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India-US Trade and Investment: Have They Been Up To Potential?

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Abstract: This paper documents stylized facts about the evolution of trade and foreign direct investment (FDI) between India and the United States over the last four decades. We ask the question: does India-US trade and FDI deviate from its potential i. e. the level that would have been predicted by standard determinants? Using an augmented gravity model and a large sample of countries over 1970–2009, we find that while India's exports to the US are 34% higher than predicted, US exports to India are in line with its potential. Notably, we find strong reversals in the nature of these trading relationships over time. India loses its over-trading status while US turns out to be under-exporting to India in the period after 1990. We also find significant variation in trade performance across product categories. For primary and intermediate goods during post-1990, US exports to India turn significantly below normal. Conducting similar analysis for bilateral FDI flows for the period 1985–2009, we show that while US direct investments in India are in line with predictions based on fundamentals, India has actually been an under-investor in the US market.

Keywords: trade, FDI, gravity model

JEL Classification: F13, F14

1 Introduction

Following independence from the British rule in 1947, India adopted a socialist strategy of development, which envisaged a heavy role for the government in shaping India's economy. The trade regime till the early 1980s was characterized by high nominal tariffs and non-tariff barriers coupled with a complex import licensing system. In 1991, India initiated a drastic liberalization of its external sector. Average tariffs in manufacturing came down from 117 percent in 1990–91 to 39 percent in 1999–2000 (Kumar and Mishra (2008)). In addition to tariffs, India also reduced non-tariff barriers (NTBs) with the average import coverage

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ratio (the share of imports subject to non-tariff barriers) declining from 82 percent to 17 percent in 1999–2000. In addition, foreign investment was liberalized and exports were promoted through a host of special tax zones, and importation privileges (Lawrence and Chadha 2004).

As part of the reforms in 1991, India also relaxed its foreign investment regime. The approach adopted was to attract both Foreign Direct Investment (FDI) as well as portfolio investment. In 1990 while the overall inward FDI to India was merely US\$ 107 million, it went up to US\$ 34.9 billion by 2008. Over time India has also witnessed a substantial rise in outward investment similar to other developing and emerging markets.

Globally, the stock of outward FDI from developing economies reached 15.3 per cent of global outward FDI stock in 2010 (US\$ 3.1 trillion), up from 10.8 per cent a decade ago (UNCTAD 2011). Specifically, based on data from the Reserve Bank of India (RBI), India's outward investment reached US\$ 98 billion in 2011 up from a value as low as US\$ 1.86 billion in 2000. The steep increase in outward investment are seen by some to be a sign of success of new emerging Indian entrepreneurs at a global level while on the other hand critics perceive this as a symptom of lack of effective reforms, infrastructure and overall investment climate within India.

With this background we take the specific case of India and the United States bilateral economic relationship and ask the question: Has India-US trade and investment been to its potential. Alternatively has there been under-trading from either side i. e. does India-US trade deviate from its natural level as predicted by standard determinants?

We address this question using data on trade in goods over a long period of time (1970–2009) and do a similar analysis for investment.¹ The long period encompasses different phases in India's external policy regime as well as other important events such as nuclear tests by India in 1997, signing of India-US nuclear treaty in 2006, accession of China into the WTO in 2001 and phasing out of multi-fiber agreement in 2005. Similar to trade, we also ask the question: has FDI between India and US been up to the potential or has there been under-investment from either side?

We estimate standard gravity models of international trade and foreign direct investment augmented to include indicators for Indian exports/investments to and imports/investments from the US. The model controls for all possible bilateral time-invariant and time-varying determinants of trade and investment and importantly also for time-varying multilateral resistance terms.

¹ Lack of availability of multi-country data on trade for several years obviates similar analysis in case of services trade.

We find that over the period 1970–2009, India's exports to the US are 34 % higher than the level predicted by the gravity framework (statistically significant at 1 % level), whereas US exports to India are 2 % below the predicted level (and is statistically insignificant). Interestingly, there exists significant variation in these findings over time. While India's exports to the US were 87 % above the gravity-predicted level in the pre-1990 period, it was just 1 % below predicted during post-1990. Similarly, while US exports to India was 58 % above its potential during pre-1990 period, in the later period, it was 40 % below the predicted level. These results suggest strong reversals in the nature of trading relationships between India and US over time. India loses its over-trading status while US turns out to be under-exporter in the period after 1990. Further, we find significant variation across product categories as well. In particular, for primary and intermediate goods in the post-1990 period, we find US exports to India to be significantly below normal.

Our main findings are broadly similar when we employ Poisson Pseudo Maximum Likelihood (PPML) estimation, which also accounts for zeros in bilateral trade. In addition, the results are robust to controlling for indicators of trade between competitor countries and the US, indicators of trade between India and alternative destination markets and dropping years of the global financial crisis.

In case of FDI covering the period 1985–2009, US investments into India are in line with gravity model predictions. This is in sharp contrast with US' investment in China that is about 65 percent higher than the gravity predicted level. Both India and China seem to be under-investing in the US but the extent of under-investment is small (2–2.5 percent) for both the countries. The under-investment by Brazil into the US is comparatively high at over 4 percent.

The rest of the paper is organized as follows: Section II presents information on trade and investment for India in a global context. Section III presents a summary of data used in empirical analysis. Section IV summarizes the methodology used to assess the trade and investment performance of India-US and US-India pairs. Section V presents the main empirical findings and robustness tests. Section VI concludes.

2 Trade and Investment Profile of India Over Time

Although India's trade has grown faster than GDP over the last two decades, India continues to have a small share in world exports (1.2 % in 2009, Figure 1).

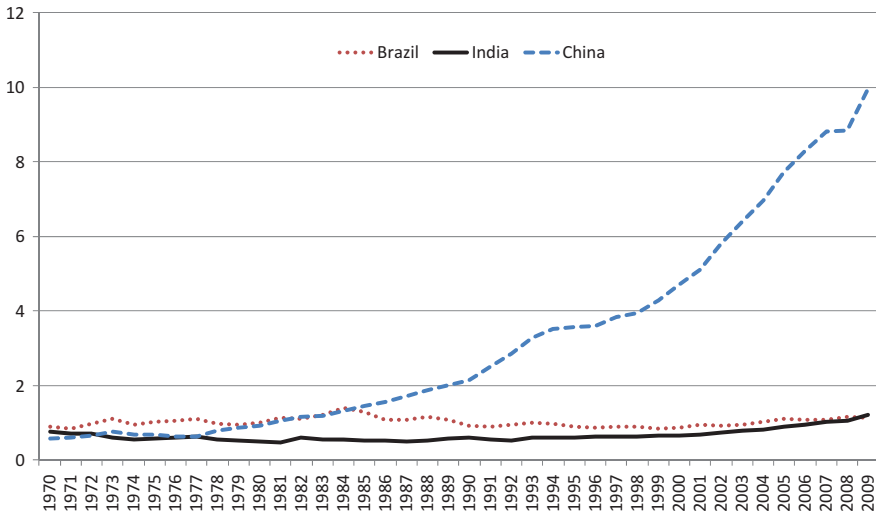


Figure 1: Share in World Exports: India, Brazil and China 1970–2009 (in percent).

Its share is roughly one-tenth that of China which is particularly striking given that both had similar shares back in 1970. India's share is however, similar to that of Brazil (though Brazil is only one-sixth of its size in terms of population).

India's share in world exports mirrors its low share in most developed country markets: e.g. 1.3%, 0.7% and 0.02% in US, Japan and European Union (EU) markets respectively (Figure 2(a)–2(c)). Its share in the Japanese market has in fact declined over time, whereas it has remained stagnant in the EU market. In comparison, its share in the United States (US) market has increased moderately from 0.7% in 1970 to 1.3% in 2009 and is now greater than its share in world exports.

While Indian exporters have a small share in the US market, US still remains the most important destination country for India, accounting for 13.5% of total Indian exports (UAE and China being the second and third most important with shares of 9% and 7% respectively) (Figure 3). The share of US in total Indian exports has however been declining over the last decade (from greater than 20% in 2000 to 12% in 2009). Not surprisingly, US' decline has coincided with the rise of China with its share in total Indian exports increasing from close to zero in the late 1970s to a peak of 7.6% in 2005 (Figure 4(a)). Similarly, although US remains important in the Indian imports market, its share has declined drastically over time, and has been taken over by China since 2004. In 1970, one fourth of Indian imports had an American origin but in 2009, this figure had fallen below 7 percent (Figure 4(b)).

