Exchange Rates and Foreign Direct Investment into China

An Honors Thesis for the Department of Economics

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PART I. INTRODUCTION

Rise of China's Economy

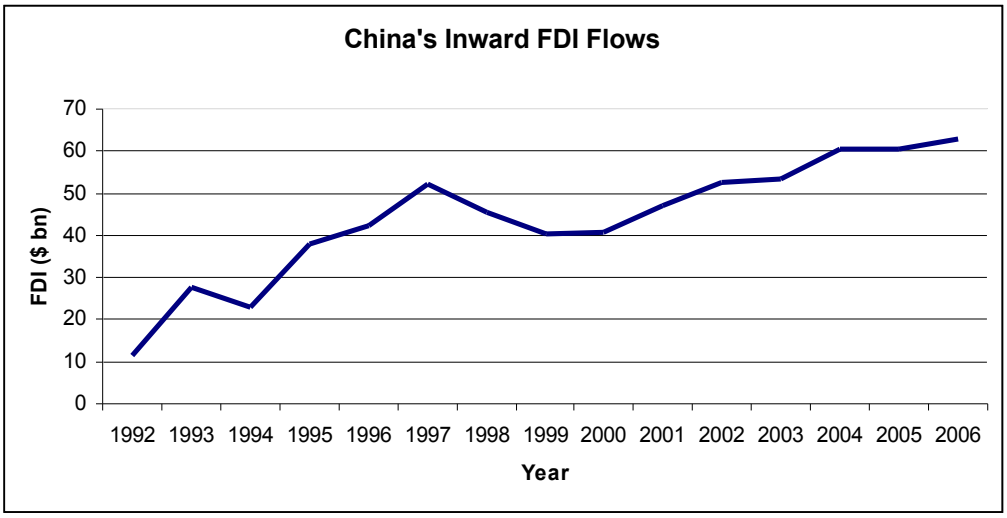
Since the end of the reform period in 1978, China has been experiencing unexpectedly high levels of growth over the last three decades. Less than a year ago, China officially surpassed Japan as the second largest economy in the world in nominal terms, with a GDP of $5.745 trillion in 2010.[1] Japan had enjoyed the lead for the previous decade. This succession had already occurred several years ago as measured in PPP terms.[2] Economist Charles Wolf predicts that China's GDP measured by PPP will in fact double that of Japan's by 2015.[3]

While the full implications of this development are unclear, there is no doubt that this dramatic growth will significantly impact the world economy. This effect will likely be especially profound for international trade. An overwhelming 65% of global trade in goods was comprised of China's trade alone in 2008, up from only 13% in 2006. Of Chinese exports, 92.4% are merchandise exports, making the manufacturing sector the "main driving force behind China's industrialization and rapid growth." Resulting from these conditions is expected GDP growth hovering around the 10% figure for several years to come.[4]

Another large part of China's growth has been its uncontested ability to attract foreign direct investment into the country. A lack of bureaucratic red tape and lenient tax and tariff policies have allowed firms in developing nations as well as those from highly-industrialized nations in Europe, America, and the Asia Pacific to take advantage of extremely low input costs for materials and labor. However investors are also averse to any instability, perceived or actual, in the investment environment in China, that may stem from changes in business regulation or exchange rate valuation which have considerable impediments on investment returns.

China's inward FDI reached a high of $92.4 billion in 2008 with growth rates reaching into the double digits.[5] Figure 1 shows the upward trend of China's FDI from 1992 to 2006. China has experienced a steady exchange rate with the rest of the world due to the fixed exchange rate regime, though it always laced with a hint of precariousness in the government's policy decisions. However despite this level of uncertainty, the overall investing environment has been favorable for international firms to take advantage of this opportunity for capital growth.

Figure 1: China's Inward FDI Flows 1992-2006



This ballooning growth and subsequent rapid increase of wealth has transformed China internally in various social aspects, as well as its international diplomatic and economic relations. The government has found the funds to invest in a number of developing economies in Africa, Latin America, the Middle East, and the Caribbean. Gaining access to these emerging markets not only promises high return on their investment, but also opens up a new market of consumers to Chinese goods. In addition, China selects strategic relationships where it can also benefit from cheap access to raw materials that will help the booming domestic manufacturing industry.[6]

As a result from trade and investment balances, China is one of the largest holders of foreign currencies in the world, which may give it special power in influencing American

inflation rates, interest rates, and wages, especially in America. At the same time, the United States is one primary consumer of Chinese manufactured goods that are responsible for Chinese growth. Thus, the symbiotic relationship between the United States and China is truly unique.

Exchange Rate Policy and "Currency Wars"

In addition to threatening the relative position of high-growth "Asian tigers," China's ascension in global GDP rank also threatens to disrupt both the European and American economies. Of particular concern in this respect has been the Chinese government's policy throughout the last several decades of using their monetary policy and central government control to fix their exchange rate at an artificially low level. China pegged the renminbi to the U.S. dollar in 1994 at 8.27 yuan to the U.S. dollar, which lasted until 2005.[7] The following three-year period was a managed floating exchange rate where the yuan appreciated 21.1% to 6.83 yuan to the U.S. dollar at the end of 2008.[8] After repegging to the dollar briefly after the onset of the financial crisis in 2008, the government has since announced on in June of 2010 that it will "proceed further with reform of the RMB exchange rate regime and to enhance the RMB exchange rate flexibility." [9]

Such Chinese exchange rate policy and its implications have recently caused a backlash from some of the world's most important economic leaders. They claim that China has been exercising excessive control (dubbed manipulation) of the renminbi, including capital controls, allowing them to keep exports artificially cheap and especially attractive to foreign investors. Paul Krugman of the New York Times has also pointed out that "massive foreign exchange intervention over a period of years, is in effect a combination of an export subsidy and an import tariff;" the latter two claims violate the rules of the WTO of which China is a member.[10]

There have been many studies that attempt to measure the market equilibrium rate of the RMB to the American dollar. Economists from the Peterson Institute of International Economics estimate that the yuan would have to appreciate by at least 24% against the dollar; other estimates suggest; other estimates suggest an appreciation of up to 40%.[11]

However, from China's perspective, much of attracting foreign investing and trade has been due to a fixed exchange-rate regime. While a floating currency is seems to be the default for most advanced countries, scholars such as Calvo and Reinhart (2000)[12] have shown that "developing countries are structurally different from advanced countries that make floating exchange rate inappropriate."[13] Juggling international pressure to allow floating rates, as well as domestic pressure to uphold booming economic growth, the Chinese government has been taking many precautions ensure it's economic and political stability.

The liberalization of the Chinese currency has been encouraged by Western economists as its current exchange rate and monetary policy disadvantages trade conditions for American firms. However, policymakers are well aware that this process requires slow adjustments to policy and exchange rates, as an immediate shift from strictly managed currency to free-floating can cause potentially colossal disruptions in the domestic economy. Scholars often look to Japan several decades ago, who were in a similar situation. Faced with international pressure to allow a free-floating yen, Japan, the United States, and other industrialized nations agreed upon the Plaza Accord in 1985, which agreed to allow for an appreciation of the yen to alleviate the current account deficit of the Western nations. Despite a planned and agreed upon appreciation of 51% between 1985 and 1987, the negative economic impacts of the Japanese economy were significant. As Western goods became noticeably cheaper, the export-led growth in Japan experienced a sharp drop. Despite attempted monetary and fiscal stimuli by the Japanese

government, there was much uncertainty surrounding the exchange rate. The value of assets, such as stocks and land prices, rose rapidly, and "Black Monday" struck the stock market in October of 1987. The consequences of this crisis are still being felt today with a lack of policy or conditions to bring it out of the long-term slump in the entire economy.[14]

Today, China fears a similar shock to the Chinese economy in the case of mismanagement of the situation. While the government recognizes a need to loosen the grip on exchange rate policy, it must balance this liberalization with the decline in economic prosperity it will experience from a decrease in exports and inward investment. With an economic structure so dependent on exports and inward capital flow, it is important to examine how big of a role exchange rates have played in determining the trade and investment levels.

Motivations for Research and Hypotheses

In the initial stages, the scope of my research was limited to the data available to me as an undergraduate student. Access to data in the yearly China Statistical Yearbooks led me to choose a topic investigating whether fixed exchange rates had the same effect on foreign investment as it did on trade. The mechanisms that connect exchange rates and trade are relatively direct, whereas exchange rate and investment mechanisms are less intuitive. Perhaps the empirical evidence would clash with financial theory, which would have negative implications for theoretical research on the topic.

