Evidence on female education from India: what is the impact of trade Liberalization?

An honors thesis for the Department of Economics

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Tufts University, 2015

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Introduction

India's first prime minister, Jawaharlal Nehru, believed strongly that socialist economic policies were necessary to transform India into a successful modern state, and therefore in 1947, the new Indian economy was based on centralized planning, centralized investment and heavy regulation of private enterprise to ensure that wealth was not concentrated. In order to make India self reliant, foreign trade was extremely limited. Tellis (2014) writes that Nehru's economic policy was the 'experiment that failed', asserting that this not only reduced India's opportunities for growth and development, but also created a state-society dynamic that to this day, continues to stifle private entrepreneurial activity. He cites an audit by Arvind Virmani, former Chief Economic Advisor to the Government of India, that shows that India's per capita gross domestic product (GDP) at purchasing power parity (PPP) declined relative to the average world per capita GDP at PPP from 1950 to 1979 — the years that Nehruvian economics framed India's macroeconomic policy (Tellis, 2014, p.12-13).

In the 1980s, it was becoming increasingly clear that these policies were failing, and there was a gradual change in governmental attitude towards encouraging business and entrepreneurial activity, resulting in very minor changes in policy. In 1991, a balance of payments crisis necessitated IMF support that was conditional on drastic macroeconomic and trade policy reforms. This was a key turning point in India's economic history. While other changes in economic policy were important too, trade reform is the focus of this paper.

Several economists have documented that short- and medium- term costs accompany trade reform in developing countries, and a few studies consider these in an Indian context. For example, Topalova (2010) measures the impact of India's trade liberalization on poverty and finds that in rural districts in which production sectors more exposed to liberalization were concentrated, poverty declined slower and consumption growth increased slower than the national trend. She writes that due to India's inflexible industrial structure and inadequate social safety nets, the long run benefits of trade liberalization could come at a substantial social cost. And Edmonds, Pavcnik and Topalova (2009 and 2010) show that while schooling increased in India through the 1990s, this trend is attenuated in districts in which production sectors were more exposed to liberalization.

In this paper, I seek to understand whether trade reform has had any effect on education outcomes, specifically looking at its' impact on women. This is similar to the work of Edmonds, Pavcnik and Topalova (hereafter referred to as EPT), but makes two contributions to the literature. First, I use a different measure of education from EPT, and find slightly different results. EPT's measure of education is attendance, while mine is total years of education. Trade policy could affect both attendance and years of schooling by affecting poverty and returns to education. Both measures have their benefits, and both contribute to our understanding of the situation. Attendance captures more short term or contemporaneous effects, and valuable information was available to EPT on how children spend their time when not in school, which helped them explain mechanisms underlying trends of decreased attendance in more liberalized districts. But this measure might be biased towards capturing negative effects on education. For example, if a child

that has good attendance is prompted to study further as a result of liberalization, this will not be reflected in the EPT approach. Years of schooling as a measure of education would capture both positive and negative effects, and reflects decisions made with a longer-term perspective. Moreover, supplementing EPT's results on attendance with results on years of schooling gives us a more complete picture of how tariff changes affected schooling. The second way this study contributes to the literature is by investigating the impact of tariff changes on girls versus boys, and on different income groups. EPT did not consider heterogeneous effects of tariff changes.

To understand the impact of trade reform on educational outcomes is both interesting and important. This is interesting because education decisions are a result of forces that simultaneously act in different directions. Topalova (2010) showed that districts that are more exposed to liberalization have greater relative poverty. Poverty acts to reduce schooling by increasing its costs: school fees as a proportion of incomes increase, and the opportunity costs of sending children to school increase, because children could work to bring in extra income, or help more in the household to allow both parents to spend more time bringing in extra income. At the same time, it is conceivable that liberalization could change employment opportunities and increase returns to education, in which case families might be more willing to invest in education.

The benefits of education are so widely known and accepted that it seems unnecessary to elaborate on them here. It is important to understand the effects of reforms on education because if tariff reductions had a negative impact on education, then this might trap families in cyclical poverty that affects many generations to come.

In this paper, I investigate whether India's trade reform has any impact on years of education by exploiting heterogeneity in pre-1990 industrial composition of districts of India, and differential tariff cuts by industry, to identify districts that were more and less exposed to liberalization. This is the same empirical strategy that is used by Topalova, EPT, and others. I use trade data directly from Topalova (2010) and household data from the 1992 and 1999 Demographic Health Surveys.

Education increased across India in the 1990s, but as mentioned, EPT find that school attendance increased less in districts in which employment is concentrated in industries that faced greater tariff cuts. However, I find that in these same districts, one specific group is significantly and positively affected by tariff cuts. For young girls in rural areas in the lowest 30% of the income distribution, tariff cuts are associated with a significant increase in average years of schooling. For the average reduction in weighted district tariffs of 5.5%, this translates to almost another full year (0.96 years) of education as a result of tariff declines. For poor Muslim girls, the magnitude of effect is less strong, but still positive (0.58 years). This is consistent with the findings of Anukriti & Kumler (2015), who associate tariff cuts with greater improvements in survival rates of young girls in lower socioeconomic classes, compared to higher socioeconomic classes. These effects are likely driven by tariff and poverty-induced increases in female labor force participation, which might increase perceived returns to education, and increases in relative female income that might result in greater female bargaining power within households, and therefore a smaller gender gap in education. Taking into account the

2.8% decrease in attendance for girls observed by EPT (2010), my results here imply that for girls that are still in school, average years of education increase by 0.99 years more as a result of tariff decline.

This paper is organized as follows. Section I provides background on education and trade reform in India. Section II outlines my empirical strategy, and includes descriptions of the data used, the measurement of trade liberalization, and the empirical framework. Section III presents main findings, with a brief note on robustness. Section IV considers the mechanisms that could lie beneath the relationship between schooling and trade reform. And Section V concludes. All tables and figures are presented in Section VII.

I. Background

A. Education in India

In this section, I briefly describe trends in education over the years for different demographic groups, the main findings of the PROBE report (1999) that sought to present a picture of the Indian schooling system as experienced by children and parents, and some important government schemes implemented in the period under consideration.

Trends in educational outcomes

As seen in Figure 1 (Literacy Rates 1951-2000), literacy rates have been increasing steadily since India became independent in 1947, from 18% in 1951 to 64% in 2001. However, two points are clear from this figure. First, India still has a very long way to go. 64% is impressive considering where India started, but looking at this figure in absolute terms, it is evident that there is much to be done. And at the start of the millennium, half of all women and a quarter of all men, or about 360 million people, were unable to read or write. Moreover, India fares poorly when compared to similar developing countries. As of India's most recent census in 2011, the literacy rate was 82% for men and 65% for women. By comparison, according to the CIA World Factbook, the literacy rates for men and women are 95% and 91% in Vietnam, and 99% for both men and women in Uzbekistan. These two countries have a GDP per capita similar to India. For additional comparison, literacy rates for men and women in countries sometimes compared to India are: 97% and 93% in China, 99% and 97% in South Korea, 94% and 93% in South Africa, and 96% and 91% in Thailand (World bank databank, CIA World Factbook).

The second point is that access to education is unequal. The gender gap in education is evident in Figure 1, for a number of reasons mentioned below. Literacy rates also vary by caste, religion, and region. Figure 2 (Educational attainment by socio-religious categories) shows the education gap between the general population and India's two largest minority groups: SCs/STs and Muslims. The historically disadvantaged lower castes and about 600 officially recognized disadvantaged tribes are listed in a schedule in the Indian constitution and therefore termed Scheduled Castes (SCs) and Scheduled Tribes (STs). As seen in Figure 2, SC and ST education rates are low compared to the rest of the population. This gap persists among men and women, in urban and rural areas, and across all educational levels. Muslims, India's largest minority religion, have also been historically disadvantaged relative to Hindus. According to Asadullah et al. (2013), there has been "considerable progress" in closing the Hindu-Muslim education gap, but it is "still sizable" (p.869). The reasons for the Hindu-Muslim gap are not clear. Asadullah et al. find that household level socio-economic factors, which might be expected to influence demand for education, can explain a significant proportion, but not all, of the gap. Asadullah et al. cite studies that consider other factors that might contribute to the gap. These include higher Muslim fertility compared to Hindu fertility, lower budgetary allocations to education in Muslim households, and lower parental ambitions and motivations that might stem from discrimination. Figure 3 (Graduation rates by socio-religious categories) show graduation rates for higher education over time for Muslims and SCs/STs compared with the rest of the population. It is evident that education rates

are increasing for SC/STs and Muslims but the gap remains.

Lastly, education rates, and the rate of their increase, vary considerably among states of India. Figure 4 (Change in Literacy Rate of Males and Females) shows the change in literacy rates across states over two consecutive decades. Through this paper, I attempt to understand why there is so much variation in the rate of change of education among states, and whether tariff changes might be partially responsible for this. I also attempt to understand whether tariff changes have had an impact on the schooling of women, Muslims, and SC/STs.

Constraints to schooling

The purpose of this section is to present a brief overview of some of the main constraints to education in India. The Public Report on Basic Education (PROBE team, 1999) is widely cited in the economic literature on education in India, and is focused on in this section. It was published in association with the Center for Development Economics, and is based on extensive fieldwork in rural areas of five states (Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh and Himachal Pradesh). It is worth keeping in mind that much of the survey is based on self-reported answers, and therefore might not be perfectly representative of reality.

The five PROBE states account for 40% of the population of India, and more than half of all out-of-school children. Except for Himachal Pradesh, these states are the worst performing in terms of elementary education. The authors find that even in these states, where parental apathy is most likely to be widespread, most parents attach importance to their children's education. An indication of increasing educational aspirations is that the proportion of children who have never been in school is declining rapidly: in 1986, 55% of children in rural areas in PROBE states were never-enrolled, compared to 19% in 1996 (p.19). Moreover, 98% of parents answered "yes" when asked "is it important for a boy to be educated?" (p.6).

However, parental motivation for the education of girls is lacking in a significant proportion of families. Saha (2013) observes significant gender disparity in intra-household educational expense, and notes that this discrimination is not confined to the 'backward' or developing states of India, but is widespread. This is supported by PROBE findings. When asked "how far would you like your son/daughter to study?", 57% of parents said "as far as possible" for their sons, and only 28% said the same for their daughters. According to the PROBE authors, reasons for this difference in attitude are due to two main factors. First, north Indian parents seem to often think of their daughter's upbringing from the point of view of her marriage. And second, employment opportunities for women were more limited than men. The issue of marriage is an interesting one — it appears to make education desirable, undesirable and a matter of indifference. When asked whether educating a daughter makes it easier or more difficult to get her married, 73% said it was easier and 27% said it was more difficult. The authors explain this in terms of marriage prospects and costs. Education may give a bride better prospects of finding a 'good' husband, but it would also raise the cost of her marriage because social norms require that she marry someone more educated. Once a north Indian

daughter is married, she typically leaves her family and joins her husband's family in his village, and her relationship with her parents is then quite distant. Sons traditionally remain close to their parents and often assist them in their old age. If parents are therefore indifferent about their daughters' education, then this leads them to give up as soon as the expenditure or effort involved in sending a daughter to school rises above a low threshold. Moreover, Maertens (2013) finds that the perceived ideal age of marriage significantly constrains the aspirations that parents have for their daughters, but does not do the same for their sons.

Boys might be educated more than girls because parents might view this as a more worthwhile investment. School demand is sensitive to the perceived rates of returns to education (Duflo & Bannerjee, 2011), and there is evidence that perceived rates of returns to education differ by gender. Chari & Maertens (2014) find that parents perceive a gap between what men and women can earn at each level of education. The PROBE survey also finds that a large majority of parents (87%) believed it important to educate sons because this improves employment opportunities, compared to 40% who believed the same for daughters.

However, the PROBE authors write that high parental motivation does not necessarily lead to regular attendance or even school enrollment, and that there are two reasons for this. First, that motivation for education may not be the same as motivation for the schooling supplied. Parents might feel that education is important, but that the education they want is not provided by the schooling system. And second, parents may be unable to send their children to school for a number of reasons: high costs of schooling, lack of facilities, need for children at home, etc.

The PROBE team attempted to find out what kind of schooling parents in rural areas of the PROBE states wanted, and found that this was similar to what most parents of all socio-economic groups would want: board exams, English-medium, uniforms, books and homework. They refute the widespread view that poor parents want their children to learn manual skills at school rather than acquire intellectual knowledge. However, there are minimal requirements for any schooling, such as adequate facilities, responsible teachers, and an engaging curriculum, which are not being met. The authors write that "the dismal condition of the schools precludes quality education of any kind, and is the main reason why high parental motivation for education often combines with open contempt for the schooling system" (p.27) There are several studies that document the fact that children are not learning much in schools. In the Annual State of Education Report (ASER), 700,000 children across India were tested and it was found that almost 35% of children aged 7-14 years could not read a simple paragraph (first grade level), and only 30% could do second grade mathematics (Duflo and Bannerjee, 2011, p.75). Govinda, Varghese et al. (1993) found similar results.