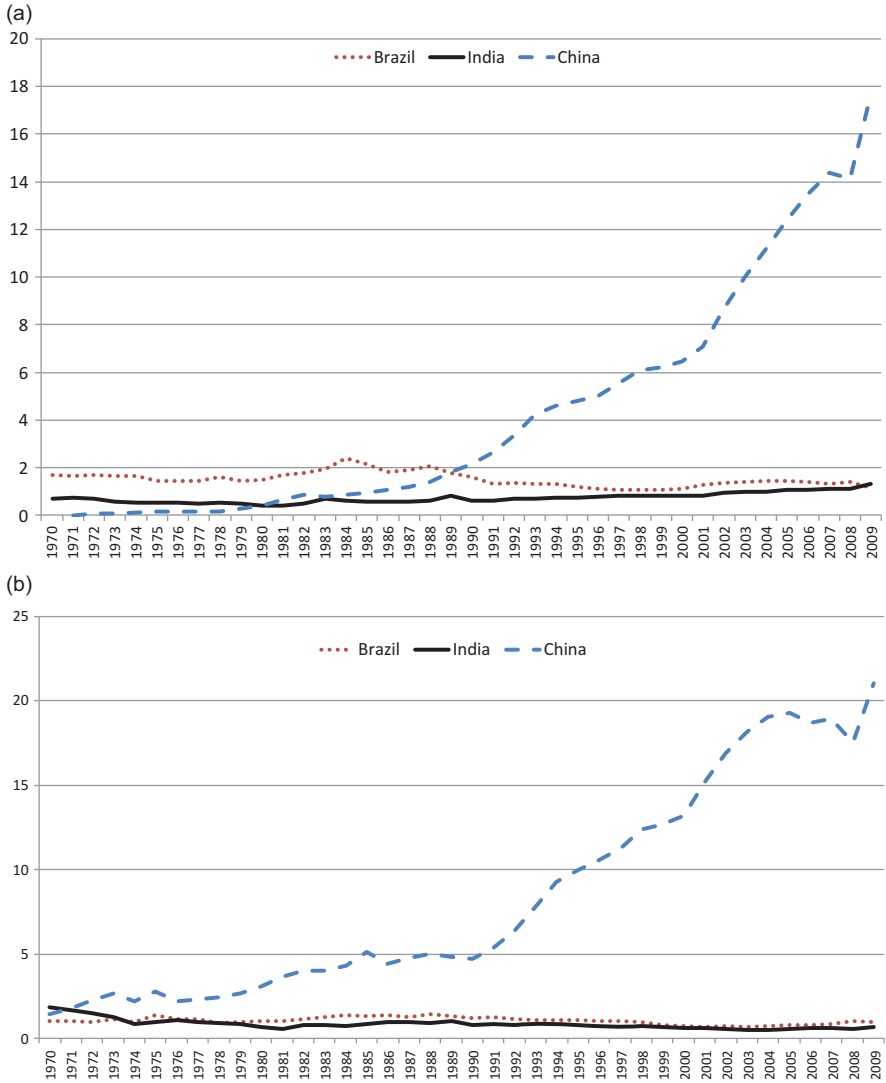


Figure 2: (a) Shares of Brazilian, Indian and Chinese Exports in US Market 1970–2009. (b) Share of Brazilian, Chinese and Indian exports in the Japanese market 1970–2009

More generally, US' share in world merchandise exports has declined sharply over the last decade. During the 1980s and 1990s, approximately 12 percent of the value of goods shipped globally originated in the US; by 2010, this share had dropped to only 8.5 percent (Mandel Benjamin 2012).

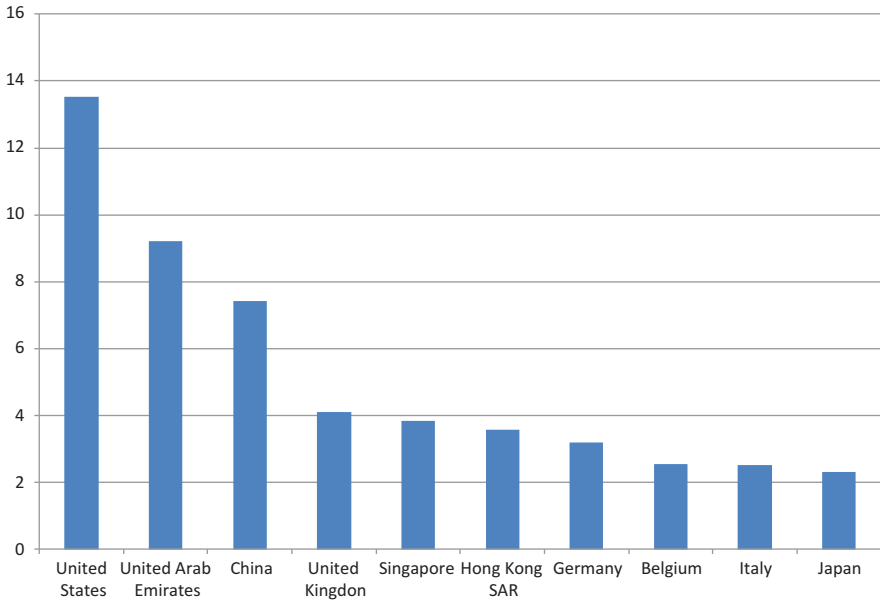


Figure 3: Share in India's exports (top 10 in percent).

There is an ongoing debate about the factors responsible for the diminishing trade performance of US (for example declining share of the US in world output, decline in relative productivity of the US). There seems to be an agreement that in order to reverse the trend, US would need to capture a greater share of markets where incomes are expanding at faster rates. One of the important markets in this regard is India. Indeed, President Obama's National Export Initiative (NEI) that aims to double US exports in the course of 5 years enlists India as a key emerging market in support of NEI. Notably, US exports to India trebled in nominal terms between 2005 and 2009.

Although India still does not appear among the top ten destinations for US exporters, its share in total US exports has increased significantly since 2001 (Figure 5(a)). The most important destination for US exports continues to be its North America Free Trade Agreement (NAFTA) partners viz. Canada and Mexico followed by China. India was ranked 17th in 2007 (Figure 5(b)).

India and the US are getting increasingly more important for each other from a trade perspective. See Inoue (2014) for dynamics of India's export demand over time.

In case of FDI, globally the US has consistently been a major player. In fact, it has remained the leading investing economy based on data up to 2012. The US accounted for nearly 25% of global outflows at US\$ 351 billion in 2012. Nearly