I hypothesized first that exchange rates did play a large role in foreign direct investment decisions into this emerging market. If the central bank of PRC intervenes hundreds of billions of dollars on an annual basis to keep exchange rates pegged to the dollar, there must be further benefits to this situation than just a comparative advantage in trade. Second, I predicted that FDI

flows would change more or less the same as trade flows – a relative depreciation of the RMB would attract foreign investors. As the RMB is weaker, the returns of investment projects in this currency seem more attractive due to lower initial costs, which would logically imply an expansion of exports, and increased foreign investment. This hypothesis is partially based on research from the WTO which finds a positive relationship between trade and FDI, primarily through production facilities, distribution networks, inventories, and after-sales services in order to remain competitive. The establishment of these processes abroad logically leads to transferred technology and increased productivity, which is linked to trade with an increase in exports. A boost in FDI is seen as having a positive correlation with trade levels. With a weaker Chinese currency, as trade levels increase, one should also expect to see a boost in FDI.[15] On the other hand, however, studies have also shown that this relationship is not as clear. For example, a paper published by NBER suggests that the linkage between FDI and trade in goods should be strong, but bi-directional. And because there are many difference components that affect each measure, this linkage may be very dependent on the stages of development of the source country.[16] Thus, there is evidence arguing for and against correlation between exchange rates and FDI.

Finally, for sector level data, I envisioned exchange rates to be significant and higher in magnitude for industries such as manufacturing that rely heavily on cheap labor and input costs. It is for these firms that find the most advantage in a weaker RMB. This is based on numerous studies that show that cheap labor and input costs of raw materials is a key player in attracting foreign direct investment. Other important factors include the growing market size of the Chinese market, and government regulation.[17]

This paper will first review existing research that has been done on the topic, then review the sources of data and examine their characteristics. The following two sections are divided into two different models based on different sets of data which include background of the model, results, and discussion within each section. The first one organizes FDI flows into China by country, while the second organizes FDI flows into sector. Both models have the goal of describing the relationship between levels of foreign direct investment (dependent variable) and exchange rates (independent variable) by looking at different aspects of investment flows. Finally, the conclusion will sum up main points from the paper.

PART II. PAST RESEARCH

Literature Review

The issue of exchange rates in China is a hot topic given its contested fixed exchange rate policy and its current role as a robustly rising economic superpower. It is therefore not surprising that the controversy surrounding China's decisions regarding a relatively devalued RMB, policy has been the focus of many academic papers.

There have been substantial studies on the effect of Chinese exports with respect to changes in exchange rate: those done by Ahmed (2009)[18], Hua (2006)[19], Kalirajan et al. (2009)[20], and a study by the Peterson Institute of International Economics (2010) are just a few that are notable. These studies generally agree that an appreciation in the real exchange rate would result in a drop in Chinese exports and subsequent shift in the Chinese economy on the world economic horizon. For example, Cline from the Peterson Institute found that a rise in the real effective exchange rate by one percent reduces the trade surplus by .30% of GDP. [21]

The topic of investment in the context of exchange rate uncertainty and investment has also been studied in depth on both the domestic and international front, but conclusions are much more ambiguous. This study was examined thoroughly by a number of economists. The seminal study by Dixit (1989) finds that the value of waiting increases as there is more uncertainty in exchange-rates, and thus this uncertainty will delay any investment activity of the firm.[22] In later research, he produced an economic model, the Dixit-Pindyck model (1994)[23] which was used by several other economists to infer more ambiguous conclusions.

For example, Darby et al. (1999)[24] studied the Dixit-Pindyck model in the context of European FDI. Using exchange rate data and intra-European FDI statistics, they found that for risk-averse firms, there are different scenarios under which exchange rate uncertainty will depress or boost investment. Lin et al. (2006)[25] break down firms into two groups: market-seeking firms, who target the new consumers of the FDI-receiving country, and export-substituting firm, who seeks to serve foreign consumers, but invest in countries with cheap labor or other import costs. Using firm-level data on investment from Taiwan into China, their findings reveal that exchange rate uncertainty tends to delay investment decisions of a market-seeking firm, but apparently accelerates investment decisions of an export-substituting firm. Thus, depending on the type of firm, and a firm's specific risk profile, there is no defining relationship between exchange rate volatility and levels of FDI.

Depending on the selection of industry and countries, one can infer different conclusions. For example, Xing et al. (2008)[26] conducted a similar study using data on investment from Japan into China. They found that with an appreciation of the Japanese yen, Japanese investment moves into China, but due to brand recognition and barriers to entry into the market, economic

profits increase in Japanese firms but not Chinese firms. They postulate that within this mechanism, appreciation of the renminbi have a positive effect on FDI flows.

Hattari and Rajan (2009)[27] sought to find specific determinants of FDI levels specifically in bilateral FDI flows between Asian countries looking at statistics between 1990 and 2005. They produced a model that identifies the following as key factors: the GDP of both the investing and receiving country, a dummy variable determining whether the two countries share a language, and the geographical distance between the two regions. The pair also identifies less quantifiable variables that are not embedded in any model, but still serve as important considerations: political risk, origin of legal system, and levels of asymmetric information between the two countries.

There has also been in-depth research on the effects of foreign direct investment on neighboring countries of East Asia. Das (2007)[28] conducted a thorough analysis and summary of the FDI environment in Asia over the last several decades and the role of China in this region. In examining the effect of FDI from one country to its neighboring countries, he found that a 10% increase in FDI flows into China raised FDI inflows into its eight neighboring Asian economies by 2-3%. In this sense, FDI into China benefits the entire region economically. Despite extensive studies into the topic of both the effects of exchange rates and the effects of foreign direct investment, and specific case studies in Asia, there still lacks a general consensus on the practical conclusions from these studies.

PART III. DATA

Data for the following variables were taken from a variety of sources and organized into panel data format. See Table 2 for data descriptions and Table 3 for summary statistics.

Table 2: Description of Data

Variable	Units	Source	Description
fdi	10,000 USD	China Statistical Yearbook	Foreign Direct Investment from source country to China
exrate	local currency / RMB	International Financial Statistics; Central Bank of Republic of China	averaged monthly averages of LCU (local currency units) to USD. Each rate was multiplied by a USD/RMB exchange rate to yield a LCU / RMB exchange rate
gdp	USD	International Financial Statistics	Annual gross domestic product (GDP)
reer	index with 2005=100	IMF World Economic Outlook Database, Oct 2010	China's RMB real effective exchange rate expressed as RMB to world currencies in index form with 2005=100

Table 3: Summary Statistics

VARIABLE	N	mean	sd	min	max	Var	skewness
year	795	1,999	4.323	1,992	2,006	18.69	0
fdi	733	88,758	274,852	2	2.085e+06	7.554e+10	5.396
exrate	792	217.0	1,093	0.00164	10,261	1.195e+06	6.893
irchina	795	1.975	4.105	-7.982	7.311	16.85	-0.755
irlocal	633	6.523	10.08	-32.06	78.79	101.7	2.569
gdp	720	5.852e+11	1.526e+12	7.971e+07	1.334e+13	2.329e+24	5.093
exlcurmb	792	27.03	134.0	0.000297	1,240	17,949	6.760
lnfdi	733	8.859	2.555	0.693	14.55	6.528	-0.150
lngdp	720	25.03	2.557	18.19	30.22	6.538	-0.620
lnexlcurmb	792	-0.505	2.169	-8.120	7.123	4.705	1.444

Foreign Direct Investment

Actual FDI flows into China, expressed in 10,000 U.S. dollars are available directly from the China Statistical Yearbook which is published annually by the National Bureau of Statistics of China. The time frame of my data starts in 1992 and ends in 2006 (15 years). FDI flows were available by country, organized by continent. For the purposes of this model, I only include data of from the top fifty investing countries in any given year. There are a total of fifty-three countries within this dataset. Included in this list are special administrative regions of China, Hong Kong and Macao, and Taiwan carrying the same weight as other countries.