Duflo and Bannerjee (2011) write that as demand for schooling increases, parents will put pressure on public schools to deliver quality education, or else invest in private schools that are able to deliver education of the quality they demand. And it is conceivable that this is happening in India. Tooley (2009) describes the emergence of dozens of low-cost,

for-profit private schools in the slums of Hyderabad, India. Despite the fact that government schools were available for free, parents were choosing to pay for their children's education.

This is not always an option. Even in families that believe their children should be in school, regular attendance can be a challenge for two main reasons: dependence on child labor, and high costs of schooling. The PROBE team found that cases of full-time child labor for a wage are "only a minority" (p.28). They write that the vast majority of young children out of school help their parents at home and in the field, working as part-time family laborers. What is unclear is the extent to which child labor demands clash with schooling. The PROBE team found that on average, both girls and boys who were out of school only worked 2 hours more than those still in school. They also make the point that when children work rather than go to school, the direction of causation need not run from child labor to non-attendance, in fact in many cases that they saw, it was the other way round. However, in some situations, it can certainly be difficult for children with work duties to go to school. For example, older girls might have to work at home and care for younger siblings, and during periods of peak agricultural activity, children might have to stay home to help, which could sometimes - not always - lead them to drop out. Moreover, schooling costs are significant although the actual cost of tuition fees is often negligible. Tilak (2002) estimates that the combined cost of fees, books, uniforms, transport, etc. makes up about 7% of the average annual income for families in the poorest 10% of the income distribution. The PROBE authors also note that parents do not have the freedom of paying for items when they can, and many are therefore faced with a liquidity problem, even if annual expenditure might be affordable.

The costs of schooling can be reduced through public policy, and if the quality of schooling were improved then parents might be prepared to spend more. However, the authors write that although some major initiatives have been taken, "the general pattern remains one of limited and haphazard intervention" (p.32).

Government schemes

Several noteworthy government projects were implemented after the millennium and are therefore beyond the scope of this paper (for example, the Sarva Shiksha Abhiyan/the Education for All Movement, and the Right to Education Act). However, there were three significant changes to educational policy that do affect the period of this study. It is important to understand whether their impacts would interfere with the results of this paper.

The first was the National Policy on Education, 1986, which aimed to remove disparities and equalize educational opportunity for women, and SC/ST communities (Childline India website). As part of the National Policy, the government also launched 'Operation Blackboard'. This was intended to improve primary schools across the nation by supplying them with necessary facilities, equipment and materials. The National Policy on Education was modified in 1992 to create a common school system of 10 years + 2 years + 3 years, and a common entrance examination for admission to professional and technical programs. There is some variation in the Demographic Health Survey data

about the number of years of education required for primary/secondary education to be complete, and it is possible that changes in schooling structure may be partially responsible for this.

The second change in policy was the implementation of Phase 1 of the District Primary Education Program (DPEP), partially funded by the World Bank and launched in 1993-94 with the aim of achieving universal primary education through a variety of interventions. These included village education committees, mother-teacher associations, and increasing the availability of textbooks in regional languages. Phase 1 of DPEP was launched in 42 districts across 7 states: Assam, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, and Tamil Nadu (Jalan & Glinskaya, 2003). An evaluation of the impact of DPEP between 1993 and 2000 found a "small positive impact" on primary school attendance, and progression to higher levels of education. The impact on attendance rates was "at best 1%", and impacts were greater for male children and for children living in the state of Madhya Pradesh —the latter due to the simultaneous initiation of two substantial state level primary school programs. There was almost no impact on female children or children from scheduled tribes, although there was a small positive impact on children from scheduled castes. There is information available on which districts in particular were included in the DPEP, so in Section III (Robustness) I check whether this affects my results.

The third significant change in policy was the implementation of a mid day meal scheme to increase enrollment, attendance and retention at a primary school level and also to improve nutrition. This was partially implemented in 1995 and implemented across the country by 1997-98. (Ministry of Human Resource Development). While potentially responsible for increases in education during the period of this study, there is no reason why the implementation of this scheme would be correlated with tariff changes. This is addressed in some more detail in Section III (Robustness).

B. Trade Reform

According to Topalova (2010) and EPT (2010), Indian trade liberalization is an excellent setting to study the relationship between trade policy and poverty, child labor and schooling, since this was "sudden, wide-reaching, and externally imposed, providing an unusual natural experiment" (Topalova, 2010, p.10). In this section, I contextualize trade reform in India, and summarize the findings of other papers that have investigated the effects of India's trade liberalization.

Trade Reform in India

India became independent from the British in 1947. The first Prime Minister, Jawaharlal Nehru, was distrustful of private business and believed that poverty would be eradicated by macroeconomic policies that were "inward-looking and interventionist" (Cerra & Saxena, 2002). Policies pre-1990 included import protection and substitution, complex industrial licensing, and substantial public ownership of heavy industry. The import of consumer goods was completely banned, and for capital goods and raw materials, import licenses were granted provided there was proof of no indigenous supply (Chaddha et al., 2003). Production of several items was reserved for the small-scale sector. Many of these

items (garments, shoes, toys) had high export potential, but were inefficiently produced and not globally competitive. Tariff and non-tariff barriers were among the most severe in the world, and although India began gradually turning towards export-led growth in the late 1980s, in 1990 the average tariff was still greater than 90% (Cerra & Saxena, 2002). Figure 5 (Average nominal tariffs) shows the decline in average nominal tariffs from 1987 to 2001.

In the years immediately leading up to 1991, a number of factors (oil shocks due to the First Gulf War, slow growth in important trading partners, domestic political uncertainty, and loss of investor confidence) caused an "exceptionally severe" balance of payments crisis that necessitated urgent reduction in the fiscal deficit (Cerra & Saxena, 2002; Ahluwalia, 2002, p.67). India had to turn to the International Monetary Fund (IMF) for assistance, and IMF support was conditional on demands that included reducing India's budget deficit, opening its markets to foreign competition, reducing licensing requirements, cutting subsidies, and liberalizing investment (Weinraub, NY Times, 1991). The Indian leadership recognized that this was a turning point in Indian economic history. As quoted by Weinraub (1991), Manmohan Singh, Finance Minister at the time, announced that excessive bureaucracy and controls had damaged the nation's economy, that foreign investment would be sought and that India must face the realities of failed policies. The reforms that followed were meant to make India internationally competitive, and poverty was to be tackled through rapid and sustained growth in output and employment (Chaudhuri, 2002).

EPT (2010) make three points about the tariff reforms relevant to their study, and to mine. First, since tariffs were previously high, the reforms drastically reduced their levels. According to Topalova (2005), the average tariff declined from 83% in 1991 to 30% in 1997. Second, liberalization of this kind was unanticipated. Although very gradual policy changes had begun in the 1980s, the dramatic changes of 1991 were triggered by the balance of payments crisis and resultant IMF bailout conditions. They were not likely foreseen in schooling and labor decisions made by households during the 1980s, and played no part in district industrial composition before the crisis. And third, because IMF conditions required that the levels and dispersion of tariffs be reduced, the structure of protection was altered without considerations that might have played a role if this were a more organic process. Topalova (2005) observes that tariff changes are not strongly correlated with industry characteristics (productivity, skill intensity, capital intensity). EPT and Topalova argue that tariff changes even before 1991 were unrelated to the current situation. They cite Gang & Pandey (1996) who study the determinants of protection from 1979-1992, and consistently find that economic and political factors are not important determinants of tariffs in India. Rather, they explain that trade barriers were set in the Second Five Year Plan (1956-1961) and stayed roughly static since then, even though the economy was evolving.

Trade Reform in India: Relevant Literature

I exploit heterogeneity in pre-1990 industrial composition of districts of India, and differential tariff cuts by industry, to identify districts that were more or less exposed to liberalization. This strategy has been used in several studies: Topalova (2005), Topalova

(2007), Topalova (2010), Edmonds et al. (2010), Gaddis and Pieters (2012), Hasan et al. (2006-07), and Anukriti & Kumler (2015).

Topalova (2010) found that rural districts that were more exposed to liberalization experienced slower declines in poverty and lower consumption growth than districts less exposed to liberalization. Tariff cuts caused relative poverty to increase by 3.9% in districts that faced an average tariff decline of 5.5%, which is significant considering that the overall poverty decline from 1987-1999 was 13% (p.14-15). This is in contrast to what is theoretically expected: the Heckscher-Ohlin model predicts that countries will import goods that intensively use relatively scarce factors of production, and export goods that intensively use relatively abundant factors of production (unskilled labor in India), thereby raising the price and therefore real returns to the abundant factors. But, as Topalova explains, this depends crucially on the assumption that all factors are perfectly mobile. If labor employed in a given production sector is immobile in the short run, then price changes due to tariff reform will result in adjustments in factor returns, rather than adjustments through changes in employment and output. Topalova shows that the impact of the reforms seems concentrated among the poor, who are also the least geographically mobile, and contrary to Hecksher-Ohlin theory, finds no evidence of significant intersectoral reallocation of labor and capital. In fact, she found evidence of adjustment through changes in output prices and returns to factors of production. She also found that the impact of tariff changes on poverty and consumption was less pronounced in states with relatively flexible labor laws.

Topalova (2010) reassesses the findings of Topalova (2007) after Hasan, Mitra and Ural (2007) challenged these findings. She extends her original analysis and shows that her findings are robust to potential endogeneity of pre-1990 employment composition, and robust to the confounding effect of concurrent reforms, including the reductions of non-tariff barriers.

EPT (2010) find that although school attendance increased in India in the 1990s, it increased less in rural districts that were relatively more exposed to tariff reductions. The average tariff decline of 5.5% was associated with only a 15% increase in schooling, compared to a national average increase of 17%. However, they mentioned that the implied magnitude of tariff effects on attendance was relatively small when compared to the magnitude of effects such as SC status. To explain the slower increase in schooling, they find little evidence in favor of declining returns to education (rather, evidence showed tariff changes were more associated with increasing returns to education) or increases in child labor demand, and instead conclude that the relative reduction in schooling was due to the relative rise in poverty in affected districts observed by Topalova; that schooling was lower in more liberalized districts in an effort to save schooling costs. In support of this, they found suggestive evidence that in more liberalized districts, more households were observed taking out formal and informal loans for educational purposes. In addition, they found that tariff declines were associated with declines in household educational expenditure per capita. In a comparable study of urban areas (EPT 2009), findings are similar with two main differences. First, the magnitude of change in child time reallocation was larger in urban areas. They write that this might be

reflective of greater transmission of tariff reductions to urban markets. Second, the trade-poverty-schooling cost connection is more apparent in rural India. In urban India, the role of schooling costs is not so clear. EPT write that schooling might be less expensive in urban areas, or that employment opportunities might be more widely available to children.

Anukriti and Kumler (2015) compared women and births in rural districts of India and found that tariff declines benefitted females from lower caste, less educated and relatively poor households, compared to those in higher caste, more educated and richer households. They found that in districts more exposed to tariff cuts, when compared to high socioeconomic status women, births to low socioeconomic status women were more likely to be female, and newborn girls were also more likely to live through their first year. They also show that tariff declines caused fertility to increase for lower caste women, and to decrease for upper caste women, and that tariff declines increased relative female employment for lower caste women, and decreased the same for upper caste women. They write that tariff cuts decreased total household income, with larger declines among low caste families, which explains changes in fertility. And they write that sex ratio and mortality effects can be explained by changes in relative female income, which increase the intra-household bargaining power of women and relative perceived future labor market returns.

To summarize, in Indian districts that are relatively more exposed to liberalization, studies found: (1) slower declines in poverty and lower consumption growth, (2) smaller increases in attendance due to high schooling costs in rural India, (3) smaller increases in attendance and smaller declines in child labor in urban India, (4) increased returns to education, (5) for lower socioeconomic class women, relative to higher socioeconomic class women: greater fertility, lower female infant mortality, and greater female employment.

In terms of education outcomes, this means that the following could be expected in districts that are more exposed to liberalization relative to those that are less exposed: (1) smaller increases in schooling in more exposed districts because of increased relative poverty, (2) comparable or greater increases in schooling because of increased returns to education and improved employment opportunities, (3) fewer girls in school, if girls disproportionately bear the burden of poverty and high schooling costs, (4) more girls in school if female employment and household bargaining power is increasing.