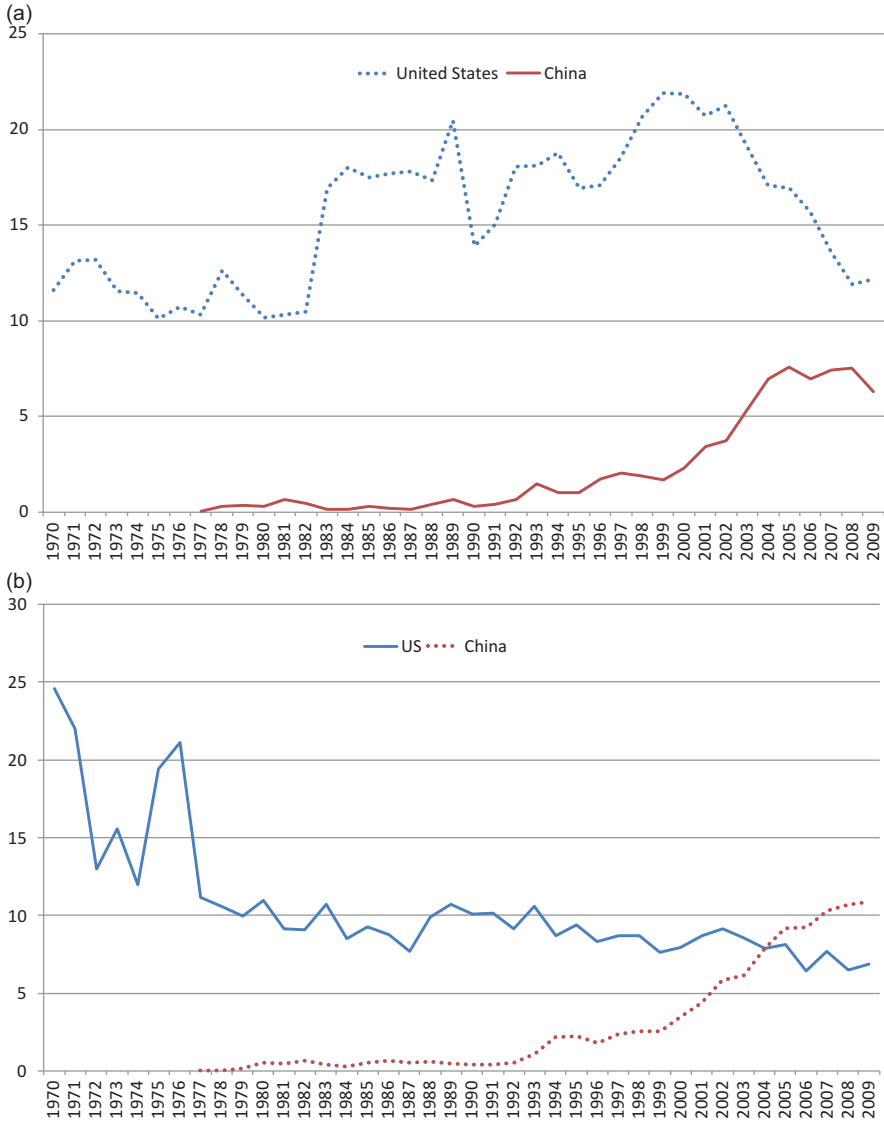


Figure 4: (a) Share of the United States and China in India's exports 1970–2009 (in percent). (b) Share of the US and China in India's import market 1970–2009 (in percent).

half of that investment was realized in Europe. The US is followed by Japan, Belgium, Germany, United Kingdom, China and France. China is fast emerging in the league of leading investors but relative to outflows of the US it still remains a small player (just 17% of the level of FDI outflows out of the US in

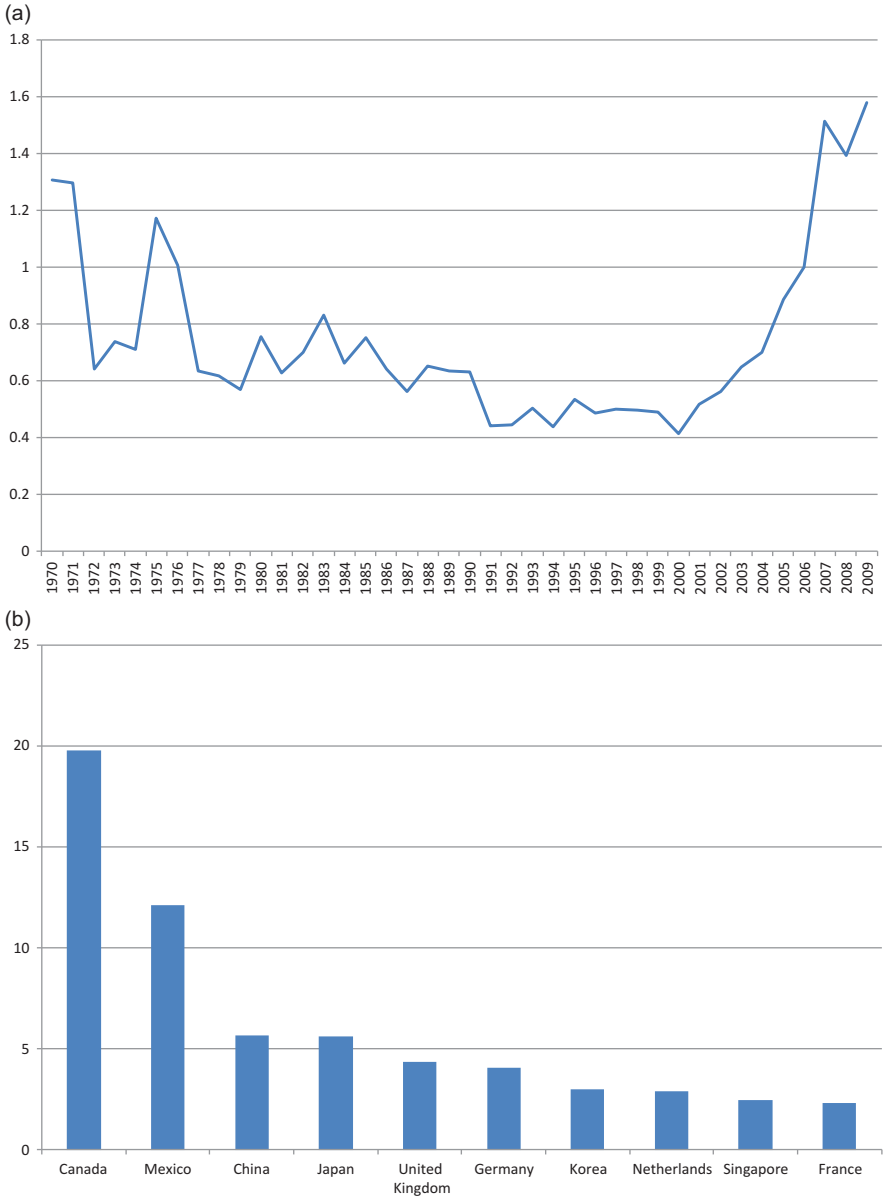


Figure 5: (a) Share of India in US exports 1970–2009 (in percent). (b) Share of different countries in US exports in 2007 (in percent).

2012). Among emerging markets, US outflow to India in 2009 equaled US\$ 19.1 billion (same as that of Taiwan) compared to over US\$ 45 billion to Hong Kong, US\$ 50 billion to China, US\$ 53 billion to Brazil and US\$ 82 billion to Mexico.

On the inflow side as well, US has been a major player but recently it has begun to trail China. According to OECD data, in 2012, 44 % of the global FDI inflows were hosted by only five countries. China attracted the highest share at 18 % of total (US\$ 253 billion) followed by US (US\$ 175 billion), Brazil (US\$ 65 billion), United Kingdom (US\$ 63 billion) and France (US\$ 62 billion). Yet, among the OECD countries US is the frontrunner as a destination for FDI inflows. For changes in FDI in OECD countries please see Ghosh et al. (2012).

At the same time developing countries are fast emerging as global investors. According to UNCTAD (2011), the ratio of outward FDI from developing countries to global outward FDI rose from just 8.7 % in 2000 to 26.9 % in 2011. The share of emerging countries in inflows into the US is rising as well.

3 Data

Our sample comprises 132 advanced, emerging, and developing economies as exporter, covering the period 1970–2009. For computational reasons, we restrict the set of importers to 51 advanced and emerging economies. Bilateral import and export flows are obtained from the IMF's Direction of Trade Statistics (DOTS) database. These are reported in current U.S. dollars and are deflated using the world import and export price deflators, respectively, from the International Financial Statistics (IFS) database, to get each country's real imports and exports.

The data on FDI is taken from the OECD, and covers the period from 1985–2009. FDI is defined as investment by a resident entity in one economy that reflects the objective of obtaining a lasting interest in an enterprise resident in another economy. The ownership of at least 10 % of the voting power, representing the influence by the investor, is the basic criterion used in the OECD data to qualify as FDI.

The OECD's database provides statistics on international direct investment to and from the OECD countries. Data for flows and stocks of direct investment are available at a disaggregated level, by geographical zone and by industries. We use deflated inflows and outflows in constant 2005 dollars from this dataset.

Other standard variables used to estimate the gravity model e. g. country-pair variables including bilateral distance, a common land border, island and landlocked status, common legal origin, language, and colonial ties are from Glick and Taylor (2010). The indicators for whether countries belong to a currency union or a free-trade area are from Glick and Rose (2002), which we extend until 2009.