Figure 4: Countries with the High FDI flows into China, 1992-2006

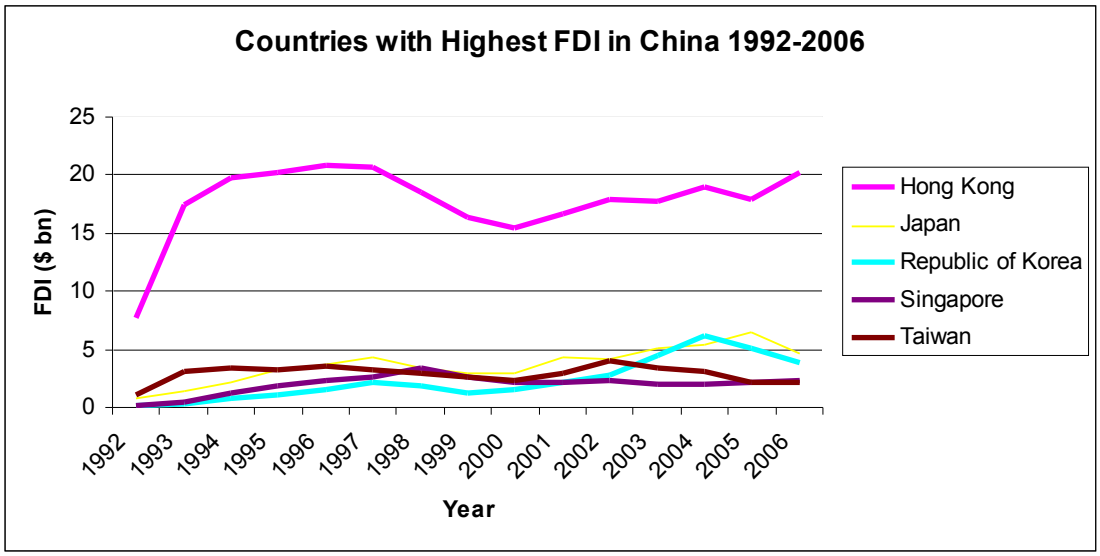


Table 4 shows the FDI levels of the five countries that have consistently investment the most capital into China through the entirety of 1992-2006. These five countries and regions, Hong Kong, Taiwan, Singapore, South Korea, and Japan, dubbed the "Asian tigers," are characterized by being small economies that experienced extremely high export-led growth over the past several decades. They all have strong trade and investment relations with China due to proximity, and historically linked political and economic ties. Hong Kong specifically stands out even among these top five countries as having exceptionally high rates of FDI, possibly due to its history of colonization with the United Kingdom. It may have served as the primary channel through which investment flowed from Europe and the West into China prior to currently established channels into China directly.

Inward investment flows, expressed in 10,000 U.S. dollars are separated by sector with a time range of fourteen years, over the period of 1994-2007. The FDI in this section is the amount that is agreed through contracts, while the actual amount of FDI used is likely to be less. The division of sectors themselves is inconsistent across years. In 1997, there were only nine broad sectors such as "Education, Culture and Arts" whereas by the mid-2000s, there are 19 more

specific sectors (Education, Health Care, and Culture are each a different sector). I excluded data from the years 1994-1996, because there is a drastic change in categorizing of data between 1996 and 1997 in the China Statistical Yearbook. For the purposes of conglomerating data, I collapse many of the more specific sectors from later years into more broad categories consistent with the earlier years.

This data set of ln(foreign direct investment) which measures yearly FDI has 733 observations with a median of 9.01, a mean of 8.86 and standard deviation of 2.55. The minimum value is .69, while the maximum is 14.55. It is negatively skewed by a factor of .15. See Table 3 for summary statistics and Table 5a for a histogram.

Exchange Rates

Annual exchange rate data beginning in 1960 is readily available from the International Financial Statistics Database for all of the countries included in my FDI dataset with the exception of Taiwan. These nominal rates are listed in local currency units per U.S. dollar, using monthly averages. Similar data is available for Taiwan from the Central Bank of the Republic of China's online database.[29] These figures were then adjusted by the USD/RMB exchange rate to account each country's exchange rate with China.

To account for varying costs of living, the implied PPP conversion rate was also available from the International Monetary Fund's World Economic Outlook Database from October 2010. These figures are given in national currency units per current international dollar and then adjusted accordingly for the exchange rate relative to China's currency. These figures were used to measure real exchange rates.

This data set of ln(exchange rates) which measures yearly change in exchange rates has 792 observations with a median of -1.34, a mean of -.51 and standard deviation of 2.17. The minimum value is -9.12, while the maximum is 7.12. It is positively skewed by a factor of 1.44. See Table 3 for summary statistics and Table 5b for a histogram.

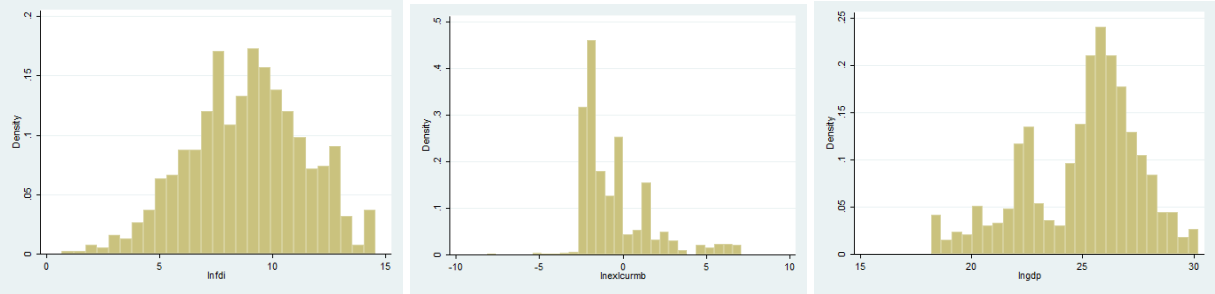
GDP

Annual GDP figures are available from the International Financial Statistics Database starting from 1960 for all countries. Figures are in USD. This data set of ln(GDP) which measures yearly change in GDP has 720 observations with a median of 25.60, a mean of 25.03 and standard deviation of 2.56. The minimum value is 18.19, while the maximum is 30.22. It is negatively skewed by a factor of -.62. See Table 3 for summary statistics and Table 5c for a histogram.

Real Effective Exchange Rate

The annual real effective exchange rate for China is available for 1992 until present from the International Monetary Fund's World Economic Outlook database. The real effective exchange rate is given as index with 2005=100, and the value represents the RMB exchange rate relative to a weighted average of other world currencies determined by relative unit labor costs. This measure of exchange rate was used for the second model that studied sensitivity to exchange rates by sector.

Figure 5: Histogram of Key Variables



a. Histogram of lnfdi **b. Histogram of exchange rates (LCU / RMB)** **c. Histogram of lngdp**

PART IV. FOREIGN DIRECT INVESTMENT BY COUNTRY

Model Description

With FDI (log form) as the dependent variable, the following variables are used to explain variations in FDI inflows: exchange rates (log form) and GDP (log form) of the source country. I had also included several other variables such as interest rate differentials between those in China and those in the source country.

Given the nature of the panel data, with observations from each source country for each year between 1992 and 2006 inclusive, I was able to model FDI using country and year fixed effects. Thus, the estimated coefficient for exchange rates should represent the sensitivity of inward flow of FDI to exchange rates controlling for all unobserved country and year characteristics. These unobserved characteristics might include proximity to China, previous trading relationship, strength of bilateral economic relationship, characteristics of the source country and its economy (that is, exporter or importer, domestic economic policy), changes in exchange rate regime (that is, adoption of the Euro), and so on. Initially I had experimented with country-fixed and year-fixed effects by removing each one from the equation. I soon realized that both were necessary due to exceedingly low R-squared values consistently without these fixed effects.

Within this model, each observation can be expressed by the following expression:

$$ln(fdi)_{it} = \beta_0 + \beta_1 ln(exchange\ rate) + \beta_2 ln(gdp)_{it} + countryFE_i + yearFE_i + u_{it}$$

This data set of this specific model excludes the U.S., and countries with currencies pegged to the USD: Hong Kong, Bahamian, Barbadian, Belize, Macanese, and countries where the USD is used: Marshall Islands, and Bermuda. The core model for FDI is expressed by the above equation for each observation. I estimate the model using different subsets of data defined by region and/or time period. For example, a separate regression was run for the following regions: Asia, Europe, and Latin America. Additionally, this was replicated for specific time periods, in particular, the period before China entered the WTO (1992-2001) and the period after (2002-2006). This allows for observations to be made specific to time period or region which might provide further insight into the relationship between FDI flows and exchange rates. Additional variations of the model include substituting the contemporaneous *exchange rates* with *exchange rates* with one-year lag, and two-year lag. These would account for the long-term decision making process of firms, when the investment decision comes after several months of research and deliberation. Yet another variation on the model looked a forward lags, which would take into account expected changes in the exchange rate. Expected exchange rate is an indicator of the expected price of goods, as well as interest rates according to uncovered interest parity:

$$i_{home} = i_{foreign} + (E^e/E),$$

where E is expressed in home currency/foreign currency. Thus, an increase in the expectation of the exchange rate would lead to depreciation and higher home interest rates relative to foreign. Thus, expected exchange rates are an important proxy for relative interest rates.

Results

The core model using the set of panel data that shows FDI flows from specific countries attempts to model changes in FDI using exchange rates and GDP, using fixed-country and fixed-year effects. This model is extended to include only subsets of data divided by continents (Asia, Europe, and Latin America) and by time period (before and after 2002, starting when China officially gained membership to the WTO.