II. Empirical Strategy

A. Data and Summary Statistics

The data for this analysis are drawn from two main sources: household data from Demographic Health Surveys 1992 and 1999 (known in India as National Family Health Surveys, NFHS-1 and NFHS-2), and trade data directly from Topalova (2010).

DHS education data

For data on education, Demographic and Health Surveys (DHS) were used because these are easily accessible, nationally representative surveys that provide household level information on education, occupations, and family characteristics (e.g. religion, asset ownership, etc.). DHS data on India is available for 1992 (NFHS-1), 1999 (NFHS-2), and 2005 (NFHS-3). However, district identifiers are absent from the 2005 round for privacy reasons, because of an additional HIV questionnaire. Since a state-level analysis would be too broad to draw any meaning, only the 1992 and 1999 rounds were used.

Following EPT (2009, 2010), my main group of interest is children who were 10-14 years in 1991. These children would be 18-22 years in DHS 1999, and therefore at an age old enough to have completed most of their schooling. This is important because my measure of education is total years of schooling, which has to be measured after a child's schooling is completed. For example – if a child is 15 years old and intends to study until she is 18, her reported total years of education at the age of 15 would not reflect the fact that she intends to study further. According to the data, 90% of the sample has less than 12 years of schooling in both 1992 and 1999. 95% of the sample has less than 14 years of schooling in 1992, and less than 15 years of schooling in 1999. Since elementary education begins at roughly age 6, this means that 90% of the sample has completed their schooling by roughly age 18, and 95% by age 20-21. I therefore assume that measuring an individual's total years of schooling at age 18-22 does not significantly underestimate the individual's total years of schooling.

Tariff reforms took place in 1991. I compare the 'reform' cohort that was 10-14 in 1991 (and 18-22 in 1999) to a 'pre reform' cohort that was 10-14 in 1984, and therefore 18-22 in 1992. There are about 17,000 individuals in the 'reform' cohort, and about 33,000 in the 'pre-reform' cohort.

Mean years of education between these two groups increased from 5.6 years to 6.1 years for men, and 3.2 years to 3.9 years for women (Table 1). Figure 6 (Years of education) compares the distribution of years of education for children that were 10-14 years in 1984 and 1991. It is evident that most children that are educated get up to about 5 or 10 years of education. This roughly corresponds to a complete primary and secondary education, respectively. The number of years taken to complete primary/secondary education is not standardized – Figure 7 (Educational attainment) shows the number of years of education and the corresponding educational level attained. While not standardized, it is clear that more years of education generally translate to greater educational levels attained. Using single years of education is a better measure than educational level attained because it is continuous. It allows differentiation between two children who have an incomplete

primary education, but 1 and 4 years of schooling. A weakness of this measure is that while more years of education generally translate to greater educational levels attained, this is not perfect. For example, the total years of education do not give any indication of whether a child repeated a grade due to failure. It is assumed here that greater total years of education indicate greater educational attainment.

In the 1992 and 1999 DHS surveys, Hindus make up 78%, Muslims 10-12%, Christians 5-7%, and Sikhs 2-3%. People with SC/ST status make up about 24-29% of the population. Table 1 also shows that there are considerable gaps in education by religion. For example, mean years of education for boys aged 10-14 in 1991 is 6.2 years for Hindus, 5.0 years for Muslims, 6.6 years for Christians, 6.5 years for Sikhs, and 5.3 years for SCs/STs. Table 1 also shows that for both girls and boys, mean years of education increase from 1984 to 1991. Mean years of education are higher for boys than girls, and differ not only across religion and caste, but by wealth level, and area of residence (urban vs rural).

DHS asset-based income index

DHS data does not have explicit data on income levels, but it has information about the ownership of various assets. Using this, I have constructed a rough asset-based income index to see the different effects of tariff changes on the relatively wealthy and poor. The wealth index assigned the following scores to the following assets:

1 point if household has electricity
1 point if household has a TV
1 point if household has a fridge
1 point if household has a car, or 0.5 points if household has a motorcycle
(1 point if household has both car and motorcycle)
1 point if household has piped water, or 0.5 points if household has a handpump or well in residence/yard/plot
1 point if household has private flush toilet, or 0.5 if household has private pit toilet/latrine

Scores range from 0-6, at 0.5 intervals. Figures 8 and 9 (Wealth index scores) show the wealth index scores for rural and urban populations. In an attempt to roughly equalize numbers of 'rich' and 'poor' for this analysis, I divided up the population into the 30% with most and least assets. Since the asset measure is a crude one, using only the top and bottom 30% also serves the purpose of leaving out the middle gray area. The urban-rural split is shown in Figure 10. This is the measure of wealth that has been used in Table 1. Again – this is a rough measure, and since some of these assets are more readily available in urban areas, ownership of these assets might not imply wealth as much in urban areas as in rural areas. This is possibly why in Table 1, rich urban men are seen to have fewer average years of education than rich rural men.

B. Measurement of Regional Exposure to Trade Liberalization

The district-level tariff data comes directly from Topalova (2010).

India is administratively divided into 29 states, which are further divided into districts. In 1991, the total number of districts was about 460. Districts differ in their industrial and employment composition. Since tariff protection varies by industry over time, districts are differentially impacted by tariff changes due to differences in employment composition. Depending on their employment composition at the time of the trade reforms, some districts experienced larger reductions in tariff protection relative to others (see Figures 11 and 12). This geographic heterogeneity in exposure to tariff protection is exploited here to understand the effect of tariff changes on educational outcomes. As can be roughly seen in Figure 12, the average change in employment-weighted average district tariff is 5.5%.

Topalova (2010) determines industrial employment shares in 1991 using the Indian Census of 1991, which documents employment by production sector at a district level. District tariffs are calculated as the industry employment weighted average nominal ad valorem tariffs at time *t*.

For each industry *i* and each district *d*:

$$employment\_share_{i,d,1991} = \frac{employment_{i,d,1991}}{\sum_i employment_{i,d,1991}}$$

And district tariffs at time *t* are the employment-weighted sums of industry-specific national tariffs.

$$tariff_{d,t} = employment\_share_{i,d,1991} \times tariff_{i,t}$$

It is worth emphasizing that this measure uses district-specific employment weights based on industrial composition *prior* to the reforms. Employment changes over time due to tariff reform therefore do not affect this measure of exposure to tariff reform.

Topalova uses the earliest available data, 1987, for the 'pre-reform' tariff measure, and 1997 as the 'post-reform' tariff measure.

This measure takes into account employment in both traded industries and non-traded industries. Non-traded industries (services, transport, and cultivation of cereals and oilseeds) are assigned a tariff value of zero for the entire period. This means that $Tariff_{dt}$ is sensitive to the share of people involved in non-traded industries, most of whom are poor cereal and oilseeds farmers. $Tariff_{dt}$ is therefore related to initial poverty levels. All else equal, districts with greater share of employment in non-traded sectors and therefore higher initial poverty levels would, by construction, have lower district tariffs and lower tariff changes. This could confound the empirical strategy, since poverty is correlated with education. For this reason, another tariff measure is constructed: $TrTariff_{dt}$, the traded tariff. This is constructed the same way as $Tariff_{dt}$ except that it ignores workers in non-traded production sectors and uses only those employed in traded sectors to weight the tariff measure.

The traded tariff $TrTariff_{dt}$ is not mechanically affected by the size of the non-traded sector. While this means that it is not related to initial poverty levels, this also means that

$TrTariff_{dt}$ does not reflect the magnitude of the effect that trade policy might have. However, this makes $TrTariff_{dt}$ a good instrument for $Tariff_{dt}$: it is strongly correlated with average tariffs but not correlated with initial district poverty levels.

Non-tariff barriers to trade (NTBs), the most widespread of which were import licenses, historically played a large role in Indian trade policy, and were gradually removed over the 1990s. Ideally these would be included in this analysis too, but data on NTBs was not easily available. EPT (2010), who also did not include NTBs in their analysis, explain why this does not drastically alter the results. First, they write that omitting NTBs would be a problem if NTBs were increasing as tariffs were decreasing, but this was not the case. They cite Nouroz (2001), who shows that NTBs were decreasing with tariffs, but more slowly. By 1997, 64% of imports were free of import licenses. Second, the exact timing of NTB dismantlement compared to tariff reductions does not affect results because only one pre-reform and one post-reform round are considered. However, since NTBs and tariffs are positively correlated, some of the effects attributed here to tariff declines might be the result of NTB declines. And third, they show that between 1989 and 1997, import volumes were increasing despite the lack of complete elimination of NTBs. They also cite a study that directly shows that reductions in tariffs were associated with greater import volumes between 1989 and 1997.

C. Empirical Framework

I am interested in the relationship between tariff protection and schooling, measured by years of education. As explained, India's trade reform of 1991 was an exogenous change that had differential impacts across districts of India, due to different pre-reform district employment compositions. In this paper, I compare changes in education between districts that experienced different levels of tariff decline. District level trade data generates the variation in tariff protection that is used to identify the effects of tariffs on education, but I estimate regressions at an individual level in order to control for other factors, like age, religion, etc. on an individual basis.

This empirical strategy rests on a few key assumptions about India's tariff reforms, mentioned in Section I.

1. It is assumed that the tariff reforms were exogenous, and unanticipated by parents and children making schooling decisions. This is a reasonable assumption because, as previously mentioned, India's liberalization was in response to conditional IMF support that followed a severe balance of payments crisis in 1991.
2. It is assumed that previous tariff levels, and tariff changes, are not influenced by education, poverty, etc. in a way that would imply endogeneity. This is also a reasonable assumption. Topalova (2005) observes that tariff changes are not strongly correlated with industry characteristics, like productivity, skill intensity, or capital intensity. And EPT (2010) cite Gang & Pandey (1996), who study the determinants of protection between 1979-1992 and find that economic and political factors are not important determinants of tariff protection.

As mentioned briefly in the previous section, the measure of district tariff protection is $Tariff_{dt}$, which is the average district tariff weighted by industry employment shares. $Tariff_{dt}$ is correlated with poverty by construction; this will be addressed. The dependent variable, education, is measured as total years of schooling. In the previous two sections, a few assumptions were made with respect to these two key variables. They are summarized here.

1. I assume that measuring an individual's total years of schooling at age 18-22 does not significantly underestimate the individual's total years of schooling.
2. I assume that greater total years of education indicate greater educational attainment, and that the number of individuals that repeated years of schooling by failing to graduate to the next grade is negligible.
3. I assume that all education reported by survey respondents was the result of childhood, and not adult, schooling. This is important because I am using two data points (DHS 1992 and 1999) to retrospectively calculate average years of children's schooling at various points in the past.
4. I assume that omitting NTBs from this analysis does not bias the results, and I assume that any increases in import volume that affect poverty, wages, returns to education, etc. are due to changes in tariffs. This is reasonable since tariffs and NTBs were both reduced together, but it might overestimate the impact of tariff declines.

One might expect that tariff changes would affect education decisions over a relatively long period, since it is likely that it would take some time for parents and children to become aware of, and adjust to, changes in returns to education. Adjustments to changes in poverty may or may not be quicker. Regardless, one might expect a lag before parents' and children's education decisions respond to changes in tariffs. Since I have only two data points (1992 and 1999), accounting for lagged changes is not possible. I therefore chose to limit the age groups I include in this analysis, with the following logic.

5. I assume that children who were 10-14 years in 1991, at the time of tariff changes, are young enough that tariff changes could affect their total years of education.

   This age group was chosen because children that were older at the time of tariff reforms would have presumably completed more of their schooling, and would therefore be less likely to be affected by tariff changes. Younger age groups could not be chosen since the second DHS round is only 8 years after the tariff reforms, and children that were of an 'impressionable' age in terms of their educational potential during the reforms would have to be old enough by 1999 to have completed most of their education, so that this could be measured as total years of education. The absence of a lagged effect means that it is likely that the results of this analysis would underestimate the effect of tariff reforms on schooling, or would show only preliminary effects.

Main specification

Given these assumptions, for a child *j* living in household *h* in district *d* at time *t*, the base specification is:

$$edyears_{jhdt} = \beta_0 + \beta_1 Tariff_{dt} + \beta_2 age_{jt} + \beta_3 gender_{jt} + \alpha_1 H_{ht} + \tau_t + \lambda_d + \varepsilon_{jhdt}$$

H_{ht} is a vector of household characteristics (including religion, sex and age of the household head, and SC/ST status). β_1 is the main coefficient of interest. τ_t is a post-reform fixed effect that controls for average changes in the education of children across all districts between 1984 and 1991. Districts differ in many respects -- endowments, schooling facilities, accessibility, geography, etc. These are potentially correlated with both industrial composition and schooling. To control for time-invariant district characteristics, λ_d is a district fixed effect. Since the tariff measure is constructed with constant pre-reform industrial weights, EPT (2010), who follow the same empirical strategy, write that this is effectively a counterfactual of how education would change if all else equal, national level tariffs were the only parameter that changed. All else equal, a positive value of β_1, the coefficient on $Tariff_{dt}$, would suggest that tariff declines are associated with decreases in schooling relative to the national trend.