3.1 Trade

Figures 6 and 7 show real values of India's exports to and imports from the US over time. While India's exports to the US have grown enormously (ninety times) over the last four decades, its imports from the US have increased only fifteen times. The figures also show the timeline of the key events which might have played a role in explaining the trend in exports. For example, the rising trend in India's exports to the US coincided not only with the initiation of trade reforms in India but also with the collapse of the Soviet Union in 1991 (Figure 6). Indian exports to Union of Socialist Republics/Former Soviet Union (USSR/FSU) collapsed from about 2.9 billion dollars in 1990 to 0.9 billion dollars in 1998.

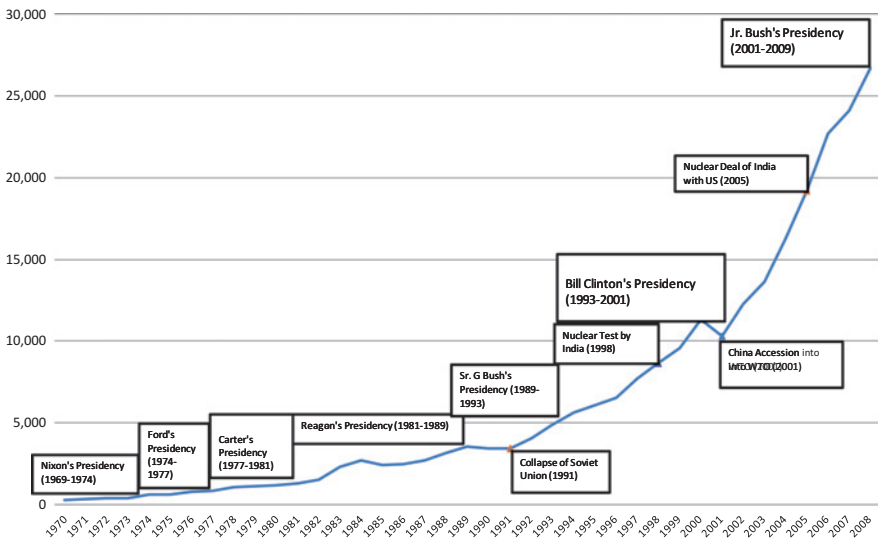


Figure 6: Exports from India to the US (in deflated million dollars).

There was a sharp drop in imports as well from USSR/FSU, from a value of 1.3 billion in 1990 to a low of 0.7 billion in 1998 (Aggarwal and Mukherji 2008). Even more striking is the shift in trend for Indian imports from the US after 1991 (Figure 6). Interestingly after 2001, the year of China's accession into the WTO, there seems to be a positive trend shift in Indian exports to US.

Next, we explore how India-US trade has fared under different political regimes. Prior to 1990 the progress in bilateral trade was largely muted irrespective of the governments in charge. Similarly, after 1990, India-US trade has seen a robust upward trend independent of the changes in governments in the US or India; under both republican as well as democrat administrations, bilateral India-US trade has seen a steady upward trend.

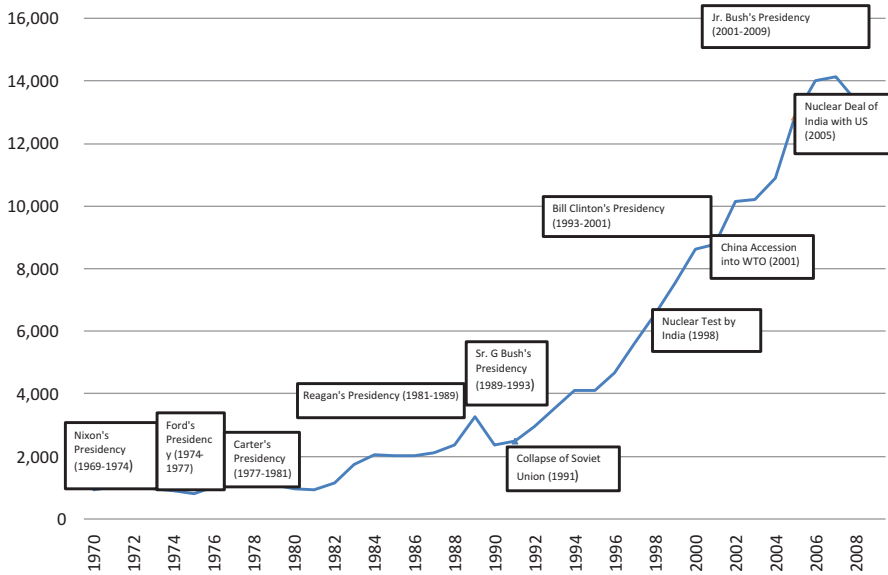


Figure 7: Imports of India from the US (in deflated million dollars).

The nuclear test by India in 1998 also seems to have done little to change the trajectory of India-US trade. Not surprisingly, there is a dip in India's exports to the US in 2001 which is likely a common effect on all exporters to the US after the 9/11 terrorist attacks. Later on, India's imports from the US decreased following the Global Financial Crisis (GFC) in 2008–09, another shock that would have affected all exporters to the US markets and/or US exports to all markets (Figure 7). We do not find any marked decline in real exports from India to the US following the GFC.

The discussion above establishes the importance of US in India's trade in goods. However, a lot of the discussion in the media and policy circles relating to India's trade with the US has been centered on services. Our dataset does not allow us to include services in the empirical analysis due to absence of cross-country data on services trade over a long period of time.

Based on information from the Bureau of Economic Analysis, services have indeed been an important component of India-US trade especially during the last decade. On average, after 2000, services exports to the US from India have been over 40 percent of the goods exports. Prior to 2005, US exports of services to India exceeded its imports from India but since then this trend has reversed (Figure 8). As of 2011, India is the biggest exporter of services among developing countries. Unlike almost all other developing countries India is the only one having a positive services trade balance with the US.

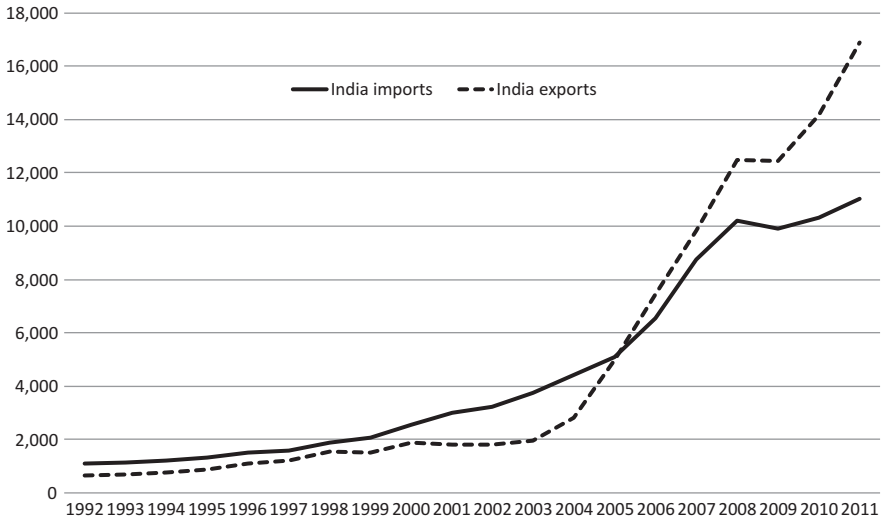


Figure 8: India-US: Exports and Imports of Services (in US dollar million).

3.2 FDI

Though FDI outflows to India from the US have increased over time, the rate of increase has been extremely slow especially in relation to emerging markets of Brazil, China and Hong Kong (Figure 9).

