-5	0.042	0.115
Madagascar	1992	0-5	0.319	0.609
Madagascar	2008	0-5	0.263	0.492
Malawi	1992	0-5	0.286	0.558
Malawi	2006	0-5	0.269	0.532
Maldives	1994	0-5	0.125	0.361
Maldives	2001	0-5	0.145	0.319
Mali	2001	0-5	0.235	0.427
Mali	2006	0-5	0.2	0.385
Mauritania	1990	0-5	0.341	0.548
Mauritania	2008	.5-5	0.063	0.242
Mexico	1988			0.287
Mexico	2006	0-5	0.045	0.155
Mongolia	1997	0-5	0.128	0.311
Mongolia	2005	0-5	0.099	0.275
Morocco	1987	0-5	0.134	0.345
Morocco	2003	0-5	0.098	0.231
Myanmar	2000	0-5	0.164	0.408
Myanmar	2003	0-5	0.163	0.406
Namibia	1992	0-5	0.136	0.357
Namibia	2006	0-5	0.104	0.296
Nepal	1997	.5-5	0.283	0.611
Nepal	2006	0-5	0.203	0.493
Nicaragua	1993	0-5	0.115	0.296
Nicaragua	2003	.5-5	0.052	0.188
Niger	1992	0-5	0.267	0.483
Niger	2006	0-5	0.344	0.548
Nigeria	1990	0-5	0.287	0.505
Nigeria	2008	0-5	0.237	0.410
Pakistan	1990	0-5	0.339	0.545
Pakistan	2001	0-5	0.215	0.415
Papua New Guinea	2000	0-5	0.158	0.424
Papua New Guinea	2007	0-5	0.21	0.401
Peru	1991	0-5	0.147	0.373
Peru	2007	.25-5	0.078	0.282
Romania	1999	0-5	0.058	0.153
Romania	2002	0-5	0.042	0.128

country	year	age group	st3sd (severe stunting)	st2sd (total stunting)
Rwanda	1992	0-5	0.275	0.568
Rwanda	2005	0-5	0.248	0.517
Sao Tome/Principe	2000	0-5	0.144	0.352
Sao Tome/Principe	2008	0-5	0.119	0.293
Saudi Arabia	1994			0.214
Saudi Arabia	2004	0-5	0.026	0.093
Senegal	1992	0-5	0.156	0.337
Senegal	2005	0-5	0.074	0.201
Sierra Leone	1974	0-5		0.403
Sierra Leone	2008	0-5	0.219	0.374
Solomon Islands	1970	0-5	0.123	0.313
Solomon Islands	2006	0-5	0.085	0.328
Sri Lanka	2006	0-5	0.039	0.173
Sri Lanka	2009	0-5	0.046	0.192
Sudan	1992	0-5	0.2	0.386
Sudan	2006	0-5	0.2	0.379
Suriname	1999	0-5	0.043	0.145
Suriname	2006	0-5	0.021	0.107
Swaziland	2000	0-5	0.152	0.366
Swaziland	2006	0-5	0.11	0.295
Syria	1993	0-5	0.173	0.329
Syria	2006	0-5	0.157	0.286
Tanzania	1991	0-5	0.228	0.497
Tanzania	2004	0-5	0.177	0.444
Thailand	1993	0-5		0.211
Thailand	2005	0-5	0.033	0.157
Togo	1976	.5-5		0.399
Togo	2008	0-5	0.089	0.269
Tunisia	1973	0-5	0.193	0.418
Tunisia	2006	0-5	0.023	0.09
Turkey	1993	0-5	0.088	0.241
Turkey	2003	0-5	0.049	0.156
Uganda	1988	0-5	0.212	0.476
Uganda	2006	0-5	0.155	0.387
Uruguay	2002	0-5	0.048	0.147
Uruguay	2004	0-5	0.047	0.139
Uzbekistan	2002	0-5	0.11	0.253
Uzbekistan	2006	0-5	0.075	0.196
Vanuatu	1983	0-5		0.246
Vanuatu	2007	0-5	0.079	0.259
Venezuela	1981	0-5		0.094
Venezuela	2007	0-5		0.156
Vietnam	2002	0-5		0.358
West Bank/Gaza	1996	0-5		0.106
West Bank/Gaza	2006	0-5	0.042	0.118
Yemen	1991	0-5	0.277	0.524

country	year	age group	st3sd (severe stunting)	st2sd (total stunting)
Yemen	2003	0-5	0.358	0.577
Zambia	1992	0-5	0.199	0.464
Zambia	2007	0-5	0.216	0.458
Zimbabwe	1988	.25-5	0.103	0.310
Zimbabwe	2005	0-5	0.152	0.358

APPENDIX B: Change in Total Stunting Prevalence between Earliest and Latest Surveys

(Sorted by percentage point change/year)