World Data Set

The first core regression uses data from all countries, inclusive of all continents and time periods. The dependent variable, ln(FDI) is explained by the independent variables ln(GDP) and ln(exchange rates). The complete output from these regressions can be found in the Appendices. Table 6 provides a summary of key findings. The relationship between exchange rates and FDI flows appears to be insignificant, in the contemporaneous situation, with a lag of 1 year of exchange rates, lag of 2 years, with a forward lag of 1 year, and a forward lag of two years (columns (1)-(5) in Table 6). The lags account for the delay in information collection and decision-making within a firm, and delay in the implementation of the investment decision, which may last up to a year or more. The forward lag accounts for expected exchange rates, which in theory includes the interest rate in both countries, consistent with uncovered interest parity. All of the GDP coefficients are significant at the 1% level, with similar values. They all indicate that an increase in GDP by 1% is associated with an increase in FDI by between 1.29% and 1.438%.

Table 6A: Regression Output of LN(FDI) using World Data

	(1)	(2)	(3)	(4)	(5)
VARIABLES	real-contemp	lag1	lag2	contemp+F1	real-contemp+F2
lnexR	**0.0208**			**0.0872**	**0.107**
	(0.816)			**(0.747)**	**(0.457)**
L.lnexR		**0.00862**			
		(0.924)			
L2.lnexR			**-0.00769**		
			(0.931)		
F.lnexR				**-0.0910**	
				(0.818)	
F2.lnexR					**-0.169**
					(0.570)
Constant	-26.06***	-28.05***	-29.01***	-27.43***	-27.29***
	(0.00109)	(0.000809)	(0.000682)	(0.00143)	(0.00305)
Observations	591	559	527	548	505
R-squared	0.864	0.864	0.869	0.873	0.879

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6B: Regression Output of Growth Rate of FDI from World Dataset

	(1)	(2)	(3)	(4)	(5)
VARIABLES	contemp.	lag1	lag2	contemp+F1	contemp+F2
DexR	**-0.111**			**-0.0127**	**-0.130**
	(0.606)			**(0.968)**	**(0.603)**
L.DexR		**-0.252**			
		(0.251)			
L2.DexR			**-0.0906**		
			(0.688)		
F.DexR				**-0.180**	
				(0.677)	
F2.DexR					**0.443**
					(0.581)
Constant	0.819***	0.194	0.338	0.241	0.850**
	(0.00931)	(0.557)	(0.321)	(0.475)	(0.0156)
Observations	538	506	476	495	452
R-squared	0.101	0.085	0.082	0.104	0.108

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This regression was repeated to estimate growth of FDI ($\Delta \ln(FDI)$) using growth in GDP ($\Delta \ln(GDP)$), and rate of depreciation of the source country's currency ($\Delta \ln$(exchange rates)). The results of these regressions are available in Table 6B; the columns correspond to the same coefficients in Table 6A. Here, the trends are less clear: growth rates of GDP are not correlated at all with growth rates of FDI. Additionally, the correlation between rates of depreciation and growth rates of FDI are also inconsistent and statistically insignificant.

Subset: Asia

The same series of regressions were applied to the subset of data for FDI flows originating from thirteen countries in Asia: Brunei, Cambodia, India, Indonesia, Japan, Macao, Myanmar, the Philippines, South Korea, Singapore, Thailand, Taiwan, and United Arab Emirates. Table 7A exhibits the output regressions as elasticities of the variables FDI with exchange rates and GDP; Table 7B displays the regressions using the growth rates of these factors. Table 7A indicates that a 1% change in GDP results in an increase in FDI by anywhere from 1.40% to 2.15% increase in FDI. Coefficients that show correlation between FDI and exchange rate changes are generally not significant. The following regression (output shown in Table 7B) follows the same pattern, but using the growth rates of these variables. There appears to be no significance in any of these variables with the growth rate of FDI.

Subset: Europe

The subset of data which includes Europe exclusively follows a similar trend as other subsets. This data has a few characteristics which are unique from other areas of the world, primarily the convergence of fourteen currencies into one with the emergence of the Euro in

1999. The statistical implications of this will be discussed further in the Discussion, and the situation results in additional regressions for this subset separated by time, prior to- and after-1999 (columns (5) and (6) in tables 8A and 8B.)

Table 7A: Regression Output of LN(FDI) from Asia

	(1)	(2)	(3)	(4)
VARIABLES	real-contemporanous	lag1	lag2	Real-contemp+F1
lnexR	**0.201***			**0.308**
	(0.0629)			**(0.373)**
L.lnexR		**0.157**		
		(0.161)		
L2.lnexR			**0.0440**	
			(0.702)	
F.lnexR				**-0.157**
				(0.778)
Constant	-35.74***	-42.26**	-43.13***	-30.46**
	(0.00290)	(0.0116)	(0.00155)	(0.0205)
Observations	146	138	130	135
R-squared	0.915	0.913	0.914	0.925

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7B: Regression Output of Growth Rate of FDI from Asia

	(1)	(2)	(3)	(4)
VARIABLES	real	lag1	lag2	contemp+F1
DexR	**-0.209**			-0.374
	(0.288)			(0.237)
L.DexR		**-0.312**		
		(0.124)		
L2.DexR			**-0.158**	
			(0.444)	
F.DexR				**0.297**
				(0.484)
Constant	1.356***	0.456	1.385***	0.105
	(0.00190)	(0.271)	(0.00129)	(0.816)
Observations	134	126	118	123
R-squared	0.341	0.289	0.291	0.348

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8A: Regression Output of LN(FDI) from Europe

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	real	lag1	lag2	real-contemp+F1	pre1999	post1999
lnexR	**-0.277*** **			-0.408	**-0.493*** **	-1.495
	(0.00684)			(0.535)	**(0.00698)**	(0.226)
L.lnexR		**-0.231** **				
		(0.0244)				
L2.lnexR			-0.138			
			(0.185)			
F.lnexR				0.207		
				(0.825)		
L.lnfdi						
Constant	-24.88***	-29.90***	-33.71***	-23.11**	5.691	-76.47**
	(0.00753)	(0.00205)	(0.00125)	(0.0295)	(0.831)	(0.0119)
Observations	262	246	229	244	118	144
R-squared	0.883	0.883	0.885	0.885	0.902	0.902

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8B: Regression Output of Growth Rate of FDI from Europe

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	real	lag1	lag2	contemp + F1	pre1999	post1999
DexR	**-0.0903**			**-0.175**	**0.125**	**1.325**
	(0.812)			**(0.865)**	**(0.821)**	**(0.508)**
L.DexR		**-0.303**				
		(0.438)				
L2.DexR			**-0.357**			
			(0.376)			
F.DexR				**0.133**		
				(0.940)		
L.Dlnfdi						
Constant	-0.184	-0.176	-0.503	-0.138	-0.406	-0.212
	(0.554)	(0.579)	(0.143)	(0.672)	(0.441)	(0.522)
Observations	242	226	210	224	99	143
R-squared	0.128	0.104	0.108	0.134	0.194	0.076

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

First, by looking at only percent changes (Table 8A), it appears that percentage change in GDP is correlated with percent change in FDI, significant at the 1% level. An increase in 1% GDP is associated with an increase in FDI by 1.07% to 1.52%. The significant exchange rate coefficients are negative and significant at the 1% level from real exchange rates with no lag (column (1) and for the subset prior to 1999 (column (5)). These coefficients are -0.28 and -0.50 respectively. The remaining coefficients are not significant.

Next, Table 8B summarizes the output results for the growth rates of the same variables. Unlike the previous output, there is no statistical significance behind these the coefficients of the independent variables GDP or exchange rates with any lag.

Subset: Latin America

This subset of data includes FDI, exchange rate, and GDP data from four countries: Belize, Bolivia, Brazil, and Panama. Several other countries originally included in this dataset, such as Caymen Islands, Barbados, and Virgin Islands were excluded due to fixed exchange rate regimes with the USD, or the countries use the US dollar as their official currency. These regimes do not provide variation in exchange rates relative to China, so they are not meaningful source in explaining variation in FDI flows.

The same regressions were run on the Latin American dataset as the previous subsets. The difference in output results from the Latin American countries is that neither GDP nor exchange rates (real or nominal) were significant at the 10% level. This is true from the elasticity model, as well as the first-difference model. (See Tables 9A and 9B.)