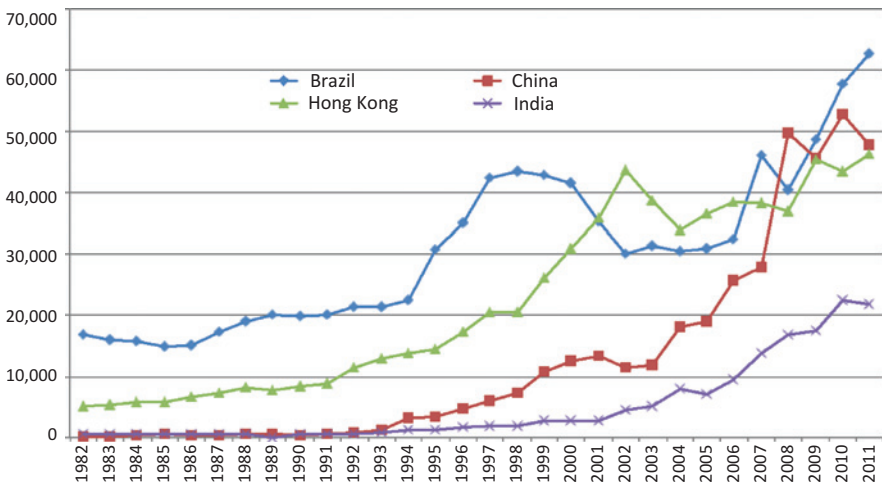


Figure 9: FDI outflows from the US (in 2005 dollars).

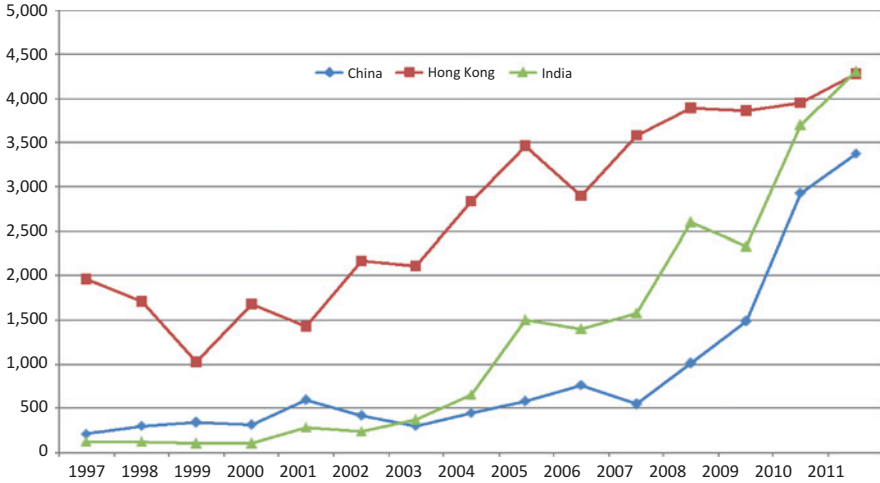


Figure 10: FDI inflows in the US from emerging markets (in 2005 dollars).

FDI inflows from emerging markets into the US have become more important since late 1990s. As shown in Figure 10, the rate of increase of Indian FDI into the US is comparable to that of China and Hong Kong. Even though India's investment into the US is lower than that of China and Hong Kong combined, the gap has narrowed in recent years.

4 Methodology

We use the standard empirical model of trade i. e. the gravity model to assess the trade (in goods) and investment performance between India and the US. The gravity model offers a well established framework with theoretical underpinnings to analyze the determinants of bilateral flows between countries.² It relates the level of bilateral trade or investment flows to characteristics of the importing (destination) and exporting (source) countries (most notably size and level of development) as well as to country-pair characteristics such as distance between

² The framework can be derived formally from a general equilibrium model of production, consumption, and trade, as in Anderson and van Wincoop (2003). See also Baldwin and Taglioni (2006) for a survey of the use of gravity models in the literature, as well as the pitfalls one faces in estimating them.

the two countries and whether they share a common border, language, or currency or if there are preferential trading arrangements.

Variations of the gravity model have been used extensively in recent studies as benchmarks from which to assess the trade and investment impact of various economic disturbances, policy regimes, and political events (see, for instance, Glick and Taylor 2010, and references therein). Recently, Behar and Freund (2011) have also employed a gravity specification to assess under-trading by Middle East and North Africa (MENA) countries.

We augment the conventional gravity model to include bilateral indicators of relationships between India and the US. Each observation in the regressions we estimate represents, for a particular year, an importer (destination)-exporter (source) pair.

4.1 Trade

Our main estimating equation for bilateral trade flows is specified as follows:

$$M_{ijt} = \gamma + \pi_{it} + \tau_{jt} + \alpha D_{US-Ind} + \beta D_{Ind-US} + \theta Z_{ijt} + \varepsilon_{ijt} \quad [1]$$

where M_{ijt} is the natural logarithm of imports of country i from exporter j at time t . The importer -time and exporter-time fixed effects are π_{it} and τ_{jt} , respectively; Z_{ijt} is a vector of pair varying controls. The pair-wise controls include time-invariant variables such as bilateral distance, common border, common language, common religion etc. as well as time-varying ones such as whether or not the partners belong to a currency union or a free trade area. Most importantly, π_{it} and τ_{jt} account for time-varying unobserved multilateral resistance terms, the τ_{jt} inclusion of which has been considered to be crucial in the estimation of gravity models.³

In addition, π_{it} and τ_{jt} also control for all observed and unobserved country-specific and time varying characteristics. Examples include institutional quality, crises, and accession of countries into arrangements such as EU and WTO. D_{US-Ind} is a time-invariant indicator for imports of US from India (or India's exports to the US). Similarly, D_{Ind-US} is a variable indicating imports of India from the US (or US exports to India).

The coefficients of interest are α and β . If $\alpha < 0$ this will imply that India's exports to the US are below normal or the gravity-predicted level (in other words India is "under-exporting" to the US). The opposite will hold for $\alpha > 0$. Instead if

³ See Pomfret (2010), Inma Martinez-Zarzoso and Wilmsmeier (2010), Fidrmuc (2009), Novy (2010), Aidt and Gassebner (2010), and Baldwin (2006).

$\beta < 0$, US exports to India would be below the gravity-predicted level (in other words US is under-exporting to India).

The magnitude of under/over trading can be calculated as follows:

$$\text{Size of under/over - exporting from India to US} = e^{\alpha} - 1 \quad (\alpha < 0 - \text{undertrading}, \alpha) \\ 0 - \text{overtrading}$$

$$\text{Size of under/over - exporting by the US to India} = e^{\beta} - 1 \quad (\beta < 0 - \text{undertrading}, \beta) \\ 0 - \text{overtrading}$$

In an alternative specification we also make adjustments for zero trade between bilateral trading pairs with the method of Poisson Pseudo Maximum Likelihood Estimator (PPML) introduced by Santos Silva and Tenreyro (2006). The gravity model in this case is estimated multiplicatively rather than its log linear form implying that zero trade can be included in the analysis. We implement eq. [1] for both aggregate trade as well as separately for each broadly disaggregated product category.

4.2 FDI

In case of FDI, we estimate separate regressions for inflows and outflows. The estimating equation for inflows is specified as follows:

$$In_{ijt} = \gamma + \pi_{it} + \tau_{jt} + \alpha D_{US-Ind} + \theta Z_{ijt} + \varepsilon_{ijt} \quad [2]$$

where D_{US-Ind} is a time-invariant indicator for inflows of FDI from India into the US, and the other variables are defined as above. If $\alpha < 0$ this will imply that India's FDI into the US is below normal or the gravity-predicted level (in other words India is "under-investing" in the US). The opposite will hold for $\alpha > 0$.

The estimating equation for outflows is described as below:

$$Out_{ijt} = \gamma + \pi_{it} + \tau_{jt} + \beta D_{Ind-US} + \theta Z_{ijt} + \varepsilon_{ijt} \quad [3]$$

where D_{Ind-US} is a time-invariant indicator for inflows of FDI into India from the US (or outflows from the US), and the other variables are defined as above. If $\beta < 0$ this will imply that US' FDI into India is below normal or the gravity-predicted level (in other words US is "under-investing" in India). The opposite will hold for $\beta > 0$.

5 Results

The results are organized as follows- first the gravity model results on trade flows are presented followed by those pertaining to FDI.

5.1 Trade

Table 1 presents the estimates from the gravity model specified in eq. [1]. To account for potential heteroskedasticity in the error term, standard errors are clustered at the exporter level. For brevity, the coefficients on the exporter-time and importer-time fixed effects are not reported. Column [1] shows the results from estimating eq. [1] over the full sample from 1970–2009. The estimated

Table 1: Estimated gravity model of trade: significance of India-US trade.