β_1, the coefficient on $Tariff_{dt}$, is identified under the assumption that unobserved district-level shocks that affect education decisions are uncorrelated with changes in district tariffs over time. EPT write that changes in district tariffs capture the interaction of changes in tariffs at a national level and initial employment composition in a district. Therefore, only time trends in schooling that are correlated with both initial industrial composition and national tariff changes could be a source of bias. Since India's tariff reforms were the product of a balance of payments crisis and IMF demands, political economy played a very small role, and as mentioned previously, studies have shown that tariff changes were not correlated with industry characteristics (productivity, skill intensity, capital intensity) at the time of reforms. However, changes in district tariffs depend on the size of the non-traded sector, which could be associated with time trends that also affect education. This is addressed by instrumenting for district tariff $Tariff_{dt}$ with district tariff on traded goods $TrTariff_{dt}$.

Table 2 shows results for the following first stage equation:

$$Tariff_{dt} = \alpha + \alpha_1 TrTariff_{dt} + \tau_t + \lambda_d + \nu_{dt}$$

District and time fixed effects (λ_d and τ_t) are included. It can be seen that $Tariff_{dt}$ and $TrTariff_{dt}$ are strongly correlated. The coefficient on $TrTariff_{dt}$ (0.422) is significant at 1%. This IV strategy rests on the assumption that $TrTariff_{dt}$ is not correlated with ε_{dt}, which has been previously addressed.

It is hypothesized that tariff reforms could have influenced the education of children aged 10-14 years in 1991, and therefore 18-22 in 1999. Educational outcomes of this 'reform' group are compared to the 'pre-reform' group: children that were 18-22 years old in 1992

and therefore 10-14 years old in 1984, well before the trade reforms. It is assumed that people aged 18 or older in 1991 would be too old for their education to be significantly affected by tariff reforms.

To ensure that it is tariff changes that were affecting educational changes between these two cohorts, an alternative regression is presented that similarly compares two cohorts seven years apart, but ten years before the tariff reforms – this is effectively a control group or placebo. People that were 10-14 years in 1974 act as the control 'pre-reform' group, compared to people that were 10-14 years in 1981, that act as a control 'reform' group. People that were 10-14 years in 1974 were 28-32 years in 1992, and people that were 10-14 years in 1981 were 28-32 years in 1999. It is expected that tariff changes should affect the 1991 group more significantly than the 'false' 1981 group.

To reiterate for clarity, in tables that follow, results labeled '10-14 years in 1991' show the effect of tariffs on children that were 10-14 years in 1991 by comparing children that were 10-14 years in 1984 and 1991, and therefore before and during the tariffs. This is measured by years of schooling reported when these individuals were 18-22 years old, which was in 1992 and 1999 respectively. Similarly, results labeled '10-14 years in 1981' show the effect of the same tariff changes on children that were 10-14 years in 1981, by comparing children that were 10-14 years in 1974 and 1981. Since there were no actual changes to tariffs in this period, the coefficient on 'tariffs' should not be highly significant, and will represent no more than the relationship between sectoral employment composition and years of education. This is not meaningful here, but ensures that the results picked up in the first specification do indeed show the effect of tariff changes on education.

At the end of Section I, I outlined the various (sometimes contradictory) ways in which tariffs might be expected to affect educational outcomes: smaller increases in schooling in more exposed districts due to increased relative poverty, comparable or greater increases in schooling because of increased returns to education and improved employment opportunities, etc. Given differences in the educational levels and constraints on men vs women, urban vs rural, and different income levels, it is hypothesized that tariff reforms might affect different socioeconomic and demographic groups differently. To avoid having to include dozens of interaction terms within a single specification, and to clearly distinguish between the effect of tariff reforms on different groups, the base specification is run separately for various groups, limiting the sample to the specific group under consideration each time. First, the regression was run based on differences in gender, wealth, and place of residence (urban/rural), with religion and SC/ST binary variables included as controls. When the effect of tariff reforms was seen to be concentrated within the subgroup of poor rural women, the regression was run separately for religion/caste subgroups.

III. Results

A. Main Findings

Table 3 presents the results of the base specification for the entire sample. Columns 1 and 2 show the OLS results, and Columns 3 and 4 show the IV results. Column 1 and 3 show the 'target' group – they compare children who were schooled before and during tariff reforms. Column 2 and 4 show the 'control' group – they compare children who were schooled well before any tariff changes. It is clear that using the IV substantially changes the results. The coefficient on $Tariff_{dt}$ is not significant in Column 1 (OLS, target group), and is significant at 10% in Column 2 (OLS, control group) – this is meaningless, since we would expect tariffs to have no effect in the 'control' specification. However, the coefficient on $Tariff_{dt}$ is significant at 5% in Column 3 (IV, target group) but not significant in Column 4 (IV, control group), which is to be expected. In Column 3, the negative coefficient on $Tariff_{dt}$ indicates that on average, the education levels of children in districts that were more exposed to liberalization increased more than that of children in districts less exposed to liberalization. In districts experiencing the average decline in $Tariff_{dt}$ of 5.5%, this means that education increased by (4.881*0.055=0.268) about a quarter of a year more than in districts that would have experienced no tariff declines. Across India, average years of schooling are increasing – the coefficient on the post dummy variable indicates that years of schooling increased by 0.9 years for boys, and by 0.4 years for girls. The coefficient on Female indicates that there is an education gap between boys and girls of about two and a half years, and the coefficient on Wealth30 indicates that children in the top 30% of the income distribution (according to the rough asset based index described in Section II) receive, on average, 5 years of education more than those at the bottom 30%. In terms of religion and caste, results show that on average, Muslim children are educated for 1.5 years less than Hindu children, although this gap is decreasing – in Column 4, we can see that ten years before, the gap was about 2.5 years. On average, Christian children are educated for 1 year more than Hindu children, and SC/ST children are educated for about 1 year less.

Table 4 shows coefficients on $Tariff_{dt}$ when the analysis is limited to various subgroups. It is clear that the effect of tariffs observed in Table 3 is entirely due to the effect observed on poor women in rural areas. The coefficient on $Tariff_{dt}$ for the entire sample is -4.881, significant at 5%. When the rich and poor in urban and rural areas are considered separately, the coefficient on $Tariff_{dt}$ in urban subgroups (rich and poor) is insignificant, as is the coefficient on the rural rich. The coefficient on $Tariff_{dt}$ for the rural poor is -15.63, significant at 1%. When considered separately for each subgroup by gender, the coefficient on $Tariff_{dt}$ is insignificant for all subgroups except rural poor women, for whom it is -17.43, significant at 1%.

Table 5 presents results for rich and poor women (i.e. in the top and bottom 30%, according to the wealth index in rural areas). The coefficient on $Tariff_{dt}$ is significant at 1%, and negative, implying again that years of education increase more in districts more exposed to liberalization than in districts less exposed to liberalization. The coefficient on the control group is significant at 5%, and also negative, but of a smaller magnitude. The

difference in magnitude of the two coefficients on tariff, and the greater significance of the target group compared to the control group indicate that tariff changes did significantly affect years of education of children aged 10-14 in 1991, but the significant coefficient on tariffs in the control group indicate that the effect of tariffs on the target group might be overestimated. In districts experiencing the average decline in $Tariff_{dt}$ of 5.5%, the coefficient on the target group in Column 1 indicates that education increased by (17.43*0.055=0.9586) almost a year more than in districts that would have experienced no tariff declines. It is especially interesting that greater tariff declines increase educational outcomes for poor rural women, because the average increase in years of education for this group across India, as seen by the coefficient on the post dummy variable, is not significant. For rich women in rural areas, the effect of tariff changes is not significant, but the coefficient is positive, indicating that tariff changes do not have the same effect on the poor and rich.

Table 6 summarizes the effect of tariff changes on mean years of education within various subgroups. In Column 1, I outline whether in districts more exposed to liberalization, years of education increase more than in districts less exposed to liberalization, increase less, or whether there is no significant difference. This is based on the sign and significance of the coefficient on $Tariff_{dt}$. If there is a significant coefficient, then in Column 2, I calculate the magnitude of increase/decrease by multiplying the coefficient on $Tariff_{dt}$ by 0.055, because the average decline in district tariffs is 5.5%. In Column 3, I provide the mean years of education for children aged 10-14 years in 1991 for reference. We see that for rural poor women, education increases more in districts that are more exposed to liberalization. For the average decline of 5.5%, this means that education increases by close to 1 year. This is substantial considering that for poor rural women, average years of education for those 10-14 years in 1991 is 1.66 years. However, this might be an overestimation, since the control group showed a significant coefficient too.

B. Robustness

The tariff-schooling relationship would be biased if $Tariff_{dt}$ was correlated with omitted district-level time varying factors that influenced years of schooling. In this section, I address the potentially confounding effects of (1) other economic reforms that accompanied tariff reforms, and (2) improvements in school infrastructure that occurred during the same time period.

During the 1990s, several other economic reforms were implemented along with tariff reforms, such as measures to increase foreign direct investment (FDI), and reforms in the banking sector. It is important to ensure that the results presented in the previous section are due to tariff changes and not these other reforms. Following Topalova (2010) and EPT (2010), I include the following additional controls in the base specification:

1. District-level employment-weighted shares of industries subject to industrial licensing
2. District-level employment-weighted shares of industries open to FDI
3. The number of banks per capita in a district

These controls are included in the results presented in Columns 3 and 4 of Table 7. Columns 1 and 2 show results from the base specification without additional controls, as presented previously. Only rural women are included here because this was the only group for which tariff reforms showed any significant effect. The coefficient on $Tariff_{dt}$ is still significant at 1%, and only very slightly smaller in magnitude (-16.96 in Column 3, -17.43 in Column 1).

In Section I, I mentioned that the government had initiated a few schemes to increase and improve education. One of these, DPEP Phase 1, was launched in 1993-94 across certain districts in certain states. In a World Bank program evaluation, data is available on specifically which districts DPEP was launched in. While there is no reason to expect DPEP to correlate with tariff changes, to ensure that this does not bias my results, I excluded the 35 DPEP districts and re-ran the base specification. Results are presented in Columns 5 and 6 in Table 7. The coefficient on $Tariff_{dt}$ is almost identical to previous results (-17.82 in Column 5, -17.43 in Column 1). It is clear that efforts to improve schooling through DPEP are not responsible for the increase in years of education described in the previous section.

DPEP is not the only government program to be initiated in the years under study, but it is the only program on which data was easily available. In unreported regressions, EPT (2010) determined that the prevalence of scholarships, free mid day meals, and free tuition did not affect their results (p.57). EPT also write that they used data on the number of primary schools per capita, and additional data on schooling facilities at a district level from the All India Education Survey, and found no evidence that changes in school availability or quality were substantially correlated with tariff changes (p. 58).

IV. Mechanisms

Results in previous sections showed that in districts more exposed to liberalization, one specific group showed a significant increase in mean years of education: poor rural women. In this section, I briefly discuss the possible channels through which tariffs could affect female education. These include: (1) changes in child labor demand and supply, (2) changes in poverty levels, (3) changes in female employment (4) changes in household bargaining power, and (5) changes in opportunities and returns to education.

Child labor demand and supply

One might expect child labor demand and supply to be affected by tariff changes, and child labor could affect schooling because time spent working might substitute time spent in school. If child labor supply increased as a result of tariff changes, for example, due to poverty, then one might expect schooling to decrease as a result.

EPT (2010) use data from the Indian National Sample Survey on children's time spent in various activities (school, market work, domestic work, idle) to test the effect of tariffs on activities by gender. They find that in rural areas, attendance increases less in districts more exposed to liberalization, but write that the data do not suggest this relative decline in attendance is primarily driven by increased employment of children in market work. Tariff declines are not associated with a statistically significant increase in the probability that a child is observed working without attending school. Rather, they find that tariff declines are associated with significant increases in domestic work, and significant increases in 'idle' time (i.e. children not in school and not working). For young girls, but not for boys, EPT find that tariff declines are associated with a significant relative decrease in market work. EPT also write that in unreported regressions, they do not observe declines in domestic work among adults associated with lower tariffs, so it seems unlikely that the rise in domestic work reflects children doing household chores instead of their working parents.