Table 9A: Regression Output of LN(FDI) from Latin America

	(1)	(2)	(3)	(4)
VARIABLES	real	lag1	lag2	contemp+F1
lnexR	**0.0372**			5.678
	(0.939)			(0.180)
L.lnexR		**0.374**		
		(0.506)		
L2.lnexR			**1.123***	
			(0.0676)	
F.lnexR				**-5.925**
				(0.164)
Constant	-2.582	-22.42	-44.53	-4.298
	(0.935)	(0.617)	(0.195)	(0.901)
Observations	55	52	49	51
R-squared	0.676	0.656	0.672	0.692

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9B: Regression Output of Growth Rate of FDI from Latin America

	(1)	(2)	(3)	(4)
VARIABLES	real	lag1	lag2	contemp+F1
DexR	**-3.964**			**-4.012**
	(0.381)			**(0.409)**
L.DexR		**2.030**		
		(0.631)		
L2.DexR			**-1.326**	
			(0.757)	
F.DexR				**2.324**
				(0.598)
Constant	0.509	0.691	0.765	0.441
	(0.514)	(0.393)	(0.434)	(0.701)
Observations	48	45	42	44
R-squared	0.289	0.282	0.281	0.296

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Subset: Before and After 2002

The full dataset was divided into groups before and after the year 2002, because the lengthy negotiation process that inducted China into the WTO formally was finalized in December 2001. Requirements into the membership of the WTO include the obliteration of trade barriers among WTO member nations. This undoubtedly had a significant impact on trade, but

here, the question is whether the ascension to this international free trade area influences FDI flows. If trade barriers are abolished, higher levels of trade flows may encourage foreign firms to engage in long-term investments. This permanent change in the trade environment could easily both lower the cost of productive inputs to investment, as well as open up new markets that would encourage investing. Table 10A reveals that there is little significance of exchange rates either before (column (1) or after 2002 (column (2)) when considering the entire world data set, but looking at subsets pains a clearer picture. Recall that the European subset serves as an exception Columns (3) and (4) look at the same relationship, excluding non-European countries. The significance here for years earlier than 2002 is negative with a coefficient of -0.504, significant at the 1% level. There is no significance after 2002. Conversely, looking at the subset of world data that excludes Europe, there is no clear correlation between percentage change of FDI and percentage change of real exchange rates before or after 2002 (columns (5) and (6).

Similarly, these regressions were repeated for the first-difference model looking at rates of growth of these variables. However, there are no significant coefficients at the 10% level for growth rates of real exchange rates, or growth rates of GDP, with growth rates of FDI as the dependent variable at any time period.

Table 10A: Regression Output of LN(FDI) from before 2002

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	real<2002	Real >=2002	EUROPE <2002	EUROPE >=2002	NON-EUROPE<2002	NON-EUROPE>=2002
lnexR	**0.0577**	**0.290**	**-0.504*** **	**-0.123**	**0.0776**	**0.972**
	(0.576)	**(0.595)**	**(0.000540)**	**(0.960)**	**(0.531)**	**(0.191)**
Constant	-15.41	1.381	6.922	-18.28	-3.118	4.480
	(0.171)	(0.911)	(0.650)	(0.737)	(0.872)	(0.805)
Observations	376	215	172	90	175	110
R-squared	0.896	0.950	0.895	0.909	0.888	0.963

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10B: Regression Output of Growth Rate of FDI starting in 2002

	(1)	(2)	(3)	(4)	(5)	(6)

VARIABLES	Real <2002	Real >=2002	EUROPE <2002	EUROPE >=2002	NON-EUROPE <2002	NON-EUROPE >=2002
DexR	**-0.0955**	**-0.883**	**-0.103**	**4.412**	**-0.113**	**-0.00211**
	(0.726)	**(0.664)**	**(0.812)**	**(0.571)**	**(0.715)**	**(0.999)**
Constant	0.261	0.399	-0.518	-0.0954	0.327	0.161
	(0.550)	(0.332)	(0.174)	(0.856)	(0.536)	(0.687)
Observations	323	215	152	90	147	110
R-squared	0.100	0.226	0.187	0.132	0.124	0.386

pval in parentheses
*** p<0.01, **
p<0.05, * p<0.1

Discussion

My original hypothesis stated earlier was that there would be a relatively strong correlation between exchange rates and foreign direct investment, and that this relationship would be negative. That is, with an increase in the exchange rate (defined by local currency / renminbi) – a relative appreciation of the Chinese currency — FDI flows from this country would decrease.

However, the results show that there is a general trend of statistically *insignificant* coefficients that relate exchange rates and FDI flows into China, failing to support the hypothesis. The instances of significance occur most notably in the European subset by taking the natural log of FDI flows, GDP and exchange rates (Table 8A, column (1)). It implies that an increase in 1% increase in the European exchange rates is correlated with a 0.28% decrease in FDI flows to China, which does agree with my initial hypothesis.

In order to account for any autocorrelation of the variables, which is shown in Tables 11A, 11B, and 11C), the first difference in logs was taken. This model captures growth rates of the variables in the regression, rather than elasticities. This clarifies the relationship between the two variables given the evidence of autocorrelation. Since there is still no clear correlation

between exchange rates and FDI flows in this new model, this strengthens the results of the previous regressions.

Table 11A: FDI Autoregression

VARIABLES	FDI
L.fdi	**1.228*** **
	(0)
L2.fdi	**-0.227*** **
	(0)
Constant	3,747**
	(0.0160)
Observations	612
R-squared	0.984
pval in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 11B: GDP Autoregression

VARIABLES	GDP
L.gdp	**1.406*** **
	(0)
L2.gdp	**-0.379*** **
	(0)
Constant	3.634e+09
	(0.302)
Observations	621
R-squared	0.997
pval in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Table 11C: Real Exchange Rates Autocorrelation

VARIABLES	EXCHANGE RATE
L.exrateR	**1.227*** **
	(0)
L2.exrateR	**-0.180*** **
	(5.27e-07)
Constant	-0.331
	(0.515)
Observations	689
R-squared	0.990
pval in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

Offering an alternative to these two models, yet another variation was run using ln(FDI/GDP) as the dependent variable. This model helped to account for the level of FDI relative to GDP levels. Lags and forward lags in exchange rates were included in these regression (full output shown in Appendices), and consistent with all of the results thus far, there is no correlation between exchange rates and FDI.

Taking this piece of evidence into account, it is now clear that in all of the subsets, there is nothing to suggest that exchange rates are important indicators that influence investment decisions. Though this disagrees with my original hypothesis, this result can easily be explained by the nature of investment decision-making, especially contrasting them with trade decisions. Unlike trade, which has a shorter and well-defined time horizon, investment projects take place over years. Valuation of investment returns is also much less accurate than calculating profit of trade. For example the building of a factory or a new branch in a foreign country may have some

immeasurable aspects, which make this process less accurate. Thus, there are many other factors that play a role in investment projects as compared to trading goods directly.

Additionally, investment projects have a very complicated structure, which may involve high fixed-costs, such as factory-building or large land or property purchases. Returns on investment will depend on exchange rates, but there may likely be much larger factors, such as the cost of capital (in the case of factory-building) or the local real estate market (in the case of land purchase). In contrast, if the price of goods experience a spike due to exchange rates, because of low fixed-costs, it is easier to switch sellers to other emerging markets, while it is harder to relocate an investment project elsewhere.

The subset of data divided into years 1992-2001 and 2002-2006 mark the changes in China's membership of the WTO, however, the results are more meaningful following the rise of the Euro rather than China joining the WTO. The first difference model (Table 10B) which looks at these two periods for the world data set (columns (1) and (2)), for Europe only (columns (3) and (4)), and for non-European countries (columns (5) and (6)) does not yield significance in any coefficients. Provided it is less accurate, Table 10A, the regression using natural log of FDI, reveals that the data coming from Europe between 1992 and 2001 has a statistically significant coefficient of -0.504, at the1% level. Generally speaking, the natural log model has been the only consistent regression which yields a negative significant coefficient for the variable natural log of real exchange rates (Column (1) of Table 8A and column (3) of Table 10A). Thus, while the correlation between growth rates of FDI and exchange rate are not clear, it can safely be concluded that the *percentage changes* (elasticity) of these variables is negative. Any change in variation between the time periods before and after 2002 is most likely due to changes in the currency regime in Europe rather than China's membership to the WTO. Statistically speaking,

after a switch to the Euro, less variation in exchange rates in Europe make it more difficult to attribute changes in exchange rate fluctuations. Looking at an in-depth snap shot of the European subset of data before and after the introduction of the Euro reveals that any correlation between FDI and exchange rates is due to the variation in Europe prior to 1999. This phenomenon makes it more difficult to attribute any changes in the role of exchange rates to either this statistical barrier or to actual changes in trade patterns due to China's WTO ascension, for which this division was previously made.

Additionally, examining some scatter plots of the difference in logs (growth rates) of exchange rates and FDI flows (Chart 12) and the residuals taken from variation on growth of exchange rates (Chart 13) reveal little evidence for an underlying trend between these two variables. Thus, it can be concluded that the correlation within the Europe dataset between exchange rates and FDI flows into China are attributed to the time period before the switch to the Euro.