	[1]	[2]	[3]	[4]
	Full sample	Pre-1990	Post-1990	Post-2000
Dummy: India exports to US	0.294*** [0.105]	0.626*** [0.121]	-0.012 [0.120]	-0.279** [0.140]
Dummy: India imports from US	-0.021 [0.147]	0.459*** [0.175]	-0.511*** [0.163]	-0.727*** [0.176]
Log (bilateral distance)	-1.137*** [0.055]	-1.102*** [0.060]	-1.168*** [0.068]	-1.143*** [0.076]
common border dummy	0.109 [0.172]	0.061 [0.194]	0.175 [0.175]	0.227 [0.182]
Number of island countries in pair	-1.57*** [0.215]	-0.968*** [0.251]	-2.018*** [0.504]	-2.509*** [0.253]
Number of landlocked countries in pair	0.114 [0.404]	0.918*** [0.335]	-0.18 [0.466]	-0.183 [0.247]
Common legal system dummy	0.206*** [0.054]	0.268*** [0.061]	0.165** [0.065]	0.161** [0.069]
Common language dummy	0.301*** [0.078]	0.163* [0.094]	0.4*** [0.083]	0.437*** [0.088]
Colonial ties dummy	1.101*** [0.116]	1.214*** [0.133]	0.98*** [0.118]	0.964*** [0.123]
Common religion	0.409*** [0.115]	0.076 [0.140]	0.65*** [0.133]	0.727*** [0.148]
Number of WTO member countries in pair	-1.746*** [0.214]	-1.2*** [0.210]	-1.45*** [0.462]	-3.277*** [0.294]
Dummy for common currency	-0.485*** [0.156]	0.794** [0.396]	-0.793*** [0.168]	-0.963*** [0.182]
Dummy for regional trade agreement	0.055 [0.133]	-0.057 [0.198]	0.099 [0.141]	0.335** [0.160]
R-squared	0.78	0.75	0.79	0.8
N	206,608	90,863	115,745	60,200

Note: This table shows the estimates from regression eq. [1] in the text. All regressions include exporter*year and importer*year dummies. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***,**, and*, respectively.

coefficient on the dummy for India's exports to the US is positive and statistically significant at the 1% level.

The magnitude of the estimated coefficient on D_{US-Ind} suggests that India's exports to the US are 34% above normal or the gravity predicted over the whole sample. The estimated coefficient on US exports to India is negative but statistically insignificant, suggesting that the realized exports are statistically in line with the gravity-predicted level. The sign on the estimated coefficients of most of the control variables are as expected (except the WTO and the common currency dummies). Note that in estimating the deviations from gravity-predicted using the sign and size of the coefficient of dummy for Indian exports to the US, the omitted category is the average of all other trading pairs in the world over time. The dummy for Indian exports to the US is itself a mean of India-US pair effects over the sample time period.

Importantly, there is significant variation in the estimated coefficients across time. We divide the sample into three periods: pre 1990, post 1990, and post 2000. In the pre-1990 period the bilateral trade dummy for India's exports to the US is positive and highly significant. Notably, India's position as an over-exporter reverses in the post-1990 period. With the strong positive effect in the former period, in the full sample, bilaterally India emerges as an over-exporter. Though the summary statistics show a positive trend shift in 1990s in India's exports to the US (Figure 6), once we control for standard determinants of trade, the trade performance for India in the US market appears to be in line with predicted levels in the post1990 period. The collapse of Soviet Union was an important event from India's perspective.

The result for post 1990 period seems to be driven primarily by the evidence for significant under-trading in the post-2000 period (Table 1, column 4). Indian exports to the US are 24% below predicted during this period.

Several important changes happened in the post 2000 period as well that could have affected the benchmark for estimates for under or overtrading in the India-US pair. The time period overlaps with rise of China as a trading power house including its accession into the WTO in 2001. To the extent that these events would have differential effects across bilateral country-pairs at different points in time, they are not controlled for in the framework.

For US exports to India, the results show a larger reversal in trade performance in the post-1990 era. In the pre-1990 period, US-India exports were 58 percent above the predicted level. There is however a stark reversal in the post 1990 period, with US-India trade turning 40% below normal or gravity predicted. The extent of under-trading is even more pronounced in the post 2000 period, with US exports to India being 50% below gravity predicted levels.⁴

⁴ We also ask the question whether income elasticity for US-India trade is different from that for other partners. In order to analyze this issue, we introduce three additional variables in the

Table 2: Estimated gravity model of trade: significance of India-US Trade relative to competitors.

	[1]	[2]	[3]	[4]
	Full sample	Pre-1990	Post-1990	Post-2000
Dummy: India exports to US	0.285*** [0.106]	0.614*** [0.122]	-0.018 [0.121]	-0.289** [0.141]
Dummy: India imports from US	-0.016 [0.149]	0.460** [0.176]	-0.503*** [0.164]	-0.722*** [0.177]
Dummy: China's exports to US	-0.064 [0.106]	-0.604*** [0.117]	0.493*** [0.119]	0.215 [0.139]
Dummy: China's imports from US	0.065 [0.111]	-0.234* [0.140]	0.34** [0.136]	-0.026 [0.163]
Dummy: Brazil's exports to US	-1.154*** [0.134]	-0.831*** [0.151]	-1.409*** [0.144]	-1.495*** [0.163]
Dummy: Brazil's imports from US	0.131 [0.163]	0.283 [0.194]	-0.004 [0.165]	0.256 [0.183]
R-squared	0.78	0.75	0.79	0.8
N	206,608	90,863	115,745	60,200

Note: This table shows the estimates from regression eq. [1] in the text. All regressions include exporter* year and importer* year dummies, and other controls as in Table 1. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***, **, and*, respectively.

Table 2 presents the results from model in eq. [1] augmented for two new pair dummies (i. e. four fixed effect interactions) related to Brazil-US and China-US trade. Table 3 presents the results from estimating eq. [1] to include pair fixed effects for India's trade with other developed countries viz. Japan and EU.

Compared to India, Brazil's exports to the US have been consistently below the gravity-predicted level. In fact, the magnitude of the deviation from gravity-predicted increased post 1990. This could be explained by the fact that over the last decade, Brazil's exports to Latin America and the Caribbean, the European Union, and China have grown faster than its exports to the US. Perhaps, this is because Brazil seems to have prioritized regional integration with MERCOSUR,

estimation – income of exporter* income of importer, and interaction of the latter with two the US-India dummies. Note that income levels of the importer and exporter are absorbed in the exporter*time, and importer*time fixed effects. The results suggest that the income elasticities for US-India trade are significantly lower. For example, during the post-2000 period the income elasticity for India's exports to the US are 6% lower than that for other trading partners. In other words, rise in incomes of the exporter and importer gives a smaller boost to India's trade with the US than it does on average between other trading partners.

Table 3: Estimated gravity model of trade: significance of India-US trade relative to other destination markets

	[1]	[2]	[3]	[4]
	Full sample	Pre-1990	Post-1990	Post-2000
Dummy: India exports to US	0.264** [0.107]	0.643*** [0.123]	-0.093 [0.122]	-0.372** [0.143]
Dummy: India imports from US	-0.09 [0.155]	0.443** [0.182]	-0.626*** [0.172]	-0.89*** [0.185]
Dummy: India's exports to EU	-0.125** [0.059]	0.168** [0.074]	-0.274*** [0.067]	-0.247*** [0.077]
Dummy: India's imports from EU	-0.979*** [0.201]	-0.323 [0.244]	-1.235*** [0.202]	-1.51*** [0.215]
Dummy: India's exports to Japan	-0.569*** [0.130]	0.242* [0.136]	-1.349*** [0.148]	-1.734*** [0.153]
Dummy: India's imports from Japan	-1.129*** [0.151]	-0.347** [0.169]	-1.867*** [0.176]	-2.319*** [0.190]
R-squared	0.78	0.75	0.79	0.8
N	206,608	90,863	115,745	60,200

Note: This table shows the estimates from regression eq. [1] in the text. All regressions include exporter* year and importer* year dummies, and other controls as in Table 1. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***, **, and*, respectively.

and Brazil's bilateral trade with China has been influenced by growing Chinese investment in Brazil, particularly in soybeans and iron ores (Cardenas 2010).