To summarize, EPT find that tariff declines are not associated with relative increases in the probability that children work without attending school, and so child labor should have no negative effect on female education. Additionally, out-of-school girls are less involved in cash generating activities compared to boys, and more involved in domestic work. If domestic work can accommodate a more flexible schedule, this might help explain why girls' schooling increases more than boys'.

Poverty

Schooling has direct costs (fees, uniform, travel expenses, etc.) and the indirect opportunity cost of time spent not generating income. For these reasons, one would expect poverty to be associated with decreases in schooling.

Topalova (2010) finds that in districts more exposed to liberalization, poverty decreases less. This has at least one direct impact on schooling. According to EPT, in districts more exposed to liberalization, since poverty decreases less, families might be less able to afford the costs of schooling. They find this the most plausible reason why attendance increases less in districts more exposed to trade.

One would expect this to drive female education to decrease, rather than increase, in districts more exposed to liberalization. This would also be especially expected in poor families, and given the gender education gap, it might be expected that girls would be disproportionally affected. The results presented here do not show this to be a predominant effect.

Female employment

One reason for the gender education gap is perceived differences in the income generating potentials of sons and daughters (Chari & Maertens, 2014, PROBE team, 1999). If female employment increased (in adults, not children), then since women would bring in more family income, this might increase perceived returns to girls' education, and therefore one might expect more families to invest in the education of women. Increased female employment might therefore increase female education.

Bennett (1992) writes that poverty is the most powerful determinant of female labor force behavior in India – she shows an inverse relationship between household economic status and female labor participation (Figure 13 has been reproduced from her data). She also shows evidence that constraints on women appear to be stronger among high caste Hindus than among scheduled castes and tribes, and stronger among land-owning cultivators than among landless laborers. It is therefore plausible that in districts experiencing greater tariff cuts, where poverty decreased less than in other areas (Topalova), rural women of lower income groups worked relatively more than women of higher income groups.

Anukriti & Kumler find evidence that supports the hypothesis that tariff declines and greater relative poverty are associated with greater female employment among the poor. They use data from the National Sample Employment-Unemployment Survey to show that in districts experiencing greater relative tariff cuts, employment increases significantly for lower caste women. For lower caste men, effects are weaker, but the opposite. The coefficients for upper caste women are of smaller magnitude and less significant than those of lower caste women, but imply that employment decreases as a result of tariff changes. Anukriti & Kumler write that the pattern of results for the likelihood of being a wage worker or the likelihood of being a manufacturing worker are similar to the employment results. They do not provide a mechanism for these changes in employment, but cite other studies, like Gaddis & Pieters (2012) that show consistent results.

Gaddis & Pieters (2012) study the effect of liberalization on women in Brazil using the same strategy as Topalova, EPT, Anukrit & Kumler, etc. Gaddis & Pieters find that tariff reductions were associated with an increase in female labor force participation after a period of about two years. They also found evidence that employment flowed from agriculture and manufacturing to trade and other services. Gaddis & Pieters explained this increase in female labor force participation through the income channel. They cite Fernandes and Felicio (2005), who show that wives are more likely to enter the labor force after their husbands have become unemployed. Gaddis & Pieters attempt to test this

themselves, and write: "we cannot firmly conclude that unemployment of husbands was a main channel for the effect of liberalization on wives' labor force participation, but we clearly see that unemployment among men is associated with more women entering the labor force" (p.26). They also argue that trade liberalization-induced labor reallocations among sectors, especially the shift from manufacturing to services, contributed to workforce feminization.

If women are increasingly expected to work to support their families in poor rural areas, like men, then such families might be more likely to close the gender gap in educational investments.

Relative female income and household bargaining power

In line with the point above about women's employment, if female income was to increase relative to male income, then this might increase women's household bargaining power. If men and women have different preferences about girls' education, then this increase in women's household bargaining power could decrease the educational gender gap.

Anukriti & Kumler argue that relative female income rises as a result of tariff reforms, even if total household income decreases. They say this is for three reasons. First, if male and female wages were equally affected by tariff cuts, then improvements in relative female employment would result in improvements in relative female income. As mentioned in the section above, Anukriti & Kumler find that tariff declines are associated with increases in the employment of low caste women relative to low caste men. Therefore in low caste families, tariff declines would be associated with greater relative female income. Second, they write that there was a sectoral change in male-female employment. They found that tariff declines were associated with relatively more lower caste women working in manufacturing than men, although their results for this are weak. Since manufacturing is a sector with smaller wage cuts, they argue that this caused women's income to increase relative to men. And third, they found that tariff declines were associated with an increase in lower caste women working for a wage relative to men. Since women have historically worked in the unpaid informal sector, the increased likelihood of lower caste women working for a wage further supports the argument that tariff declines are associated with greater female income relative to men.

It is plausible that if women are bringing in a larger proportion of household income than before, then their household bargaining power might increase. If women are seen to be more valuable and powerful members of a household, then the gender gap in schooling might reduce.

Anukriti & Kumler use this mechanism to support the finding that in districts more exposed to tariff declines, for low socioeconomic status women, tariff cuts improved the sex ratio at birth and the relative survival rate for girls.

The idea that greater relative female income results in greater female education is consistent with a 2002 study cited by Duflo & Bannerjee (2011). Offshore call center

recruitment was set up in three randomly selected villages in north India where recruiters would usually not go. Employment of young women naturally increased in these three villages compared to other similar villages. Three years after recruiting started, it was found that girls aged 5-11 were 5% more likely to be enrolled in school in these villages. They also weighed more; implying that they were better cared for by their parents (p.76-77).

Opportunities and Returns to Education

If perceived returns to education for women increase, then one would expect female education to increase. Anukriti & Kumler cite some interesting studies that show that in India, new opportunities might be perceived differently by men and women.

They cited Munshi & Rosenzweig (2003), who studied the effect of tariff changes on men and women from lower castes in Mumbai. They found that although returns to different occupations changed in the 1990s, men were not taking advantage of these opportunities because they had always obtained traditional jobs through well-established networks. They continued to be enrolled in Marathi medium schools. Meanwhile girls, having historically low labor force participation rates, did not have access to these networks and had no historic precedent for type of education. They therefore began going to English medium schools, which gave them access to better paying jobs.

Anukriti & Kumler also cite Jensen and Miller (2011, unpublished) who show that parents in rural India strategically prevent their sons from migrating to urban areas to take advantage of better opportunities, since they want them to continue working on the household farm and provide old age security. In such situations, returns to girls' education might be higher than boys'.

To summarize all the possible mechanisms explained above: it seems that in poor rural families, poverty and schooling costs might 'pull' female education down, while changes in female employment and relative household income might 'push' female education up. Evidence seems to show that the latter is the dominant effect.

Topalova (2010) found that tariffs have greater effects on those at the bottom of the income distribution, and Anukriti & Kumler (2015) find significance in the effects of tariffs on only low castes, not high castes. This is consistent with my results: it appears that tariffs had no substantial impact on the education of the wealthy. If greater female employment, as a result of greater relative poverty, is a driving force of greater relative female income and increased female education, then it is to be expected that this would not be observed in rich households.

V. Conclusion

In urban and rural India, in the 1990s, poverty declined and school attendance increased. However, studies find that in areas in which employment is concentrated in industries exposed to larger reductions in tariffs, poverty decreased less (Topalova, 2010), and attendance increased less (EPT, 2010), than in areas less exposed to tariff reductions.

In this paper, I study the effects of India's tariff reforms on years of schooling. I find that in districts more exposed to tariff reductions, one specific group shows greater increases in years of schooling: average years of schooling for poor women in rural areas increase more as a result of tariff declines. In districts experiencing the average decline in district tariffs of 5.5%, average years of education for poor rural women increase by almost a year more than in districts that would have experienced no tariff declines. Other demographic groups were not significantly affected by tariff reforms. This finding is robust across specifications that control for the effect of other concurrent economic reforms and the effect of DPEP, a government scheme to increase education in the 1990s.

EPT (2010) find that attendance increases less in the same districts that show an increase in years of schooling for poor rural women, both as a result of the same tariff changes captured by the same measure of district tariffs, and both using the same empirical strategy. It is conceivable that both these effects could occur. In districts more exposed to trade, a slower decline in poverty could have caused fewer families to send their children to school, resulting in a smaller increase in attendance. EPT found that relative attendance decreased by 2.8% for young girls as a result of tariff declines. In this sample of 7370, this would translate to 206 girls out of school due to poverty and schooling costs. But in the families that are still sending their children to school, it seems as though girls were being schooled more than in areas less exposed to tariff cuts. My results showed that on average, years of schooling increased by 0.96 years due to tariff declines. Taking into account the 206 that are not in school, for the remaining 7164 girls, this means on average, 0.99 more years in school as a result of tariff declines. This is possibly a result of tariff-reform induced increases in female employment, relative female income and household bargaining power that causes the gender education gap to reduce.

VI. References

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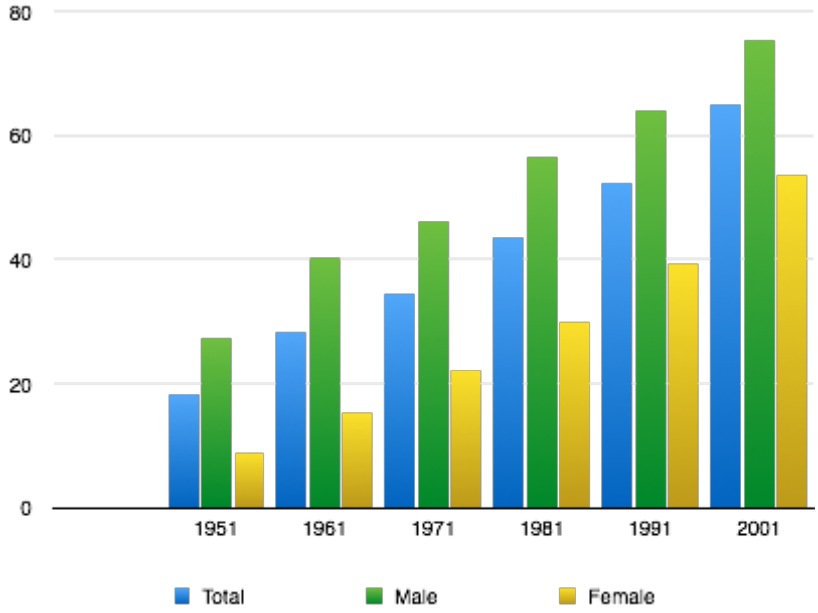
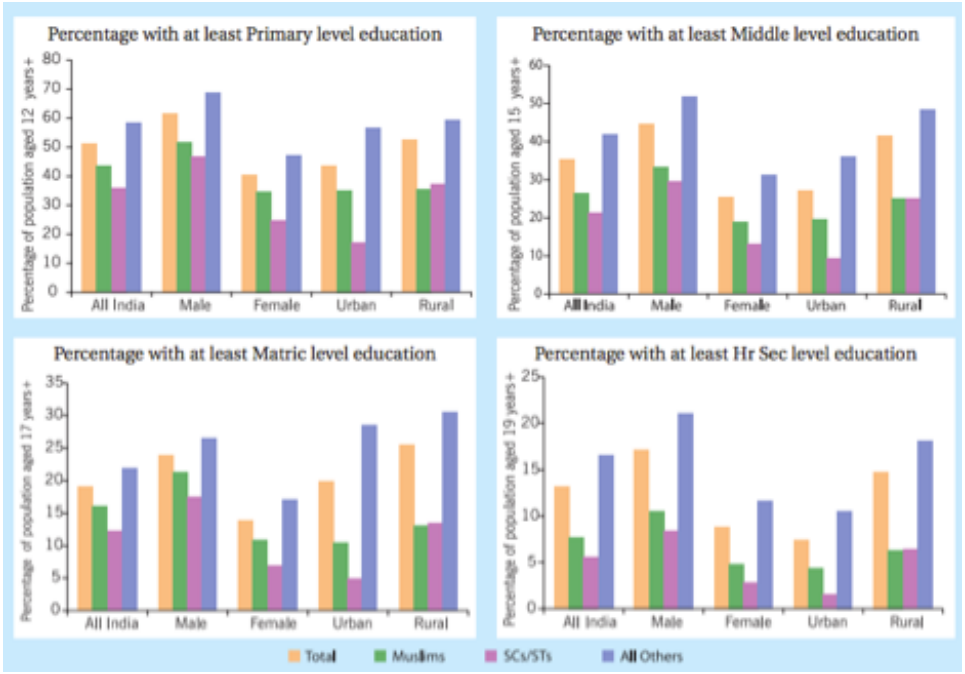
VII. Tables and Figures