Chart 12:
Scatter plot of Growth(FDI) and Growth (Exchange Rates)

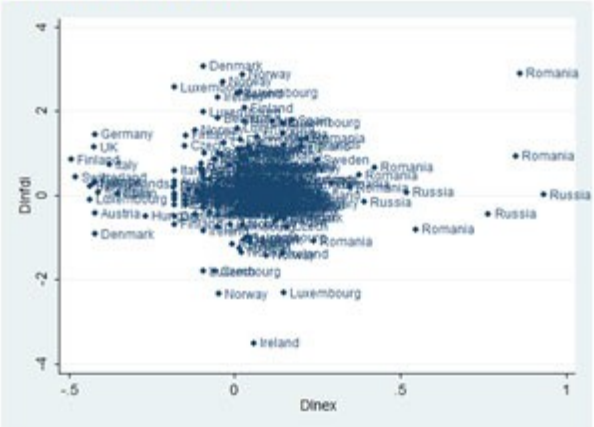
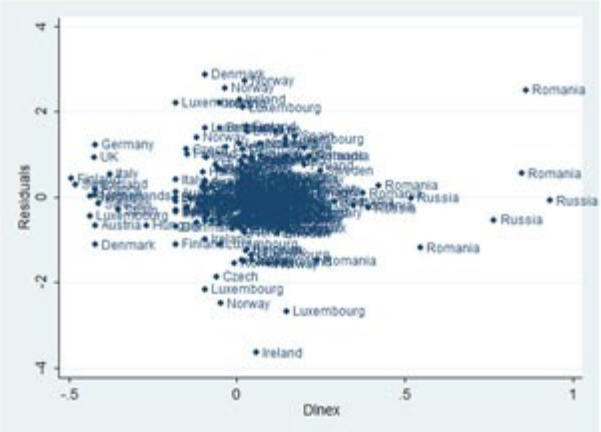


Chart 13: Scatter plot of residual and Growth (Exchange Rates)



In order to account for the unusual results in the European subset from its counterparts in Latin America and Asia, I examine some characteristics of Europe that might explain this

investment behavior. First, European nations are much more industrialized than emerging market nations in Latin America and Asia. This might be the source of investment in different sectors and thus different sensitivities to exchange rates. Also, further research reveals a special investment relationship between European firms and SOEs (state-owned enterprises) in China. Contracted by the government, there has been extensive expansion of the transportation and security goods from European firms. For example, the French firm Airbus has expanded its business in China significantly because of its advanced technology and innovation capabilities. The German Siemens has expanded business in railway locomotives, power generation equipment in China. A similar story can be sold for the Volkswagen (German), Thomson Multimedia, and Alcatel (French).[30] As these firms have established connections and infrastructure, this might encourage more FDI due to lower initial costs.

With the exception of Europe, the role of GDP in the context of these models has been fairly consistent across subsets of data. Generally speaking, GDP coefficients are consistently significant in the "A" Tables, that is, regressions taking the natural log. However, this significance disappears almost completely after taking the first difference of the natural logs ("B" Tables). Due to the strong evidence for autocorrelation for the variable GDP, one can conclude that the growth of GDP in the source country is not a significant factor in the growth of FDI levels.

PART V. FOREIGN DIRECT INVESTMENT BY SECTOR

Model Description

This second model expresses FDI (again expressed as a log) as a dependent variable explained by the independent variables China's real effective exchange rate (expressed as a log),

GDP (log form), and a number of interaction terms between sector dummy variables and the real effective exchange rate. The model is as follows:

$$ln(fdi) = \beta_0 + \beta_1 ln(reer) + \beta_2 ln(gdp) + sectorFE_i + \beta_3\, sectorFE_i ln(reer) + u_{it}$$

The above model does not exhibit the year fixed effects of this regression which accounts for unobserved time characteristics such as world recessions and booms due to large gaps in data and a relative short time period (1997-2006). Additionally, several variations of this regression include lags in the exchange rate variable by different intervals to account for the long-term decision process by firms.

By examining the differences in the coefficients, assuming statistical significance, it is possible to determine the sensitivity of each sector's FDI flows to the adjustments in China's real effective exchange rate. These beta coefficients can then be compared which might then reveal specific characteristics about each sector.

Results

While the R^2 measure for all regressions were relatively high (all variations of both models yielded at least .85), the significance of specific variables were not acceptable. This general trend suggests that while exchange rates are in fact important variables to consider as factors that affect FDI, they are not the determining factors of investment decisions by international firms.

In this model, foreign direct investment is being explained by the following variables: GDP of China (expressed in log form), sector flows represented by a series of dummy variables and interaction terms between real effective exchange rate (expressed in log form) and these

sector dummies. The same regression was run three times: with no time lag, with a lag of one year, and with a lag of two years.

By looking at the regression output (Table 14), it is evident that only a handful of coefficients from this regression are significant beyond the 10% level. Most notably Education, Household, and Social Services stand out as having statistically significant coefficients. In the Education sector, the figures suggest that a 1% increase in real effective exchange rate index is associated with a .71% decrease in FDI flows in the Education sector immediately, a 71.90% decrease after one year, and a .71% decrease after two years. The equivalent figures for the Household sector are a 71.07% increase, .12% decrease, and a 71.07% increase respectively. And finally the equivalent figures for the Social Services sector are a 65.79% increase, a 5.41% decrease, and 65.86% increase respectively. For all the sectors, there appears to be a general trend that there are positive coefficients with no lag, and a lag of two years, but a lag of one year tends to be negative.

Discussion

All fifteen sectors except for Education follow at trend of experiencing an increase in FDI flow immediately, a decrease in FDI flow after one year, and increase in FDI flow after two years following an increase in the real effective exchange rate index by one percentage point (a depreciation of the RMB). We can only really consider sectors 8 (Household) and 13 (Social Services) which have statistically significant coefficients and follow this trend. The sign of these coefficients might be explained by an initial one-time investment with the depreciation of currencies, followed by a year of investment of negative returns, resulting in a decline in investment activity. All other things equal, this reflects as a negative change in investment after

Table 14: Regression Output of Foreign Direct Investment by Sector

VARIABLES	(1) nolag	(2) lag1	(3) lag2
Construction	38.04	-31.09	42.38
	(0.197)	(0.391)	(0.147)
Education	**-0.709*** **	**-71.90** **	**-0.709*** **
	(0)	**(0.0306)**	**(0)**
Energy	38.99	-32.21	39.07
	(0.188)	(0.375)	(0.182)
Entertainment	27.73	-43.47	27.81
	(0.363)	(0.242)	(0.356)
Environmental Management	19.52	-51.67	19.52
	(0.525)	(0.168)	(0.521)
Financial Services	35.15	-36.04	35.15
	(0.240)	(0.325)	(0.234)
Household	**71.07** **	**-0.120** **	**71.07** **
	(0.0321)	**(0.0270)**	**(0.0331)**
Manufacturing	38.68	-34.28	36.62
	(0.189)	(0.344)	(0.209)
Mining	40.59	-30.61	40.67
	(0.170)	(0.399)	(0.164)
Real Estate	33.89	-36.58	35.84
	(0.250)	(0.313)	(0.219)
Scientific Research and Technical Services	39.41	-31.40	36.76
	(0.182)	(0.387)	(0.211)
Social Services	**65.79** **	**-5.414**	**65.86** **
	(0.0284)	**(0.882)**	**(0.0264)**
Transportation	40.13	-32.38	38.18
	(0.174)	(0.372)	(0.192)
Wholesale and Retail Trading	37.59	-33.61	37.67
	(0.202)	(0.354)	(0.196)
Constant	163.2	-74.67	-34.69*
	(0.190)	(0.331)	(0.0575)
Observations	138	133	128
R-squared	0.881	0.877	0.872

Robust pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

one year. After a two year period, the investment might resume again following results of this monitoring period.

While the signs of these coefficients make sense (depreciation of the RMB would attract foreign investors, the magnitudes are quite high for a simple 1% change in effective exchange rates (ie. this is correlated with a 71% increase in FDI in the Household sector). An explanation for this might be a statistical inaccuracy not in the signs of the coefficients but the magnitude, due to the fact that real effective exchange rates are measure on an index rather than an actual exchange rate.

An interesting observation that only the Education, Household, and Social Services sectors had statistically significant coefficient estimates. All three of these sectors tend to be public social services rather than labor and input intensive industries such as construction or manufacturing. These results are exactly the opposite of my initial hypothesis for this model that exchange rates would be most significant for those industries such as manufacturing and construction that rely heavily on cheap labor and input costs. This result may be attributed to the fact that firms that are in the manufacturing-related industries will invest in infrastructure and production in China regardless of fluctuations in exchange rates, because such a high proportion of their costs are already sunk costs.

FDI in China within the Education sector is centered in the higher education industry. The Chinese government places restrictions on the types of FDI in education that is allowed to enter the country, which is characterized by partnership with existing Chinese institutions. Thus there will not be costs associated with founding an institution from scratch, thus there are low fixed costs associated with FDI in education. Given this fact it is more likely that the argument holds

that investment in the education sector is more sensitive to changes in exchange rates as compared to the manufacturing sector.[31]

While there is no clear definition of the Household sector from the China Statistical Yearbook, based on the definition from the European Commission, investment in this sector includes investment in non-financial assets (such as residential property), and net financial wealth.[32] Other sources suggest that the Household sector include goods and services consumed by households, such as kitchen appliances, furniture, as well as financial (mortgage loans) and non-financial services (health care).