On the other side, in the full sample as well as in sub-samples, US exports to Brazil have been in line with the gravity-predicted. During the post-1990 phase, China's exports to the US have been strongly above normal while it was below the gravity-predicted level in the pre-1990 period.

In line with the raw data, which showed small shares of India's exports in developed country markets (Figure 2(a)–2(c)), the regression results confirm below predicted levels of Indian exports both in Japan as well as EU markets particularly after 1990 (Table 3). In fact, the extent of India's under trading with Japan is more pronounced than with the US.

Kalirajan and Bhattacharya (2007) show that export and import intensities between India and Japan have declined over the last decade.⁵ Moreover, Japan's imports from India decreased much more than its exports. Japan's imports

⁵ Export intensity between India and Japan is defined as the ratio of India's exports to Japan to Japan's share in world exports. Import intensity is defined in a similar fashion.

comprise mainly of primary and intermediate goods, whose demands are declining. In contrast, Japanese exports to India consist of machinery, transport equipment and capital goods, which are characterized by increasing demand in Indian markets. Japan's import and export intensities are well below 100, which implies that it is trading much less with India than might be expected from its share in world trade. This could imply that Japan has much potential to increase its trade with India.

Further, Table 4 presents the results from estimating the gravity model for broad product groups (consumer durables, non-durables, intermediate, primary and capital). The product-level gravity regressions are estimated separately for pre- and post-1990 samples. Information on product types is taken from the UN's Broad Economic Classification (Pula and Peltonen 2009). India's exports to the US are above the gravity-predicted level for all product groups in both the pre- and post-1990 periods, with the deviation also generally being statistically significant (except in the case of consumer non-durables pre-1990 and capital goods during the post-1990 phase). This is surprising because we did not find evidence of over-trading for aggregate trade during the post 1990 period (Table 1, Column [2]).

Table 4: Estimated gravity model of trade: significance of India-US trade: product-level.

	Consumer durables	Intermediate	Consumer non-durables	Primary	Capital
Post-1990					
Dummy: India exports to US	0.397*** [0.121]	0.683*** [0.103]	0.134 [0.124]	0.636*** [0.140]	0.911*** [0.130]
Dummy: India imports from US	1.151*** [0.164]	-0.421*** [0.148]	1.183*** [0.131]	-0.707*** [0.141]	0.216** [0.107]
R-squared	0.85	0.82	0.79	0.66	0.85
N	67305	81385	74250	78695	64363
Pre-1990					
Dummy: India exports to US	0.471*** [0.122]	1.08*** [0.127]	0.583*** [0.122]	0.96*** [0.133]	0.228 [0.150]
Dummy: India imports from US	0.338 [0.210]	-0.197 [0.173]	1.377*** [0.203]	0.79*** [0.187]	0.396** [0.161]
R-squared	0.82	0.73	0.69	0.64	0.83
N	48949	64393	56854	66232	44446

Note: This table shows the estimates from regression eq. [1] by product types. All regressions include exporter*year and importer*year dummies; and other controls as in Table 1. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***, **, and*, respectively.

Table 5: Estimated gravity model of trade: significance of India-US trade: product-level.

	Consumer Durables	Intermediate	Consumer Non-Durables	Primary	Capital
					Post-1990
Dummy: India exports to US	0.397*** [0.121]	0.683*** [0.103]	0.134 [0.124]	0.636*** [0.140]	0.911*** [0.130]
Dummy: India imports from US	1.151*** [0.164]	-0.421*** [0.148]	1.183*** [0.131]	-0.707*** [0.141]	0.216** [0.107]
R-squared	0.85	0.82	0.79	0.66	0.85
N	67,305	81,385	74,250	78,695	64,363
	Post-1990: Dependent variable: Aggregate trade (logs)				
Dummy: India exports to US	0.283*** [0.104]	0.269** [0.108]	0.345*** [0.099]	0.358*** [0.103]	0.265** [0.102]
Dummy: India imports from US	-0.208 [0.136]	-0.433*** [0.145]	-0.164 [0.128]	-0.344** [0.145]	-0.219* [0.124]
R-squared	0.84	0.82	0.84	0.81	0.83
N	67,305	81,385	74,250	78,695	64,363

Note: The top panel table shows the estimates from regression eq. [1] by product types. The bottom panel estimates the regression for overall trade in the product-specific sub samples of the data to check whether results are driven by a different sample or by the product-specific effect. All regressions include exporter*year and importer*year dummies; and other controls as in Table 1. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***,**, and*, respectively.

We explore further and examine whether the over-trading effect across all product categories stems from a different sample, or is it indeed a product-specific effect. We estimate the gravity model with aggregate trade as dependent variable in each of the product-specific samples. As shown in Table 5, India's overall exports to the US are above the gravity-predicted level in each of the sub-samples during the post-1990 period. Therefore the evidence for above normal exports across all product-groups is likely due to a different sample and is consistent with results in Table 1.

For US exports to India, the strong evidence for deviations below normal in Table 1 during the post 1990 period, seem to be driven mainly by primary and intermediate goods categories. Exports of consumer durables, consumer non-durables and capital goods are above the gravity-predicted level (Table 4). Interestingly, the evidence for over-trading is not driven by the different sample, rather it is a product-specific effect. As shown in Table 5 (bottom panel), overall trade is below normal in all the product-specific sub-samples. This result is particularly important since the product groups in

which we find US to have above normal export performance in Indian markets are precisely those products where US has been losing market shares elsewhere. For example, Del Gatto et al. (2011) note the sharp decline in US' share in world exports of capital goods (e. g. machinery and transportation equipment) (Tables 6 and 7).

Table 6: Estimated gravity model of trade: significance of India-US trade: drop years of global financial crisis.

	Full sample	Post 1990
Dummy: India exports to US	0.333*** [0.106]	0.036 [0.119]
Dummy: India imports from US	0.024 [0.149]	-0.472*** [0.164]
R-squared	0.78	0.79
N	194625	103762

Note: This table shows the estimates from regression eq. [1] in the text. All regressions include exporter*year and importer*year dummies, and other controls as in Table 1. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***, **, and*, respectively.

Table 7: Estimated Gravity Model of Trade: Significance of India-US Trade: Poisson Pseudo-Maximum-Likelihood Estimation.

	Full sample	Post 1990	Pre-1990
Dummy: India exports to US	0.058 [0.109]	0.048 [0.108]	0.193 [0.151]
Dummy: India imports from US	-0.324*** [0.114]	-0.375*** [0.132]	-0.077 [0.129]
R-squared	0.87	0.89	0.86
N	312110	157729	149381

Note: This table shows the estimates from Poisson Pseudo Maximum Likelihood Estimation. All regressions include exporter, importer and year dummies, and other controls as in Table 1. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***, **, and*, respectively.

5.2 FDI

As discussed above, separate regressions for inflows and outflows have been employed. Table 8 presents the results of gravity model estimates for FDI flows.

Table 8: Estimated gravity model for FDI: significance of India-US FDI.