country	year of latest survey	years between earliest and latest survey	st2sd	total % change	total percentage point change	total percentage point change/yr
China	2005	13	0.117	-68.88%	-0.259	-1.99
DPR Korea	2004	4	0.431	-15.49%	-0.079	-1.98
Lesotho	2004	4	0.452	-14.72%	-0.078	-1.95
Mauritania	2008	18	0.242	-55.84%	-0.306	-1.70
Cambodia	2008	12	0.395	-32.59%	-0.191	-1.59
Uzbekistan	2006	4	0.196	-22.53%	-0.057	-1.43
Ethiopia	2005	5	0.507	-11.67%	-0.067	-1.34
Vietnam	2008	25	0.305	-52.42%	-0.336	-1.33
Nepal	2006	9	0.493	-19.31%	-0.118	-1.31
Saudi Arabia	2004	10	0.093	-56.54%	-0.121	-1.21
Swaziland	2006	6	0.295	-19.40%	-0.071	-1.18
Pakistan	2001	11	0.415	-23.85%	-0.13	-1.18
El Salvador	2002	27	0.246	-56.23%	-0.316	-1.17
Bangladesh	2007	25	0.432	-39.2%	-0.279	-1.11
Nicaragua	2003	10	0.188	-36.49%	-0.108	-1.08
Senegal	2005	13	0.201	-40.36%	-0.136	-1.05
Guinea-Bissau	2008	8	0.281	-22.16%	-0.08	-1.00
Tunisia	2006	33	0.09	-78.47%	-0.328	-0.99
Turkey	2003	10	0.156	-35.27%	-0.085	-0.85
Liberia	2006	7	0.394	-13.02%	-0.059	-0.84
Mali	2006	5	0.385	-9.84%	-0.042	-0.84
Romania	2002	3	0.128	-16.34%	-0.025	-0.83
Bolivia	2008	27	0.272	-44.03%	-0.214	-0.79
Honduras	2005	18	0.299	-30.95%	-0.134	-0.74
Sao Tome/Principe	2008	8	0.293	-16.76%	-0.059	-0.74
Mexico	2006	18	0.155	-45.99%	-0.132	-0.73
Madagascar	2008	16	0.492	-19.21%	-0.117	-0.73
Morocco	2003	16	0.231	-33.04%	-0.114	-0.71
Dominican Republic	2007	16	0.101	-52.36%	-0.111	-0.69
Haiti	2005	11	0.297	-20.16%	-0.075	-0.68
Jordan	2009	19	0.083	-59.51%	-0.122	-0.64
Brazil	2006	10	0.071	-47.41%	-0.064	-0.64
Ecuador	2004	18	0.29	-27.86%	-0.112	-0.62
Maldives	2001	7	0.319	-11.63%	-0.042	-0.60
Algeria	2005	13	0.159	-32.34%	-0.076	-0.58

country	year of latest survey	years between earliest and latest survey	st2sd	total % change	total percentage point change	total percentage point change/yr
Peru	2007	16	0.282	-24.40%	-0.091	-0.57
Colombia	2004	39	0.162	-57.48%	-0.219	-0.56
Suriname	2006	7	0.107	-26.21%	-0.038	-0.54
Equatorial Guinea	2004	7	0.35	-9.56%	-0.037	-0.53
Nigeria	2008	18	0.41	-18.81%	-0.095	-0.53
Uganda	2006	18	0.387	-18.70%	-0.089	-0.49
Thailand	2005	12	0.157	-25.59%	-0.054	-0.45
Mongolia	2005	8	0.275	-11.58%	-0.036	-0.45
Jamaica	2007	29	0.037	-77.71%	-0.129	-0.44
Egypt	2008	30	0.307	-29.91%	-0.131	-0.44
Namibia	2006	14	0.296	-17.09%	-0.061	-0.44
Tanzania	2004	13	0.444	-10.66%	-0.053	-0.41
Togo	2008	32	0.269	-32.58%	-0.13	-0.41
Uruguay	2004	2	0.139	-5.44%	-0.008	-0.40
Rwanda	2005	13	0.517	-8.98%	-0.051	-0.39
Kenya	2008	15	0.352	-12.44%	-0.05	-0.33
Syria	2006	13	0.286	-13.07%	-0.043	-0.33
Indonesia	2007	7	0.401	-5.42%	-0.023	-0.33
Papua New Guinea	2007	7	0.401	-5.42%	-0.023	-0.33
Chile	2002	1	0.025	-10.71%	-0.003	-0.30
Ghana	2008	10	0.286	-8.63%	-0.027	-0.27
Malawi	2006	14	0.532	-4.66%	-0.026	-0.19
Guatemala	2002	7	0.543	-1.99%	-0.011	-0.16
Iraq	2006	6	0.275	-2.83%	-0.008	-0.13
Laos	2006	6	0.476	-1.24%	-0.006	-0.10
Lebanon	2004	8	0.165	-4.07%	-0.007	-0.09
Sierra Leone	2008	34	0.374	-7.20%	-0.029	-0.09
Myanmar	2003	3	0.406	-0.49%	-0.002	-0.07
Bosnia-Herz.	2006	6	0.118	-2.48%	-0.003	-0.05
Bahrain	1995	6	0.136	-2.16%	-0.003	-0.05
Sudan	2006	14	0.379	-1.81%	-0.007	-0.05
Czech Republic	2001	10	0.026	-16.13%	-0.005	-0.05
Zambia	2007	15	0.458	-1.29%	-0.006	-0.04
Kuwait	2009	8	0.038	-5.00%	-0.002	-0.03
Chad	2004	8	0.448	-0.44%	-0.002	-0.03
Cameroon	2006	15	0.364	0.28%	0.001	0.01
Libya	2007	12	0.21	1.45%	0.003	0.03
Solomon Islands	2006	36	0.328	4.79%	0.015	0.04
Vanuatu	2007	24	0.259	5.28%	0.013	0.05
Argentina	2004	10	0.082	15.49%	0.011	0.11
West Bank and Gaza	2006	10	0.118	11.32%	0.012	0.12
DR Congo	2007	6	0.458	3.15%	0.014	0.23
Venezuela	2007	26	0.156	65.96%	0.062	0.24

country	year of latest survey	years between earliest and latest survey	st2sd	total % change	total percentage point change	total percentage point change/yr
Burkina Faso	2006	14	0.445	9.34%	0.038	0.27
Zimbabwe	2005	17	0.358	15.48%	0.048	0.28
Guinea	2007	13	0.4	13.31%	0.047	0.36
Yemen	2003	12	0.577	10.11%	0.053	0.44
Armenia	2005	7	0.182	20.53%	0.031	0.44
Azerbaijan	2006	6	0.268	11.20%	0.027	0.45
Niger	2006	14	0.548	13.46%	0.065	0.46
Kazakhstan	2006	7	0.175	25.90%	0.036	0.51
Macedonia	2005	6	0.115	43.75%	0.035	0.58
Sri Lanka	2009	3	0.192	10.98%	0.019	0.63
Gambia	2005	5	0.276	14.52%	0.035	0.70
Guyana	2006	6	0.182	31.88%	0.044	0.73
Albania	2005	8	0.27	32.35%	0.066	0.83
Afghanistan	2004	7	0.593	11.47%	0.061	0.87
Cote d'Ivoire	2006	8	0.401	27.30%	0.086	1.08
Benin	2006	5	0.447	14.32%	0.056	1.12