Figure 1: Literacy rates 1951-2001, for those aged 7+ years



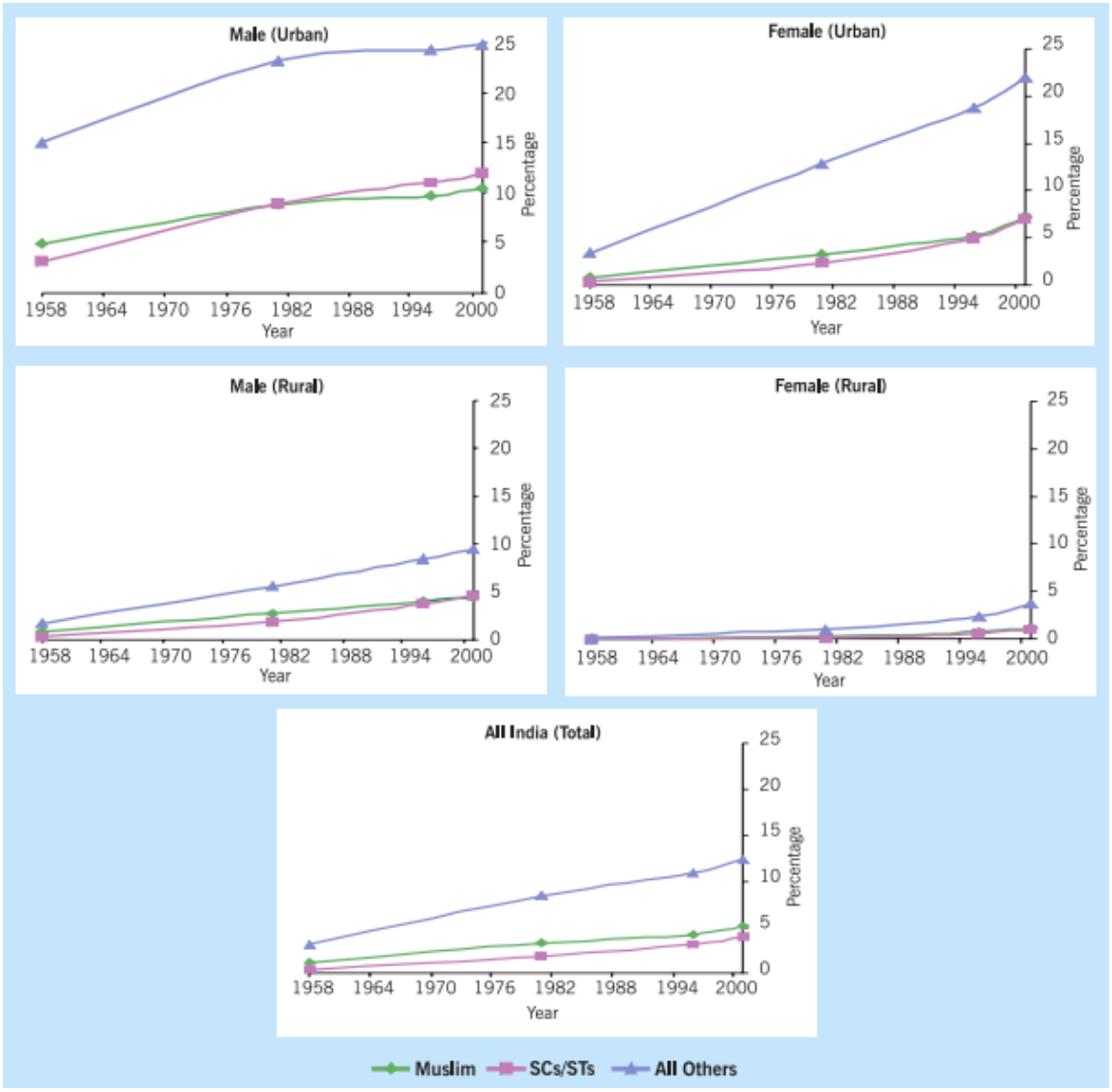
Source: Data from National Literacy Mission http://www.nlm.nic.in/literacy01_nlm.htm

Figure 2: Educational attainment by socio-religious categories



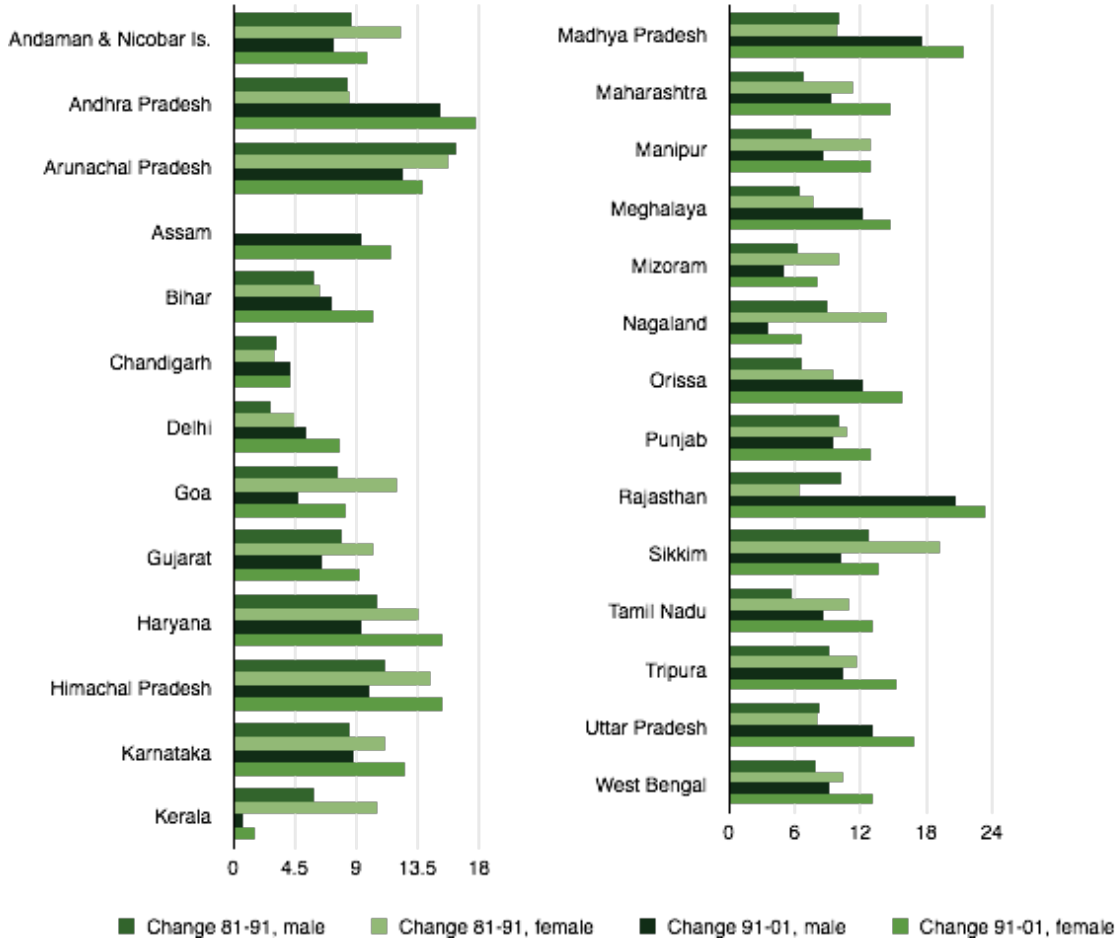
Source: Taken directly from the Sachar Committee Report, 2006, p.59

Figure 3: Graduation rates by socio-religious categories (higher education)



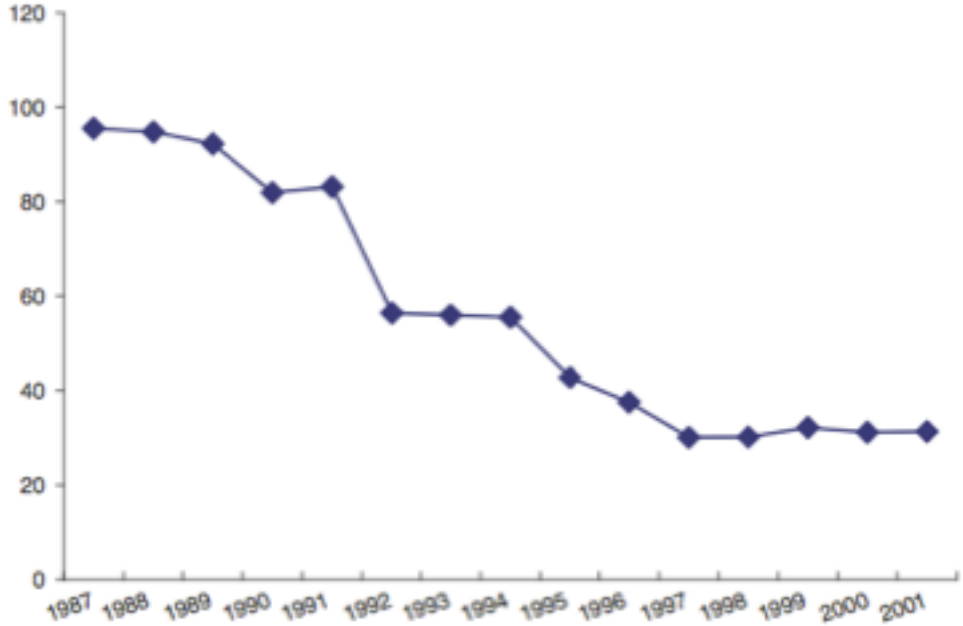
Source: Taken directly from the Sachar Committee Report, 2006, p.59

Figure 4: Change in Literacy Rate of Males and Females (ages 7+ years), 1981-1991 and 1991-2001



Source: Data from Indian census 1981, 1991 and 2001, Education for All and the National Literacy Mission

Figure 5: Average nominal tariffs 1987-2001



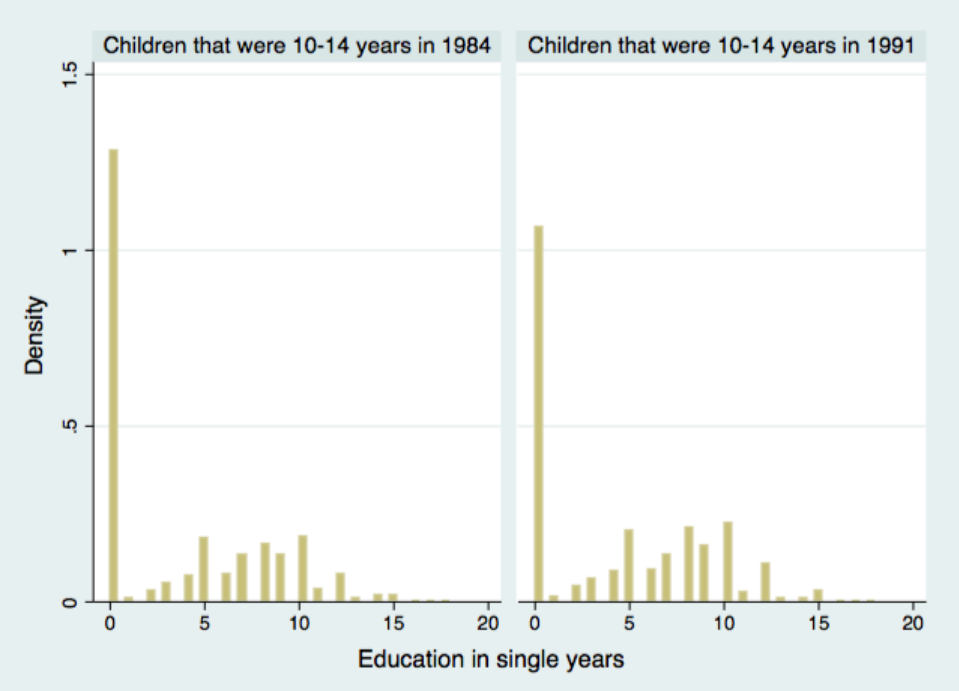
Source: Taken directly from Topalova, 2010, p. 6.