Social services in the form of foreign direct investment may have a source of non-profit or international organizations. A study by Klein from the World Bank claims that FDI in the social services sector in developing and transitional economies, such as China, include non-profit and poverty-reducing initiatives. This could include insurance, health care, aid after natural disasters, pollution, and so on.[33] In these scenarios, there are low fixed costs with establishment and maintenance of such an organization as compared to industry that are labor and capital-heavy, such as manufacturing. It is much more difficult to measure the returns of investment projects in education and social services. This lack of precision in information may mislead decision-makers to make irrational decisions. In addition, the investment horizons of these projects are much longer-term, and at times less defined. Thus, the role of exchange rate would be an important factor in investment decisions.

PART VI. CONCLUSIONS

With strong results pointing to a weak correlation between exchange rates and foreign direct investment flows as a whole, it is now much clearer that exchange rates do not play as

large of a role in investments as they do in trade. This may be due to several factors. First, the buying and selling of goods is much more tangible than investment decisions that often have immeasurable, less accurate, and less concrete returns on investment with varying investment horizons. This muddles the valuation processes behind investment projects, and as exchange rates are a large factor in initial costs, the direct effect of changes in exchange rate decreases their importance.

Second, investment decisions not only take a much longer time to be realized, which decreases the value of exchange rate fluctuations, but also have high fixed costs (ie factories, land). With trade, it is easy to switch sellers to other emerging markets in say, Latin America if costs are lower, than to move a factory in China to one in Latin America. This longer-term commitment diminishes the importance of exchange rates in foreign investing.

Europe stands out as an exception to this trend, and evidence shows that patterns of investment from Europe to China to follow the trend that a relative depreciation in the RMB is correlated with more investment flows, but only prior to 1999 with the introduction of the Euro. FDI data with Europe as a source country serves as a statistical hurdle because variation from Eurozone countries disappears completely following 1999.

There is also little correlation between the sensitivity of exchange rates among different sectors. In fact, they mostly are not significant variables in foreign direct investment flows with the exception of the sectors Education, Household, and Social Services. While this contradicts my initial hypothesis, these results can be explained by the two primary factors. First, these sectors do not rely heavily on physical assets and thus do not rely heavily on input factors such as physical capital. Physical capital is the foundation of industries such as manufacturing and construction, where the advantages of investing in China will exist regardless of a fluctuation or

a large change in the exchange rate. In addition, Education, Household, and Social Services tend to have less quantitatively measurable returns, which may lead to irrational investment decision-making to due misinformation.

To more accurately hone down on the role of exchange rates and investing, it might be more helpful to select a few, but specific types of international firms that have historically invested heavily in China's markets. This is consistent with the strategy taken by Hattari and Rajan, Das, and Xing et al. (see Literature Review). By identifying the factors that are most important in investment decisions will shed more light on the significance (or insignificance) of China's fixed exchange rate policy. However, the fact that on a whole, these scholars still have not found a clear relationship between exchange rates and FDI agrees with my inconclusive findings. The dataset used here is specific to investment with China. For comparison purposes, another study that looks at investing into all emerging markets or Asian exporting countries specifically would supplement this research using comparative analysis. By limiting the scope of this paper to only one country's FDI data, this restricts the ability to look at its conclusions in the larger context of international finance.

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<http://www.imf.org/external/data.htm>

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PART VIII. APPENDICES

A.1 World Dataset

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag 1	(6) contemp+lag1+lag 2	(7) real-contemp+F1	(8) real-contemp+F2	(9) lag FDI
lnexlcurmb	-0.0506								
	(0.633)								
lngdp	1.400***	1.291***			1.410***	1.438***	1.343***	1.336***	0.875***
	(7.66e-07)	(1.88e-05)			(7.82e-06)	(7.80e-06)	(3.87e-05)	(0.000137)	(0.00157)
lnexR		0.0208			0.0137	-0.256	0.0872	0.107	0.00499
		(0.816)			(0.971)	(0.582)	(0.747)	(0.457)	(0.965)
L.lnexR			0.00862		-0.000338	0.780			
			(0.924)		(0.999)	(0.222)			
L2.lnexR				-0.00769		-0.415			
				(0.931)		(0.167)			
F.lnexR							-0.0910		
							(0.818)		
F2.lnexR								-0.169	
								(0.570)	
L.lnfdi									0.471***
									(0)
Constant	-29.16***	-26.06***	-28.05***	-29.01***	-28.05***	-28.79***	-27.43***	-27.29***	-18.04**
	(9.16e-05)	(0.00109)	(0.000809)	(0.000682)	(0.000819)	(0.000712)	(0.00143)	(0.00305)	(0.0130)
Observations	663	591	559	527	559	527	548	505	540
R-squared	0.860	0.864	0.864	0.869	0.864	0.869	0.873	0.879	0.897

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A.2 World Dataset: First Difference

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) contemp+F1	(8) contemp+F2	(9) lag FDI
DexR		-0.111			0.338	1.328*	-0.0127	-0.130	-0.418*
		(0.606)			(0.410)	(0.0726)	(0.968)	(0.603)	(0.0795)
Dlngdp		0.282	0.384	0.388	0.400	0.406	0.231	0.390	0.392
		(0.564)	(0.455)	(0.467)	(0.437)	(0.446)	(0.654)	(0.472)	(0.352)
Dlnex	-0.431*								
	(0.0520)								
L.DexR			-0.252		-0.431	-0.728			
			(0.251)		(0.163)	(0.102)			
L2.DexR				-0.0906		0.154			
				(0.688)		(0.625)			
F.DexR							-0.180		
							(0.677)		
F2.DexR								0.443	
								(0.581)	
L.Dlnfdi									-0.493***
									(0)
Constant	0.978***	0.819***	0.194	0.338	0.176	0.366	0.241	0.850**	0.268
	(0.00178)	(0.00931)	(0.557)	(0.321)	(0.596)	(0.281)	(0.475)	(0.0156)	(0.323)
Observations	605	538	506	476	506	476	495	452	490
R-squared	0.123	0.101	0.085	0.082	0.086	0.091	0.104	0.108	0.327

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

A.3 World Dataset: with LN(FDI/GDP) as dependent variable

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI
lnexlcurmb	-0.0661							
	(0.531)							
lnexR		0.0269			-0.0135	-0.294	0.127	0.0109
		(0.764)			(0.972)	(0.528)	(0.635)	(0.925)
L.lnexR			0.0124		0.0212	0.817		
			(0.891)		(0.937)	(0.202)		
L2.lnexR				-0.00649		-0.422		
				(0.942)		(0.160)		
F.lnexR							-0.143	
							(0.716)	
L.lnfg								0.471***
								(0)
Constant	-18.61***	-18.33***	-17.27***	-17.33***	-17.13***	-16.98***	-18.37***	-9.082***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Observations	663	591	559	527	559	527	548	539
R-squared	0.869	0.870	0.870	0.877	0.870	0.878	0.874	0.905

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

B.1 Asia Dataset

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI
lnexlcurmb	0.184							
	(0.620)							
lngdp	2.205***	1.812***			1.886***	2.197***	1.589***	1.005**
	(3.29e-05)	(0.00114)			(0.00125)	(0.000471)	(0.00877)	(0.0125)
lnexR		0.201*			0.148	0.0961	0.308	0.0790
		(0.0629)			(0.806)	(0.887)	(0.373)	(0.521)
L.lnexR			0.157		0.0699	0.0610		
			(0.161)		(0.850)	(0.943)		
L2.lnexR				0.0440		-0.0191		
				(0.702)		(0.963)		
F.lnexR							-0.157	
							(0.778)	
L.lnfdi								0.511***
								(9.29e-11)
Constant	-52.72***	-35.74***	-42.26**	-43.13***	-42.08**	-43.20***	-30.46**	-19.03**
	(0.000642)	(0.00290)	(0.0116)	(0.00155)	(0.0124)	(0.00181)	(0.0205)	(0.0279)
Observations	164	146	138	130	138	130	135	135
R-squared	0.910	0.915	0.913	0.914	0.913	0.914	0.925	0.957