APPENDIX C: Summary of Econometric Literature on the Correlates of Child Nutritional Status

Study	Main Findings	Other (Control) Variables	Notes
Esrey and others 1988	Exclusive use of **improved water** improved child height in the 1-4 age year group.	Village size, rurality, presence of schools and clinics, age and sex distribution, socioeconomic conditions	Ten-village study in rural Lesotho, 1984-85.
Barrera 1990	**Maternal education** most strongly affects child stunting through increasing the efficiency at which mothers use health inputs and by facilitating the reception of information.	Maternal height and age, income, price of goods, safe water and sanitation, access to health services	Data from Philippines Multipurpose Survey of 1978 and Supplementary Survey of 1981.
Strauss 1990	Senior wife status, maternal height, maternal education, land ownership, male agricultural wage and illness are all correlates of child height.	Sex of child, paternal education, % of land in tree crops, distance to health services and schools, water, disease illness	Data from Cote d'Ivoire Living Standards Survey, 1986.
Thomas, Strauss, Henriques 1991	**Maternal education** affects child height in rural areas of NE Brazil, primarily through access to information sources). Child height increases by 0.5% for every year of maternal education in rural areas. Maternal education has interactive effect with community water, sanitation, and health services.	Paternal education, HH income, community services	Data from Northeast Brazil 1986.
Haddad and Hoddinott 1994	Mother's work outside the home has a relatively greater effect on the height of boys vs. girls.	Maternal height and age, maternal and paternal education, wife status of mother, daily wages, distance to	Data from 1986-87 Cote d'Ivoire Living Standards Survey.

Study	Main Findings	Other (Control) Variables	Notes
		school and health facilities	
Lavy and others 1996	Greater numbers of health personnel and increased drug availability are correlated with lower stunting. Staple food prices, water and sanitation, household income, parental education, and parental height were also significant correlates.	Nurses and support staff, beds in health facility, child birth and growth services, price per consultation, distance to health facility, food prices, urban/rural residence	Data from 1988 Ghana Living Standard Survey.
Thomas, Lavy, and Strauss 1996	Health infrastructure, medicine stocks, health personnel, food prices, parental height, and paternal education are all correlated with child height.	Per capita expenditure, maternal education, household expenditure	Data from 1987-88 Cote D'Ivoire Living Standards Study.
Frongillo Jr., de Onis, and Hanson 1997	**Per capita energy availability, female literacy,** and **GNP per capita** are the strongest correlates of stunting. Relationships are curvilinear: energy availability had large negative effect on stunting at low levels but no effect at high levels; effect of literacy rate on stunting only large at high levels of literacy.	Safe water access, national health expenditures, immunization rate, militarization, urbanization, population density, female labor force participation, regional dummies	Cross-country regression; 45-70 countries, data between 1980-1993.
Asenso-Okyere, Asante, Nubé 1997	**Maternal height, paternal height**, and **community electrification** all have significant impacts on reducing stunting. **Length of breastfeeding** is negatively correlated with child height, suggesting some older breastfed children may not be receiving adequate supplementary food.	Maternal and paternal BMI, child vaccination, maternal literacy, age of mother, age of child, days of child illness in the last 4 weeks	Data from 1987-88 Ghana Living Standards Survey.
Sahn and Alderman 1997	Different age groups have different determinants of growth; **maternal education** appears to be correlated to	Sex of child, transfer income, father absent,	Data from 1991-92 Mozambique

Study	Main Findings	Other (Control) Variables	Notes
	positive outcomes for children 0-2y, but not for older children; **income** has an effect on older, but not younger, children.	maternal height, sanitation, mother's migration, birthplace of child	Integrated Household Survey.
Desai and Alva 1998	The effect of maternal education on child stunting is weak once sanitation, paternal education, and region of residence is controlled for.	Safe water	DHS data from 22 countries.
Garrett and Ruel 1999	The determinants of stunting are similar in rural versus urban areas, with the exception of **seasonality**, which is more important in rural areas. **Maternal education, household expenditure levels, number of preschool children in HH, household size,** and **amount of land owned** are significant correlates of stunting.	Paternal education, war migrant status, household demographics, sex of HH head, time period of year, ability of mother to speak Portuguese, housing density, prenatal care, water and sanitation	Data from 1996-97 Mozambique household demographic and expenditure survey.
Immink and Payongayong 1999	**Per capita food availability** is a stronger determinant of stunting than **morbidity** (i.e., incidence of diarrheal disease), although the latter is still significant. **Consumption from own production** is also correlated with better nutritional outcomes.	Household size, household demographics, water availability, age of HH head, persons/room, housing quality, maternal BMI, maternal literacy	Data from six-village sample, Sacatepéquez, Guatemala.
Glewwe 1999	The effect of maternal education on HAZ works mainly through **improved health knowledge**. Literacy and numeracy skills taught in schools facilitate absorption of information.	Sex of child, maternal and paternal height, paternal education, literacy, language, land ownership, type of land, family structure, assets, grandparents' schooling	Data from 1990-91 Morocco Household Living Standards Survey.
Handa 1999	**Maternal education** is correlated	Income, sex of	Data from