Table 1: Mean years of education

	Mean years of education for children aged 10-14 in 1984 ('Pre-reform' cohort)		**Mean years of education for children aged 10-14 in 1991 ('Reform' cohort)**	
	Male	Female	Male	Female
All	5.6	3.2	6.1	3.9
Rural	5.4	2.5	5.9	3.2
Urban	6.6	5.3	7.2	6.2
Rural Rich	8.8	6.8	9.3	7.3
Rural Poor	3.8	1.0	5.0	1.7
Urban Rich	8.5	7.4	8.7	7.9
Urban Poor	3.7	1.8	4.2	1.9
Hindu	5.7	3.0	6.2	3.9
Muslim	4.3	3.0	5.0	3.5
Christian	6.0	5.1	6.6	5.3
Sikh	5.9	4.4	6.5	5.3
SC/ST status	4.8	2.1	5.3	2.8

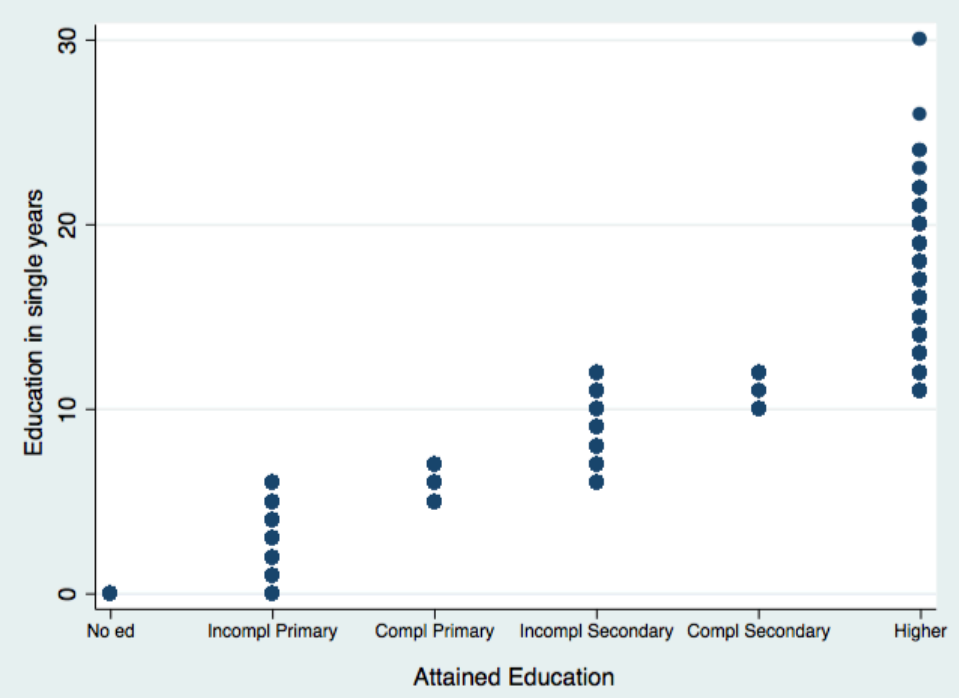
Source: DHS data, India, 1992 and 1999

Figure 6: Years of education



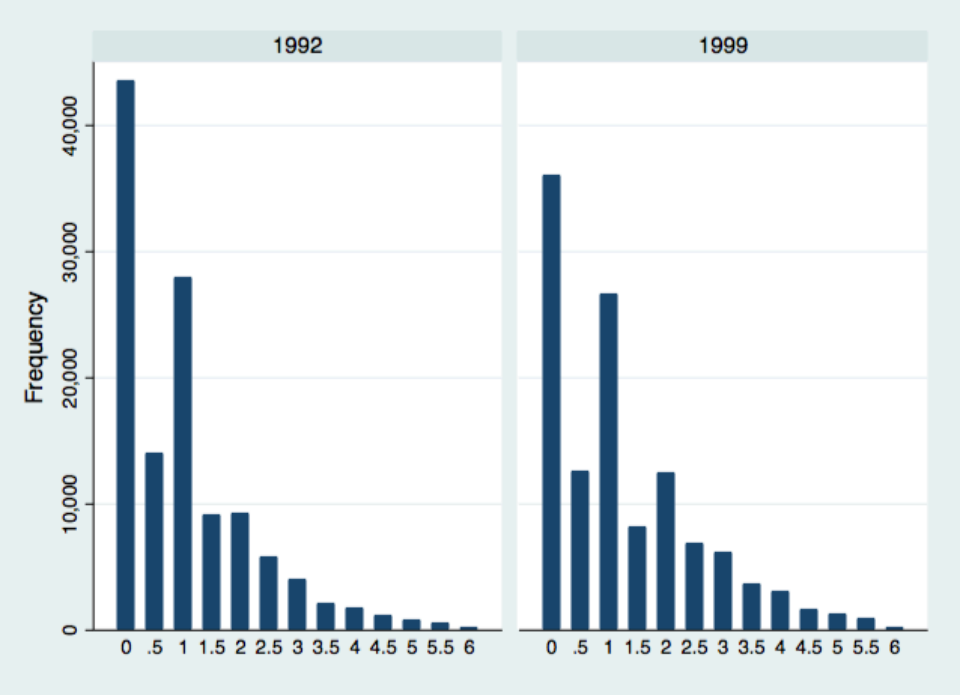
Source: DHS data, India, 1992 and 1999

Figure 7: Educational attainment and years of education



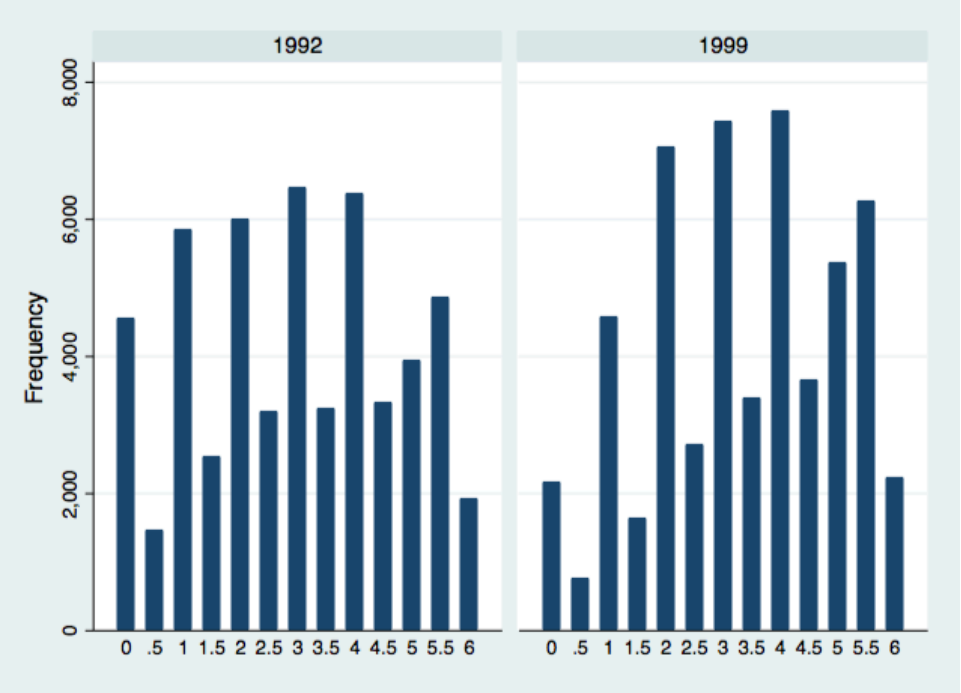
Source: DHS data, India, 1992 and 1999

Figure 8: Wealth index scores, Rural



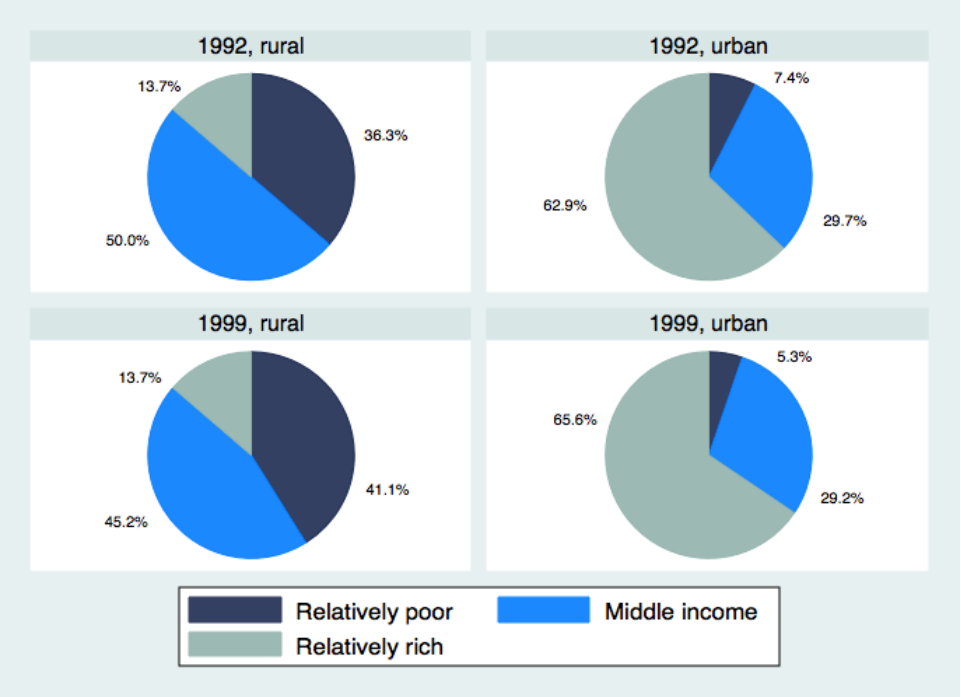
Source: DHS data, India, 1992 and 1999

Figure 9: Wealth index scores, Urban



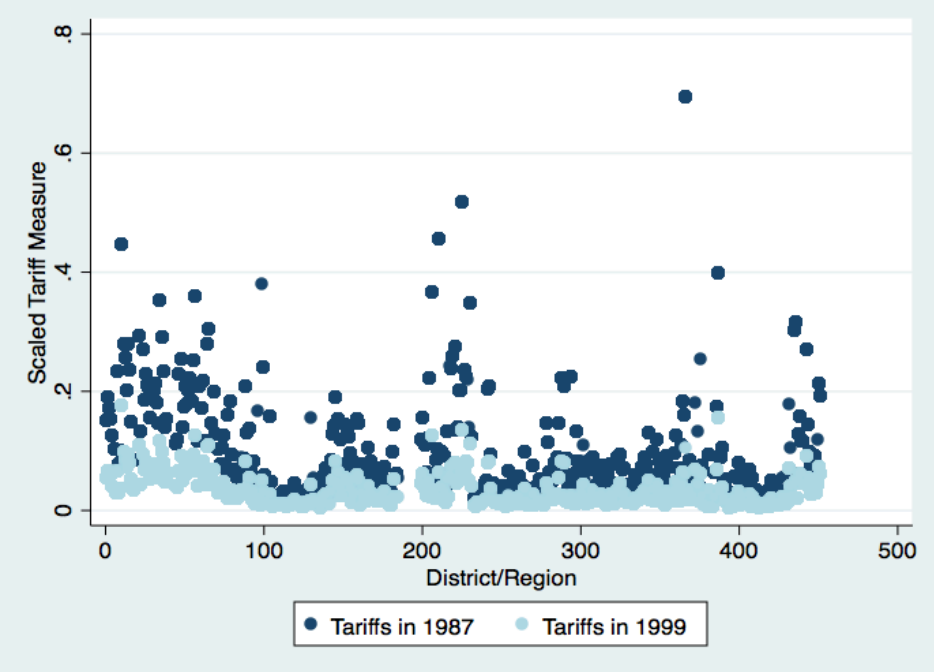
Source: DHS data, India, 1992 and 1999

Figure 10: Wealth index – Top and bottom 30% of the income distribution



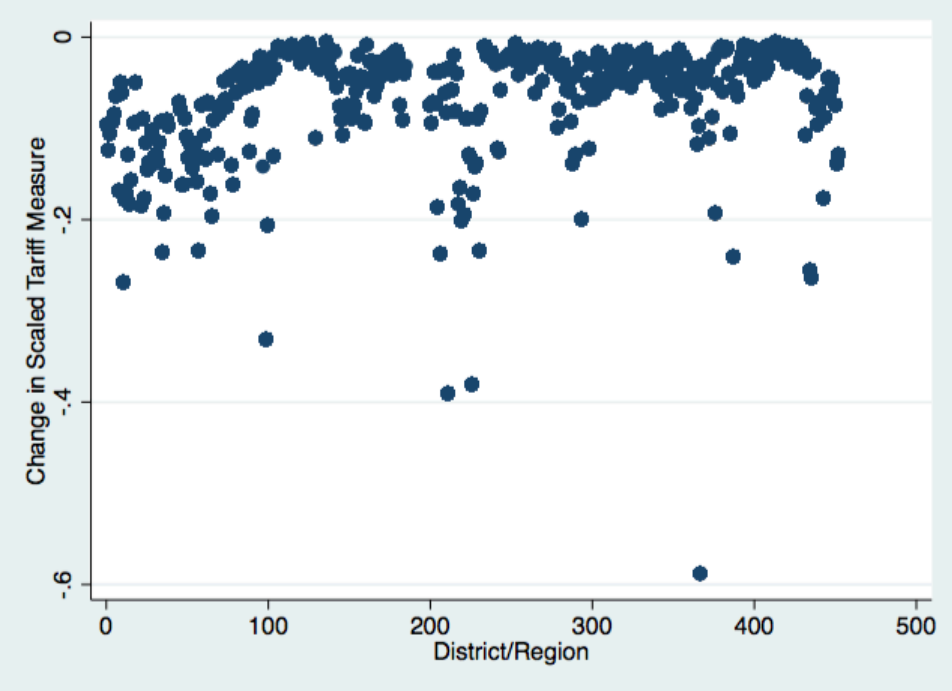
Source: DHS data, India, 1992 and 1999

Figure 11: Employment-weighted average tariffs by district, 1987 and 1999



Source: Data from Topalova, 2010

Figure 12: Change in employment-weighted average district tariffs 1987-1999



Source: Data from Topalova, 2010

Table 2 – First Stage: Relationship between $Tariff_{dt}$ and $TrTariff_{dt}$

VARIABLES	(1) First Stage
trtariff	0.422***
	(0.00165)
post	0.163***
	(0.000971)
Constant	-0.255***
	(0.00148)
Observations	298,869
Number of dist_id	424
R-squared	0.698
Region	All
Gender	All