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

B.2 Asia Dataset – First difference

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-F.contemporaneous	(8) lag FDI
DexR		-0.209			-0.196	-0.528	-0.374	-0.393*
		(0.288)			(0.638)	(0.701)	(0.237)	(0.0543)
Dlngdp		-0.310	-0.173	-0.354	-0.181	-0.397	-0.381	0.120
		(0.678)	(0.824)	(0.658)	(0.816)	(0.624)	(0.631)	(0.836)
Dlnex	-1.384							
	(0.206)							
L.DexR			-0.312		-0.203	-0.110		
			(0.124)		(0.510)	(0.817)		
L2.DexR				-0.158		-0.0330		
				(0.444)		(0.918)		
F.DexR							0.297	
							(0.484)	
L.Dlnfdi								-0.218***
								(0.00916)
Constant	1.063**	1.356***	0.456	1.385***	0.465	1.374***	0.105	0.489
	(0.0333)	(0.00190)	(0.271)	(0.00129)	(0.264)	(0.00161)	(0.816)	(0.137)
Observations	151	134	126	118	126	118	123	123
R-squared	0.351	0.341	0.289	0.291	0.291	0.294	0.348	0.272

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

B.3 Asia Dataset with LN(FDI/GDP) as dependent variable

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI
lnexlcurmb	-0.0709							
	(0.844)							
lnexR		0.224**			0.168	0.0921	0.332	0.0991
		(0.0381)			(0.781)	(0.893)	(0.335)	(0.423)
L.lnexR			0.173		0.0744	0.137		
			(0.123)		(0.841)	(0.874)		
L2.lnexR				0.0512		-0.0552		
				(0.661)		(0.894)		
F.lnexR							-0.172	
							(0.758)	
L.lnfg								0.512***
								(7.06e-11)
Constant	-17.52***	-18.22***	-13.02***	-16.58***	-20.12***	-16.95***	-17.72***	-7.919***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(4.48e-07)
Observations	164	146	138	130	138	130	135	135
R-squared	0.884	0.891	0.888	0.884	0.888	0.885	0.906	0.947

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

C.1 Europe Dataset

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI	(9) pre1999	(10) post1999
lnexlcurmb	-0.309*									
	(0.0768)									
lngdp	1.069***	1.179***			1.323***	1.524***	1.113***	1.164***	-0.00593	3.198***
	(0.00405)	(0.00108)			(0.000974)	(0.00183)	(0.00639)	(0.00275)	(0.995)	(0.00429)
lnexR		-0.277***			0.606	1.186	-0.408	-0.202	-0.493***	-1.495
		(0.00684)			(0.522)	(0.389)	(0.535)	(0.168)	(0.00698)	(0.226)
L.lnexR			-0.231**		-0.647	-1.200				
			(0.0244)		(0.325)	(0.583)				
L2.lnexR				-0.138		0.0941				
				(0.185)		(0.922)				
F.lnexR							0.207			
							(0.825)			
L.lnfdi								0.246***		
								(0.000296)		
Constant	-22.37**	-24.88***	-29.90***	-33.71***	-27.39***	-32.28**	-23.11**	-24.13**	5.691	-76.47**
	(0.0192)	(0.00753)	(0.00205)	(0.00125)	(0.00884)	(0.0120)	(0.0295)	(0.0155)	(0.831)	(0.0119)
Observations	261	262	246	229	246	229	244	242	118	144
R-squared	0.882	0.883	0.883	0.885	0.883	0.886	0.885	0.885	0.902	0.902

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

C.2 Europe Dataset – First difference

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) contemp.+ F1	(8) lag FDI	(9) pre1999	(10) post1999
DexR		-0.0903			0.309	0.445	-0.175	-0.537	0.125	1.325
		(0.812)			(0.858)	(0.815)	(0.865)	(0.363)	(0.821)	(0.508)
Dlngdp		0.650	0.991	0.877	1.054	1.304	0.720	0.961	-0.285	1.611
		(0.455)	(0.294)	(0.378)	(0.297)	(0.268)	(0.461)	(0.259)	(0.854)	(0.236)
Dlnex	-0.0903									
	(0.812)									
L.DexR			-0.303		-0.467	-1.839				
			(0.438)		(0.639)	(0.413)				
L2.DexR				-0.357		0.572				
				(0.376)		(0.608)				
F.DexR							0.133			
							(0.940)			
L.Dlnfdi								-0.474***		
								(0)		
Constant	-0.184	-0.184	-0.176	-0.503	-0.203	-0.291	-0.138	-0.524*	-0.406	-0.212
	(0.554)	(0.554)	(0.579)	(0.143)	(0.565)	(0.488)	(0.672)	(0.0653)	(0.441)	(0.522)
Observations	242	242	226	210	226	210	224	222	99	143
R-squared	0.128	0.128	0.104	0.108	0.104	0.112	0.134	0.301	0.194	0.076

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

C.3 Europe Dataset with LN(FDI/GDP) as dependent variable

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI
lnexlcurmb	-0.315*							
	(0.0659)							
lnexR		-0.283***			0.873	0.956	-0.451	-0.216
		(0.00546)			(0.325)	(0.483)	(0.479)	(0.139)
L.lnexR			-0.237**		-0.835	-0.240		
			(0.0204)		(0.175)	(0.904)		
L2.lnexR				-0.130		-0.435		
				(0.210)		(0.597)		
F.lnexR							0.261	
							(0.776)	
L.lnfg								0.252***
								(0.000203)
Constant	-20.60***	-20.25***	-19.17***	-19.08***	-18.74***	-18.47***	-20.17***	-14.23***
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Observations	261	262	246	229	246	229	244	242
R-squared	0.738	0.741	0.720	0.722	0.721	0.725	0.745	0.725

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

D.1 Latin America Dataset

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI
lnexlcurmb	-0.203							
	(0.281)							
lngdp	0.0665	0.318			0.978	2.421	0.423	-0.498
	(0.961)	(0.836)			(0.558)	(0.171)	(0.800)	(0.754)
lnexR		0.0372			0.461	0.178	5.678	0.207
		(0.939)			(0.911)	(0.963)	(0.180)	(0.688)
L.lnexR			0.374		-0.0696	0.792		
			(0.506)		(0.986)	(0.888)		
L2.lnexR				1.123*		0.227		
				(0.0676)		(0.954)		
F.lnexR							-5.925	
							(0.164)	
L.lnfdi								0.445**
								(0.0135)
Constant	1.996	-2.582	-22.42	-44.53	-21.97	-48.45	-4.298	11.70
	(0.956)	(0.935)	(0.617)	(0.195)	(0.635)	(0.203)	(0.901)	(0.724)
Observations	55	55	52	49	52	49	51	48
R-squared	0.686	0.676	0.656	0.672	0.656	0.673	0.692	0.760

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

D.2 Latin America Dataset- First Difference

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-F.contemporaneous	(8) lag FDI
DexR		-3.964			-3.951	-7.320	-4.012	-0.366
		(0.381)			(0.416)	(0.241)	(0.409)	(0.917)
Dlngdp		0.175	-1.060	-0.454	-0.0160	0.975	0.0729	-2.419
		(0.945)	(0.657)	(0.855)	(0.995)	(0.743)	(0.979)	(0.234)
Dlnex	-0.202							
	(0.605)							
L.DexR			2.030		1.804	1.346		
			(0.631)		(0.672)	(0.769)		
L2.DexR				-1.326		-5.129		
				(0.757)		(0.342)		
F.DexR							2.324	
							(0.598)	
L.Dlnfdi								-0.714***
								(3.57e-05)
Constant	0.241	0.509	0.691	0.765	0.273	1.072	0.441	-0.196
	(0.771)	(0.514)	(0.393)	(0.434)	(0.776)	(0.297)	(0.701)	(0.792)
Observations	48	48	45	42	45	42	44	43
R-squared	0.277	0.289	0.282	0.281	0.301	0.327	0.296	0.673

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1

D.3 Latin America Dataset with LN(FDI/GDP) as dependent variable

VARIABLES	(1) nominal	(2) real	(3) lag1	(4) lag2	(5) contemp+lag1	(6) contemp+lag1+lag2	(7) real-contemp+F1	(8) lag FDI
lnexlcurmb	-0.185							
	(0.315)							
lnexR		0.137			0.466	-0.0230	6.091	0.400
		(0.745)			(0.909)	(0.995)	(0.129)	(0.350)
L.lnexR			0.382		-0.0705	-0.168		
			(0.411)		(0.986)	(0.975)		
L2.lnexR				0.828*		1.011		
				(0.0860)		(0.788)		
F.lnexR							-6.239	
							(0.129)	
L.lnfg								0.455***
								(0.00899)
Constant	-22.88***	-18.63***	-16.80***	-17.15***	-17.51***	-17.84***	-16.26***	-9.000***
	(0)	(0)	(0)	(1.05e-10)	(1.88e-10)	(1.66e-09)	(8.67e-10)	(0.00519)
Observations	55	55	52	49	52	49	51	48
R-squared	0.888	0.885	0.887	0.903	0.887	0.903	0.893	0.922

pval in parentheses
*** p<0.01, ** p<0.05, * p<0.1