Study	Main Findings	Other (Control) Variables	Notes
	with better nutritional outcomes. Maternal education also has important interactive effects with access to private doctor and television use.	HH, paternal education, radio and television, community services, sanitation	1989 Jamaica Living Standards Measurement Survey.
Gragnolati 1999	Parental education, maternal height, safe water and garbage disposal facilities, presence of government health care facilities, and altitude are significant correlates of child HAZ.	Ethnicity, language, assets, sanitation, food prices, distance to market, paved roads	Data from 1995 Guatemala Survey of Family Health.
Tharakan and Suchindran 1999	**Parental education** has a significant impact on stunting rates. Prolonged **breastfeeding** appears to increase risk of stunting.	Area of residence, sex of HH head, nutrition knowledge, sex of child, house type, sanitation, participation in child welfare program, illness, food intake	Data from national survey in Botswana, 1996.
Gibson 1999, 2002	**Maternal education** has three times as strong of an impact on child stunting as does paternal education. **Household expenditures** and **maternal and paternal height** are also significant correlates. However, later work by the same author finds that conclusions are highly sensitive to assumptions about endogeneity and measurement quality. Use of instrumental variables greatly reduces the effect of maternal education and increases the effect of income.	Paternal education, household size, region, sex of child	Data from 1996 Papua New Guinea Household Survey.
Griffiths and others 2002	Covariates of stunting vary across three Indian states; state-specific policies are needed to fight undernutrition. **Breastfeeding practices** are a significant determinant common to all three states. Undernutrition appears to cluster at the family level, even controlling for other factors.	Type of house, paternal education, maternal age, TV/radio use, religion, iron/folic acid supplementation , family structure, sex of	Data from 1992-93 India NFHS (Maharashtra, Tamil Nadu, Uttar Pradesh).

Study	Main Findings	Other (Control) Variables	Notes
		child, feeding practices, living density, sanitation, maternal education, house quality, paternal occupation, antenatal, birth interval, immunization	
Caputo and others 2003	Maternal education has a strong indirect impact on stunting, working through maternal BMI, prenatal and birth attendance, breastfeeding duration, and access to safe water. Housing quality and asset ownership also show significant direct effects, as well as indirect effects through better access to sanitation, safe water, and high-quality diet. Study illustrates methods for separating direct and indirect impacts of variables.	Illness incidence, food and protein intake, time put to breast, vaccination, toilet facility, birth order, religion, mother's height, # of HH members, relation to HH head, total children ever born, age of mother at 1st birth, paternal education, type of employment	Data from 1996 Benin DHS.
Ukwuani and Suchindran 2003	Low household wealth, polygynous marriage, sex of child (male), lack of immunization, and presence of a pit toilet are significant determinants of stunting among infants. Among children, women's economic activity, maternal education, household wealth, religion, sex of child, immunization, geographical region of residence, and diarrheal incidence are the strongest factors.	Women's economic activity (cash/no cash, with/without accompanying child), paternal education, maternal age at birth of child, birth order, prenatal care, place of delivery, food supplementation , illness, water and sanitation,	Data from 1990 Nigeria DHS.

Study	Main Findings	Other (Control) Variables	Notes
		place of residence	
Alderman, Hentschel, and Sabates 2003	Community levels of **maternal education** and **access to safe water and sanitation** have significant positive externalities for households without high values of these factors. Size of externality depends on initial level of the variable in the community.	Income per capita, ethnicity, paternal education, urban/rural, sex of child	Data from 1997 Peru Living Standards Measurement Survey.
Wagstaff 2003	**Greater per capita health spending** is associated with lower stunting.	Income per capita.	Cross-country dataset. Small sample size and low explanatory power.
Brennan, McDonald, and Shlomowitz 2004	Exclusive breastfeeding, use of colostrum, hygienic bottle feeding, and adequate supplementary feeding are all feeding practices associated with lower severe and total stunting rates. Higher maternal education, higher maternal BMI, greater household wealth, and earlier birth order are also correlated with lower stunting.	Folic supplementation and tetanus injections during pregnancy, vaccination, vitamin A supplementation, breastfeeding after delivery, length of breastfeeding	Data from Karnataka and Uttar Pradesh states in India, 1998-99 NFHS.
Christiaensen and Alderman 2004	**Community diagnostic ability** to correctly identify stunting is associated with lower undernutrition rates. **Household resources** and **food prices** are other key correlates.	Household demographics, sex of HH head, female education, community water, sanitation, and health variables, food and fuel prices, rural/urban	Various surveys from Ethiopia, 1995-1998.
Attanasio and others 2004	Maternal height, maternal education, sex of child, presence of hospital, and altitude are all important correlates of HAZ.	Paternal education, household assets, program participation, water, rice price,	Data from 2002 evaluation of *Familias en Accion*, a Colombian