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3: OLS vs IV results for the entire sample

VARIABLES	(1) OLS 10-14 yrs in '91	(2) OLS 10-14 yrs in '81	(3) IV 10-14 yrs in '91	(4) IV 10-14 yrs in '81
tariff	0.179	1.256*	-4.881**	-1.369
	(1.008)	(0.716)	(2.283)	(1.578)
age	0.134***	-0.0573***	0.133***	-0.0573***
	(0.0202)	(0.0152)	(0.0202)	(0.0152)
female	-2.569***	-2.390***	-2.538***	-2.387***
	(0.0915)	(0.0602)	(0.0924)	(0.0602)
wealth30	5.143***	6.131***	5.118***	6.129***
	(0.0852)	(0.0679)	(0.0859)	(0.0679)
scst	-1.082***	-1.474***	-1.089***	-1.476***
	(0.0666)	(0.0568)	(0.0667)	(0.0568)
muslim	-1.532***	-2.423***	-1.536***	-2.425***
	(0.0926)	(0.0752)	(0.0927)	(0.0752)
christian	0.809***	0.912***	0.803***	0.910***
	(0.261)	(0.133)	(0.261)	(0.133)
sikh	0.454*	0.0262	0.452*	0.0236
	(0.261)	(0.157)	(0.262)	(0.157)
femalehhhead	-0.0276	-0.0697	-0.0220	-0.0692
	(0.108)	(0.0824)	(0.108)	(0.0824)
agehhhead	0.0192***	0.0280***	0.0191***	0.0280***
	(0.00177)	(0.00149)	(0.00177)	(0.00149)
post	1.180***	0.883***	0.870***	0.652***
	(0.133)	(0.0892)	(0.183)	(0.152)
postxfemale	-0.432***	-0.380***	-0.500***	-0.386***
	(0.129)	(0.0841)	(0.132)	(0.0842)
Constant	0.713	4.644***	1.264**	4.991***
	(0.452)	(0.475)	(0.504)	(0.510)
Observations	16,861	33,250	16,861	33,250
R-squared	0.299	0.334		
Number of dist_id	413	414	413	414
Region	All	All	All	All
Gender	All	All	All	All

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4: Coefficients on $Tariff_{dt}$ by subgroup

	Coefficient on $Tariff_{dt}$ for children aged 10-14 years in 1991 (Reform cohort)	**Coefficient on $Tariff_{dt}$ for children aged 10-14 years in 1981 (Pre-reform cohort)**
All	-4.881**	-1.369
Rural rich	3.954	7.002
Rural poor	-15.63***	-4.804*
Urban rich	-0.937	-2.404
Urban poor	1.475	14.79*
Rural men – rich	40.41	9.625
Rural men – poor	-12.67	-6.937
Rural women – rich	3.201	8.230
Rural women – poor	-17.43***	-4.446**
Urban men – rich	-9.898	-2.257
Urban men – poor	-5.488	37.82**
Urban women – rich	2.509	-2.800
Urban women – poor	6.596	-0.643
Rural women – poor, Hindu	-24.69***	-4.025
Rural women – poor, Muslim	-18.77***	-10.14**
Rural women – poor, Christian	-49.87	-2.476
Rural women – poor, SC/ST	-42.42***	-8.897**

Table 5: IV results for rural women by income group

VARIABLES	(1) Poor 10-14 yrs in '91	(2) Poor 10-14 yrs in '81	(3) Rich 10-14 yrs in '91	(4) Rich 10-14 yrs in '81
tariff	-17.43***	-4.446**	3.201	8.230
	(3.972)	(2.222)	(9.115)	(9.106)
age	-0.0303	-0.00854	0.233***	-0.119**
	(0.0211)	(0.0169)	(0.0681)	(0.0600)
scst	-0.674***	-0.595***	-1.371***	-2.491***
	(0.0677)	(0.0551)	(0.319)	(0.309)
muslim	-0.378***	-0.699***	-1.789***	-3.139***
	(0.112)	(0.0942)	(0.355)	(0.357)
christian	0.607*	1.453***	1.153	0.858**
	(0.316)	(0.205)	(0.773)	(0.377)
sikh	0.376	-0.423	0.351	-0.202
	(0.605)	(0.550)	(0.492)	(0.451)
femalehhhead	-0.0751	-0.0254	0.357	0.165
	(0.131)	(0.0941)	(0.320)	(0.293)
agehhhead	0.00972***	0.00999***	0.0300***	0.0132**
	(0.00185)	(0.00191)	(0.00666)	(0.00561)
post	0.0982	0.116	1.058*	1.008
	(0.184)	(0.120)	(0.600)	(0.699)
Constant	2.495***	1.147**	0.419	9.227***
	(0.522)	(0.536)	(1.677)	(2.115)
Observations	7,370	7,552	1,929	2,514
Number of dist_id	341	345	299	307
Region	Rural	Rural	Rural	Rural
Gender	Female	Female	Female	Female

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Summary of tariff effects

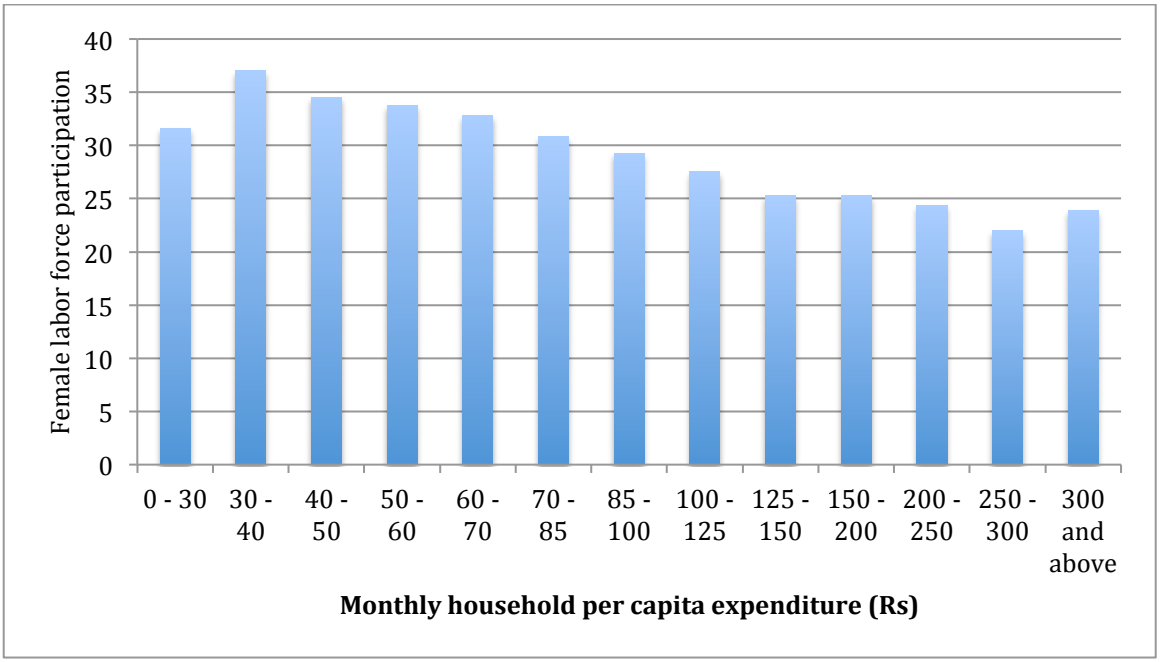
Subgroup	(1) In districts more exposed to liberalization, years of education…	(2) By how many years?	(3) Mean ed yrs for children 10-14 years in 1991
All	Increase more	0.27	4.41
Rural rich	No significant difference		7.68
Rural poor	Increase more	0.86	2.51
Urban rich	No significant difference		8.00
Urban poor	No significant difference		2.25
Rural men, rich	No significant difference		9.34
Rural men, poor	No significant difference		4.97
Rural women, rich	No significant difference		7.30
Rural women, poor	Increase more	0.96	1.66
Urban men, rich	No significant difference		8.70
Urban men, poor	No significant difference		4.21
Urban women, rich	No significant difference		7.88
Urban women, poor	No significant difference		1.88
Rural women, poor, Hindu	Increase more	1.36	1.61
Rural women, poor, Muslim	Increase more	1.03	1.56
Rural women, poor, Christian	No significant difference		3.18
Rural women, poor, SC/ST	Increase more	2.33	1.34

Table 7: Robustness check – IV results for rural women by income group

VARIABLES	(1) Poor 10-14 yrs in '91	(2) Rich 10-14 yrs in '91	(3) Poor 10-14 yrs in '91	(4) Rich 10-14 yrs in '91	(5) Poor 10-14 yrs in '91	(6) Rich 10-14 yrs in '91
tariff	-17.43***	3.201	-16.96***	3.057	-17.82***	5.270
	(3.972)	(9.115)	(4.068)	(10.03)	(4.248)	(10.20)
age	-0.0303	0.233***	-0.0315	0.233***	-0.0267	0.257***
	(0.0211)	(0.0681)	(0.0211)	(0.0682)	(0.0220)	(0.0731)
scst	-0.674***	-1.371***	-0.680***	-1.376***	-0.670***	-1.314***
	(0.0677)	(0.319)	(0.0677)	(0.321)	(0.0708)	(0.340)
muslim	-0.378***	-1.789***	-0.383***	-1.793***	-0.363***	-2.068***
	(0.112)	(0.355)	(0.112)	(0.358)	(0.115)	(0.386)
christian	0.607*	1.153	0.588*	1.134	0.431	0.980
	(0.316)	(0.773)	(0.316)	(0.776)	(0.327)	(0.882)
sikh	0.376	0.351	0.347	0.369	0.428	0.155
	(0.605)	(0.492)	(0.605)	(0.493)	(0.640)	(0.511)
femalehhhead	-0.0751	0.357	-0.0740	0.367	-0.0957	0.463
	(0.131)	(0.320)	(0.131)	(0.321)	(0.136)	(0.356)
agehhhead	0.00972***	0.0300***	0.00971***	0.0298***	0.00970***	0.0292***
	(0.00185)	(0.00666)	(0.00185)	(0.00669)	(0.00194)	(0.00715)
post	0.0982	1.058*	-0.353	1.175	0.0891	1.170*
	(0.184)	(0.600)	(0.235)	(1.073)	(0.196)	(0.650)
minmfgmfdi			0.0337	-1.828		
			(0.643)	(2.141)		
minmfgmlicense			-1.109**	-0.566		
			(0.562)	(2.376)		
bankpercap			1.646	1.341		
			(1.013)	(2.507)		
Constant	2.495***	0.419	1.974**	-0.359	2.443***	-0.232
	(0.522)	(1.677)	(0.824)	(2.897)	(0.546)	(1.787)
Observations	7,370	1,929	7,370	1,929	6,855	1,748
Number of dist_id	341	299	341	299	307	269
Region	Rural	Rural	Rural	Rural	Rural	Rural
Gender	Female	Female	Female	Female	Female	Female
Econ reforms	**No**	**No**	**Yes**	**Yes**	**No**	**No**
DPEP	**No**	**No**	**No**	**No**	**Yes**	**Yes**

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 13: Relationship between household income and female labor force participation



Source: Data from Bennet, 1992