Study	Main Findings	Other (Control) Variables	Notes
		regional effects, isolation of community	cash transfer program.
Bronte-Tinkew and DeJong 2004	**Family structure** plays a role in determining stunting; children living in single-parent or cohabitating households are 3-5 times more likely to be stunted. Particularly at risk are children **living with siblings in poor single-parent or extended family** settings. **Parental education** also plays a role.	Household wealth, birth order, biological parentage of child, caregiver sex, employment status, education, and age, hours worked by spouse, household support, urban/rural residence, distance to health facility	Data from 1996 Jamaica Living Standards Measure-ment Study Survey. Small sample of stunted children (n=72).
Glewwe, Koch, and Nyugen 2004	**Maternal education** and **parental height** are important explanatories of child undernutrition. **Income, access to private pharmacies,** and **availability of ORS** have smaller but significant impacts.	Sex of child, paternal education, religion, ethnicity, drug prices, distance to health facilities, commune health center characteristics	Data from 1992-93 and 1997-98 Vietnam Living Standards Surveys.
David, Moncada, and Ordonez 2004	Greater **household income,** wider **birth spacing,** and smaller **household size** are all correlated to better nutritional outcomes. **Maternal height and BMI** is significant in Honduras, but not Nicaragua. Other differences between the two countries exist, underscoring the importance of country-level differences in the determinants of stunting. **Diarrhea incidence** is associated with stunting in Nicaragua (not tested in Honduras).	Sex of child, maternal and paternal education, sex of HH head, food aid, food for work, food/vitamin supplementation, community variables (piped water, distance to health center, daily agricultural	Data from 2001 Nicaragua National Household Standard of Living Survey and 2002 Honduras Expenditures and Livelihoods Survey)

Study	Main Findings	Other (Control) Variables	Notes
		wages, price of corn)	
Morales, Aguilar, and Calzadilla 2004	High altitude and Quechua ethnicity are associated with higher stunting rates. Household assets, safe sanitation, and maternal education are also important.		Data from 1998 Bolivia DHS.
Smith, Ruel, and Ndiaye 2004	The determinants of stunting do not significantly differ between urban and rural areas. Levels of stunting are greater in rural areas because of relatively poor maternal education, access to safe water and sanitation, and socioeconomic status.	Women's nutritional status, prenatal and birthing care for mother, child feeding practices, health-seeking behaviors, quality of substitute caregivers	Cross-country regressions; data from 36 DHS datasets between 1990-1998.
Borooah 2005	**Health infrastructure**, including **access to safe water, anganwadi** (child care and nutrition) **centers,** and **hospitals**, had a significant impact on stunting among the lowest quintile of children in the dataset. **Maternal literacy** has effect on the middle quintiles, but not the lower quintiles. **Landlessness** increases stunting among all quintile groups. Study illustrates importance of disaggregating dependent variable into groups or severity levels.	Sex of child, birth order, age of child, age of mother, mother's profession, maternal anemia, separate kitchen in house, village development level, regional dummy	Data from 1993-94 India Human Develop-ment Survey.
Frost, Forste, and Haas 2005	Maternal education affects child stunting mainly through the pathway of **socioeconomic development** (as measured by HH assets) and **health care utilization**. **Birth spacing** and **birth parity** also have a significant effect independent of maternal education.	Paternal education and occupation, maternal knowledge, ethnicity, maternal autonomy, maternal age at birth, geographic controls	Data from 1998 Bolivia DHS.
Heaton and others 2005	Family level factors, including HH size, sex of HH head, maternal education, couple communication,	Rural/urban residence, (unspecified)	Data from 42 countries' DHS.

Study	Main Findings	Other (Control) Variables	Notes
	health utilization, age at first birth, birth interval, breastfeeding, gender equality, and sex of child are more important in determining stunting than country-level variables, although GDP per capita is indeed significant.	country level variables.	
Larrea and Kawachi 2005	**Inequality** at the provincial level is positively associated with stunting. **Per capita consumption, maternal education, housing, fertility,** and **diet composition** are also significant correlates.	Ethnicity, access to health services, child care responsibility, breastfeeding, diarrhea incidence	Data from Ecuador 1998 Living Standard Measurement Survey.
Milman and others 2005	Initial and change in immunization rate, initial and change in access to safe water, initial female literacy rate, initial government consumption, initial income distribution, and initial proportion of the economy devoted to agriculture all significant explanatory factors for stunting. Study illustrates the advantages of examining covariates of changes in stunting rates, not just levels of stunting.	Daily energy supply, women in power, female labor, ORS therapy use, urbanization, HIV prevalence, ethnic fractionalization, political rights and civil liberties, public health expenditures, ODA, external debt, per capita GNP, conflict	Cross-country regression; 85 countries from 1970-2001.
Silva 2005	**Household wealth** and **number of children under age five in a HH** have highly significant effects on child stunting. The impact of maternal height and maternal education is also significant but small. Study highlights potential externalities of community-level services (e.g., safe water and sanitation, health care) to households.	Maternal BMI, sex of household head, paternal education, access to safe water, access to safe sanitation, altitude	Data from 2000 Ethiopia DHS.
Rubalcava and Teruel 2005	**Maternal cognitive ability** has strong effects on reducing stunting, and appears to work through increasing household income.	Sex of child, birth order, household wealth,	Data from Mexican Family Life Survey 2002.

Study	Main Findings	Other (Control) Variables	Notes
	Maternal age and higher levels of **paternal education** are also significant.	rural/urban residence.	
Valdivia 2005	Maternal height, maternal education, sex of child, home language, and geographical location are all highly significant correlates of child height outcomes. Health infrastructure is also significant but weaker.	Water, sanitation, electricity	Data from 1992, 1996, 2000 DHS and 1992, 1996, 1999 health census in Peru.
Harttgen and Misselhorn 2006	Maternal education, maternal BMI, and household asset levels are strongly significant in 5 out of the 6 country regressions. Birth order, birth spacing, and access to health facilities are significant in 4 of 6 countries. Regional dummy (SSA vs SA) is strongly significant.	Breastfeeding practices, HH size, total number of children in HH, maternal age at marriage, distance to health facility, community characteristics (percent children with fever, percent secondary education, public infrastructure)	Data from DHS datasets: Bangladesh 2000, India 1999, Mali 2001, Nigeria 1999, Uganda 1995, Zimbabwe 1994
Levine and Rothman 2006	**Trade openness** has a small but significant correlation with lower stunting rates. The effect of openness occurs mostly through accelerating GDP growth, and to a lesser extent by enabling governments to increase spending on health.	Regional dummies, % of land in tropics	Data from WHO database and various other sources, from 1990 "when possible". 102 countries used for dependent variable.
Seerabutra and others 2006	**Caregiver illiteracy** and larger **household size** are associate with greater stunting.	Sex of child, GI symptoms, safe water and sanitation	Data from two-village study in rural Guatemala in 2001.
Boyle and others 2006	Three-quarters of variation in stunting associated with child level factors. **Country GDP, household**		Cross-country dataset, from

Study	Main Findings	Other (Control) Variables	Notes
	wealth, maternal education, maternal age, sex of child all significant. Contextual differences in strength of association and interaction effects across countries		42 DHS between 1994-2003. Explanatory power of model weak.
Moradi 2007	**GDP per capita** has strong lagged impact on stunting reduction in Africa throughout the 1950-1980 period, as does protein availability. Study illustrates importance of the use of lagged variables specifically and dynamic analysis generally.	Female infant mortality rate, years of schooling, rainfall, occurrence of civil war, total fertility rate, share of urban population	Data from 28 African countries, 1992-2004 DHS datasets, independent variable data from 1950-1980.
Surkan and others 2007	**Outside relationship support** is positively associated with improved HAZ. Shorter **breastfeeding duration** and more **children in HH** are associated with higher stunting rates.	Sex of child, participation in family health program, material support, affectionate support, positive social interaction, maternal depression	Data from 2001, low-income areas of one community in Piauí, Brazil.
Van de Poel and others 2007	Household poverty, sex of child (male), long breastfeeding, short birth intervals, number of preschool children in the HH, and maternal age and education status all play roles in increasing stunting rate. Household poverty, regional effects, and use of health services are the key determinants of nutritional inequality	Sex of child, region, urban/rural residence, safe water and sanitation, marital status, health services, maternal occupation	Data from 2003 Ghana DHS.
Fahrmeir and Khatab 2008	Even when the usual set of factors are controlled for, spatially-related (omitted) variables are important in determining stunting rates; points to the importance of sub-national analysis. **Maternal education, antenatal care, safe sanitation, electricity, higher maternal age at childbirth, working mother, sex of child (girls), low diarrhea**	Medical treatment during pregnancy; source of drinking water; rural/urban locality; radio in HH	Data from 2003 Nigeria DHS.

Study	Main Findings	Other (Control) Variables	Notes
	incidence, and **normal maternal BMI** decrease risk of stunting.		
Fotso 2007	Stunting rate differentials between urban and rural areas are driven by **socio-economic variables**, including **household wealth, maternal education**, and (unspecified) community-level variables.	Maternal age at first birth, marital status, religion, maternal malnutrition, sex of child, antenatal care, assisted delivery, immunization, birth order and interval	Data from DHS of 15 sub-Saharan countries (years unspecified).
Heltberg 2008	**GNI per capita** has a significant but quite small effect on rates of stunting. The effect persists when controlling for initial stunting rate and initial inequality.	Initial stunting rate, initial inequality	Data from World Bank WDI database; years not provided, but assumed to be 1970-present.
Foraita, Klasen, and Pigeot 2008	Both Benin and Bangladesh show significant associations between stunting and **protein consumption**, **household assets**, **paternal education, maternal height**, and **maternal BMI**. Other correlations different between countries, indicates nutrition production function varies across countries or unobserved factors are playing a role.	Sex of child, birth order, religion, HH members, sex of HH head, deceased children, maternal age at first birth, house quality, maternal education, maternal employment, safe water and sanitation, vaccination, prenatal and birth attendance, breastfeeding after delivery, breastfeeding practices, illness	Data from 1996 Bangladesh and Benin DHS surveys.
Semba and	**Parents' education** was	Rural/urban	Data from

Study	Main Findings	Other (Control) Variables	Notes
others 2008	significantly associated with lower stunting; maternal education was more important in Indonesia, paternal education in Bangladesh. Greater **maternal age, sex of child (**boys**),** lower **maternal height**, and higher **household expenditure** were all associated with a higher risk of stunting.	residence, birthweight, HH size	nutritional systems in Indonesia (2000-03) and Bangladesh (2000-05).
O'Donnell, Nicolás, and Doorslaer 2009	Household income explains a significant fraction of the improvement in stunting rate, but a variety of other covariates (community wealth, height of parents, age of mother, household size, household demographic structure, sex of child) are strongly significant. Changes in the levels of observed variables explain about one-half of Vietnam's impressive stunting reduction between 1993-1998, but unobserved factors and/or factors that augment the marginal impact of the observed variables are responsible for the other half; nutrition and health programs may be important in this latter half.	Safe water, safe sanitation, maternal education, paternal education, absence of one or both parents, ethnic minority, urban/rural place of residence	Data from 1993 and 1998 Vietnam Living Standards Surveys.
Barber and Gertler 2009	Increased **presence of medical staff** is associated with lower stunting rates. Doctors have the greatest impact, although the presence of nurses and midwives also reduces stunting.	Year of survey, (unspecified) household and socio-economic characteristics, (unspecified) maternal and infant characteristics, community fixed effects	Data from 1993 and 1997 Indonesian Family Life Surveys.

APPENDIX D: Indian State Dataset

2005 DATA	st2sd	fertility	mvacc	sexrt	water	malcat	precip	educ	loginc	exid21	cong21	voter21	relfrac
Andhra Pradesh	38.4	1.79	69.4	983.6	94	1	896	2.92	9.54	-0.52	11	0.67	0.27
Arunachal Pradesh	37	3.03	38.3	903.8	85	4	2782	1.94	9.37	-0.76	17	0.60	0.73
Assam	41.1	2.42	37.4	942.6	72.4	4	2818	4.15	8.96	-1.00	21	0.72	0.45
Bihar	50.1	4	40.4	917.8	96.1	0	1256	1.35	8.33	-0.52	5	0.28	0.28
Chhattisgarh	52.6	2.62	62.5	989.8	77.9	4	1334	2.12	9.20	0.14	10	0.55	0.09
Delhi	42.2	2.13	78.2	839	92.1	0	617	7.87	10.44	0.43	6	0.50	0.25
Goa	25.9	1.79	91.2	963.8	80.1	3	3005	7.42	10.41	-0.24	11	0.56	0.50
Gujarat	49.2	2.42	65.7	919.2	89.8	2	1107	4.81	9.90	0.52	5	0.49	0.17
Haryana	43.3	2.69	75.5	867.4	95.6	0	617	4.87	9.87	-0.19	11	0.67	0.21
Himachal Pradesh	34.3	1.94	86.3	970.4	88.4	0	1251	6.34	9.63	0.24	8	0.60	0.07
Jammu & Kashmir	33.1	2.38	78.3	888.4	80.8	0	1011	4.36	9.16	-0.14	3	0.42	0.50
Jharkhand	47.2	3.31	47.6	943.4	57	4	1289	2.11	9.15	-0.57	6	0.61	0.44
Karnataka	42.2	2.07	72	966.2	86.2	3	1139	4.64	9.65	-0.81	19	0.64	0.26
Kerala	26.5	1.93	82.1	1069	69.1	0	3055	7.73	9.64	-1.29	15	0.73	0.56
Madhya Pradesh	46.5	3.12	61.4	923.4	74.2	1	1198	2.36	9.14	0.10	10	0.54	0.17
Maharashtra	44	2.11	84.7	923.2	92.7	0	1300	4.58	9.92	-0.43	15	0.56	0.35
Manipur	29	2.83	52.8	979.2	52.1	0	1881	6.03	9.10	-0.48	10	0.70	0.63
Meghalaya	47.7	3.8	43.8	977.6	63.1	3	2818	2.70	9.44	-0.95	20	0.58	0.52
Mizoram	35.1	2.86	69.5	951	85	2	1881	5.77		-0.38	9	0.65	0.14
Nagaland	34.1	3.74	27.3	912.4	62.8	0	1881	3.84		-0.71	15	0.75	0.30
Orissa	43.9	2.37	66.5	974.4	78.4	4	1489	2.98	9.02	-0.57	12	0.59	0.06
Punjab	34.7	1.99	78	882.8	99.5	0	649	5.35	9.87	-0.48	10	0.61	0.54
Rajasthan	40.1	3.21	42.7	923	81.8	1	494	2.32	9.31	-0.05	11	0.52	0.21
Sikkim	31.8	2.02	83.1	880.6	77.6	0	2739	3.64	9.56	-1.00	0	0.92	0.57
Tamil Nadu	31.1	1.8	92.5	990.2	93.5	0	998	5.41	9.68	-0.67	12	0.63	0.20
Tripura	34.1	2.22	59.9	953.2	76.1	2	1881	4.27		-1.67	7	0.74	0.21
Uttar Pradesh	52.4	3.82	37.7	902	93.7	0	1025	2.36	8.87	0.38	5	0.51	0.30
Uttaranchal	39.6	2.55	71.6	962.4	87.4	0	1240	5.45	9.42	0.43	5	0.52	0.23
West Bengal	41.8	2.27	74.7	939.2	93.7	1	2000	3.45	9.51	-2.00	0	0.79	0.40

1998 DATA	st2sd	fertility	mvacc	sexrt	water	malcat	precip	educ	loginc	exid21	cong21	voter21	relfrac
Andhra Pradesh	47.2	2.25	64.7	976.2	78.5	1	896	2.51	9.23	-0.76	16	0.64	0.22
Arunachal Pradesh	30.3	2.52	33.6	882.8	80.7	4	2782	3.38	9.19	-0.90	19	0.57	0.69
Assam	54	2.31	24.6	931.4	60.1	4	2818	3.68	8.77	-1.00	21	0.73	0.47
Bihar	58.4	3.7	16.6	915.4	75.4	0	1256	1.95	8.19	-0.43	9	0.35	0.29
Chhattisgarh	60.7	2.79	35.5	987.8	63.5	4	1334	2.43	9.02	-0.10	14	0.53	0.15
Delhi	43.2	2.4	77.5	822.8	98.7	0	617	8.35	10.17	0.00	9	0.56	0.28
Goa	21.7	1.77	84.3	962.8	61.8	3	3005	7.53	10.32	-0.67	14	0.59	0.49
Gujarat	49.3	2.72	63.6	924.2	84.5	2	1107	4.87	9.69	0.00	9	0.49	0.19
Haryana	55.6	2.88	72.2	862.2	88	0	617	4.56	9.59	-0.57	14	0.67	0.21
Himachal Pradesh	48.8	2.14	83.4	970.4	77.4	0	1251	6.38	9.35	-0.19	11	0.60	0.13
Jammu & Kashmir	44.6	2.71	56.7		70.6	0	1011	3.14	9.05	-0.24	5	0.47	0.52
Jharkhand	54.1	2.76	16.6	935.3	75.4	4	1289	1.92	9.10	-0.43	9	0.59	0.29
Karnataka	41.9	2.13	67.3	963.5	87	3	1139	4.65	9.38	-0.90	19	0.61	0.26
Kerala	21.5	1.96	84.6	1052.1	19.9	0	3055	7.84	9.30	-1.19	17	0.74	0.59
Madhya Pradesh	55.1	3.43	35.5	916.9	63.5	1	1198	2.60	9.06	-0.10	14	0.53	0.15
Maharashtra	47.1	2.52	84.3	925.6	81.9	0	1300	5.71	9.68	-1.00	21	0.56	0.35
Manipur	38.5	3.04	45.8	969.2	48.9	0	1881	6.21	8.91	-0.95	12	0.74	0.61
Meghalaya	48.8	4.57	17.7	966.9	42.1	3	2818	2.76	9.18	-1.00	21	0.55	0.44
Mizoram	41.3	2.89	71	930.8	63.2	2	1881	5.98		-0.43	9	0.48	0.09
Nagaland	38.7	3.77	19.6	895.8	40.5	0	1881	4.64	9.20	-0.43	9	0.73	0.32
Orissa	49.1	2.46	54	971.7	65.3	4	1489	3.72	8.76	-0.76	16	0.54	0.07
Punjab	45.2	2.21	72.1	877.8	98.9	0	649	5.79	9.69	-0.43	9	0.51	0.53
Rajasthan	59	3.78	27.1	917.7	69.8	1	494	2.71	9.19	-0.48	14	0.52	0.21
Sikkim	35.7	2.75	58.9	875.9	84.6	0	2739	4.09	9.30	-0.81	0	0.45	0.53
Tamil Nadu	35.2	2.19	90.2	983.1	85	0	998	5.47	9.48	-0.86	16	0.67	0.20
Tripura	44.6	1.87		947.1		2	1881		9.01	-1.38	7	0.77	
Uttar Pradesh	60.7	4.06	34.6	891.4	85.6	0	1025	2.77	8.76	-0.10	9	0.51	0.29
Uttaranchal	52.5	2.61	34.6	954.5	85.6	0	1240	2.61	9.03	-0.10	9	0.51	0.29
West Bengal	50.4	2.29	52.4	928.9	89.3	1	2000	3.49	9.18	-2.00	0	0.76	0.38

1992 DATA	**st2sd**	**fertility**	**mvacc**	**sexrt**	**water**	**malcat**	**precip**	**educ**	**loginc**	**exid21**	**cong21**	**voter21**	**relfrac**
Andhra Pradesh		2.59	53.8	972.6	63.4	1	896	1.95	9.02	-0.76	16	0.64	0.22
Arunachal Pradesh	54	4.25	27.5	862.4	75.8	4	2782	1.59	9.17	-0.71	15	0.57	0.69
Assam	56.4	3.53	25.8	924.2	43.2	4	2818	2.61	8.77	-1.00	21	0.67	0.45
Bihar			14.6	908.2	63.6	0	1256	1.64	8.11	-0.71	15	0.33	0.30
Chhattisgarh			40.7	985.4	55.8	4	1334	2.13	8.94	-0.57	16	0.52	0.13
Delhi	46.9	3.02	69.6	826.4	99.5	0	617	7.24	9.91	-0.57	15	0.59	0.31
Goa	34.9	1.9	77.8	966.4	56.5	3	3005	6.44	9.89	-0.48	10	0.60	0.49
Gujarat	36.4	2.99	55.9	932.6	75.1	2	1107	3.73	9.33	-0.57	15	0.54	0.19
Haryana	50.5	3.99	60.9	864.6	73	0	617	3.12	9.44	-0.76	16	0.66	0.21
Himachal Pradesh		2.97	71.5	975.2	57.6	0	1251	4.14	9.09	-0.57	15	0.58	0.06
Jammu & Kashmir			69.1		57.3	0	1011		8.93	-0.43	9	0.49	
Jharkhand			14.6	923.9	63.6	4	1289	1.61	8.87	-0.71	15	0.57	0.30
Karnataka	47.6	2.85	54.9	960.5	75.6	3	1139	2.39	9.07	-1.00	21	0.61	0.24
Kerala	28	2	60.5	1038.3	21	0	3055	6.69	9.08	-1.19	17	0.73	0.57
Madhya Pradesh			40.7	912.7	55.8	1	1198	2.28	8.90	-0.57	16	0.52	0.13
Maharashtra	47	2.86	70.2	932.8	78.5	0	1300	4.36	9.52	-1.00	21	0.57	0.38
Manipur	32	2.76	37	959.6	47	0	1881	4.88	8.81	-1.14	16	0.72	0.55
Meghalaya	52.6	3.73	13.2	956.7	47.6	3	2818	2.57	8.98	-0.71	15	0.53	0.40
Mizoram	41	2.3	65.5	922.4	40.1	2	1881	5.83		-0.14	3	0.43	0.09
Nagaland	32.7	3.26	10	887.4	72.1	0	1881	5.21	9.21	-0.33	7	0.68	0.13
Orissa	50.8	2.92	40.2	971.1	50.9	4	1489	2.01	8.63	-0.76	16	0.52	0.06
Punjab	45.2	2.91	64.8	881.4	98.6	0	649	3.79	9.56	-0.52	11	0.50	0.51
Rajasthan	45.5	3.63	31.2	911.1	57.3	1	494	1.58	8.86	-0.67	16	0.54	0.14
Sikkim				877.7		0	2739		9.14	-0.81	6	0.35	
Tamil Nadu		2.48	71.6	975.3	74.6	0	998	4.73	9.21	-0.57	12	0.68	0.22
Tripura	52.3	2.67	28.9	945.3	44.1	2	1881	3.91	8.71	-1.57	3	0.74	0.25
Uttar Pradesh			26.3	878.2	74.3	0	1025	2.36	8.66	-0.67	15	0.51	0.29
Uttaranchal			26.3	939.5	74.3	0	1240	2.23	8.95	-0.67	15	0.51	0.29
West Bengal		2.92	42.5	918.7	84.9	1	2000	2.95	8.92	-2.00	0	0.73	0.36

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