	[1]	[2]	[3]	[4]	[5]	[6]
Log (bilateral distance)	-0.004*** [0.001]	-0.004*** [0.001]	-0.004*** [0.001]	-0.909*** [0.094]	-0.914*** [0.094]	-0.914*** [0.094]
Common border dummy	0.011** [0.006]	0.011** [0.005]	0.011** [0.006]	0.084 [0.193]	0.079 [0.195]	0.079 [0.195]
Number of island countries in pair	-0.024 [0.034]	-0.024 [0.034]	-0.024 [0.034]	-1.419 [1.139]	-1.422 [1.142]	-1.422 [1.142]
Number of landlocked countries in pair	0.01 [0.009]	0.01 [0.009]	0.01 [0.009]	-3.198*** [0.995]	-3.199*** [0.998]	-3.199*** [0.998]
Common legal system dummy	0.001 [0.002]	0.001 [0.002]	0.001 [0.002]	0.449*** [0.107]	0.446*** [0.107]	0.446*** [0.107]
Common language dummy	-0.007** [0.003]	-0.007** [0.003]	-0.007** [0.003]	0.073 [0.124]	0.079 [0.125]	0.079 [0.125]
Colonial ties dummy	0.015* [0.008]	0.015* [0.008]	0.015* [0.008]	0.889*** [0.204]	0.888*** [0.204]	0.888*** [0.204]
Common religion	0.002 [0.003]	0.002 [0.003]	0.002 [0.003]	0.597** [0.247]	0.592** [0.246]	0.592** [0.246]
Dummy for common currency	-0.005 [0.004]	-0.005 [0.004]	-0.005 [0.004]	-0.073 [0.164]	-0.074 [0.165]	-0.074 [0.165]
Dummy for regional trade agreement	0.004 [0.003]	0.004 [0.003]	0.004 [0.003]	0.116 [0.122]	0.114 [0.122]	0.114 [0.122]
Dummy for FDI flows from India to US	-0.020** [0.008]	-0.021** [0.009]	-0.021** [0.009]			
Dummy for FDI flows from US to India				-0.241 [0.163]	-0.239 [0.169]	-0.239 [0.169]
Dummy for FDI flows from China to US		-0.025*** [0.008]				
Dummy for FDI flows from Brazil to US		-0.042*** [0.012]				
Dummy for FDI flows from India to EU			-0.003 [0.002]			
Dummy for FDI flows from India to Japan			0.000 [0.002]			
Dummy for FDI flows from US to China					0.495*** [0.157]	0.495*** [0.157]

(continued)

Table 8: (continued)

	[1]	[2]	[3]	[4]	[5]	[6]
Dummy for FDI flows from US to Brazil					-0.669*** [0.155]	-0.669*** [0.155]
Dummy for FDI flows from EU to India						
Dummy for FDI flows from Japan to India						
R-squared	0.22	0.22	0.22	0.73	0.73	0.73
N	18,109	18,109	18,109	16,486	16,486	16,486

Note: Dependent variable in columns [1]–[3] is bilateral FDI inflows into OECD countries, whereas that in columns [4]–[6] is bilateral FDI outflows from OECD countries. All regressions include exporter*year and importer*year dummies. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***,**, and*, respectively.

Even though FDI flows from the US into India trails behind other emerging markets such as Brazil and China (Figure 9), the estimates from the gravity model suggest this to be in line with the normal. Controlling for several observed determinants of FDI flows but more importantly time-varying unobserved factors, there is no evidence for under-investing or over-investing by the US into Indian markets (Table 8, columns [4]–[6]). This is in contrast with other emerging market destinations. Estimates show that US is a significant under-investor in Brazil. Somewhat expectedly, the US over-invests in China by a significant margin.

Further, if we control for per-capita income differential between source and destination (and also interact it with the US-India dummy, we get some evidence for overinvestment by US in Indian markets (Table 9, columns [3] and [4]). The elasticity of FDI with respect to the income differential is significantly higher for US investment in Indian markets. We also get some evidence for overinvestment by the US in Indian markets if we restrict the sample in Table 8 to the post-2000 period (not shown).

The results are more uniform on the side of FDI inflows into the US. All three countries namely Brazil, China and India are estimated to be under-investing in the US markets (Table 8, columns [1]–[3]). Though their levels of investment into the US could be differing but the wedge between the predicted and actual outflows for India and China are nearly identical. It is in fact Brazil that seems to under-invest by the biggest margin among the three countries. Further, the results are identical with the inclusion of flows in or out of Hong Kong as a separate source-destination pair (not shown).

Table 9: Estimated gravity model for FDI: significance of India-US FDI. Control for per capita income differential.

	[1]	[2]	[3]	[4]
Dummy for FDI flows from India to US	-0.020** [0.008]	-0.042 [0.067]		
Per capita income differential (source-destination)	-0.031* [0.018]	-0.031* [0.018]		
Per capita income differential (source-destination) *Dummy for FDI flows from India to US		-0.005 [0.015]		
Dummy for FDI flows from US to India			-0.249 [0.163]	9.092*** [1.778]
Per capita income differential (destination-source)			-1.829 [1.185]	-1.829 [1.186]
Per capita income differential destination-source) *Dummy for FDI flows from US to India				2.144*** [0.410]
R-squared	0.22	0.22	0.73	0.73
N	17966	17966	16331	16331

Note: Columns [1] and [2] show the estimates from regression eq. [2] in the text, whereas columns [3] and [4] show the estimates from regression eq. [3]. Dependent variable in columns [1] and [2] is bilateral FDI inflows into OECD countries, whereas that in columns [3] and [4] is bilateral FDI outflows from OECD countries. All regressions include exporter*year and importer*year dummies, as well as all controls in column [1] of Table 8. Robust standard errors clustered at the exporter level in parentheses. Significance at the 1, 5, and 10 percent indicated by***,**, and*, respectively.

6 Robustness Tests

In this section we present tests of robustness for the results presented above in terms of trade performance vis-à-vis the potential determined by a gravity model. As a first test of robustness, we drop the years of the global financial crisis, 2008 and 2009 from the sample. The results in Table 6 show that estimated coefficients on dummies for India-US trade as well as US-India trade are broadly similar to those in the baseline results reported in Table 1.

A commonly found feature in bilateral trade data is that zero trade is common across country-pairs and products. Martin and Pham (2008) show that failure in modeling such limited dependency of the trade data can result in large biases for all estimates of interest. Helpman, Melitz, and Rubinstein (2008) attribute the absence of trade between countries to firms' selection into exporting based on fixed costs of trade and firm specific productivity. They derive a generalized gravity model that takes into account zero trade and

estimates the extensive margin. The Helpman et al (2008) model, however does not have a clear extension to panel data settings.

Hence, we adopt an alternative specification of gravity model that takes into account zero trade based on Santos Silva and Tenreyro (2006). Though Santos Silva and Tenreyro (2006) developed their model primarily to take into account the heteroskedasticity problem in empirical trade models, their methodology also allows for taking into account zero trade since their model is estimated in a multiplicative form. We estimate the gravity model in its original multiplicative form by a Poisson Pseudo-Maximum Likelihood (PPML) method. Computational limitations prevent inclusion of exporter-time and importer-time fixed effects when we implement the PPML. Instead we are able to include only exporter, importer and time fixed effects. Therefore, in this specification we are unable to control for time-varying multilateral resistance terms.

The results using the PPML methodology are presented in Table 7. While exports from India to the US are estimated to be above normal, we do not find the deviations to be statistically significant in any time period. But we find strong evidence for exports from US to India being below potential after 1990. US exports to India are 38 % below gravity-predicted level, and the deviation is statistically significant at the 1% level. Both the magnitude and the statistical significance are consistent with that in Table 1.

Overall, the robustness tests presented in this section support the finding that while India's exports to the US are in line with gravity-predicted level after 1990, there is strong evidence for US' exports to India being below its potential during the same period.

7 Conclusion

In this paper we set out to study India-US trade and investment relations with an objective to analyze the trade and FDI performance in relation to the potential from both sides. The empirical framework uses a standard gravity model for both types of flows of international trade augmented with indicators for trade and investment between India and the US (and other pairs). Importantly, the framework controls for all unobserved country-specific and time-varying effects including the multilateral resistance terms. The analysis uses data from 1970–2009 for a large sample of advanced, emerging and developing country exporters. For FDI we use the data on inflows and outflows for the OECD countries covering the period from 1985–2011.

We find that while there is some evidence for India-US trade to be above normal in the pre-1990 period, there has been a distinct change in the nature of

the trading relationship after 1990. While US exports to India turned below its potential after 1990, India's exports to the US are in line with the predicted levels. Both India's performance in the US markets and US' in Indian markets could to a large extent be driven by rise of China as a trader. Indeed, China in the US markets after 1990 emerges as performing beyond what would be predicted by fundamentals specified in the gravity model.

What could explain the below potential performance of US in the Indian market? Since the coefficient of US-India trade captures the level of trade relative to other trading relationships, it is likely that other trading pairs have fared relatively better. Alternatively, under-trading or over-trading is in essence an issue of omitted variables. The empirical model used in our study controls for several determinants of trade (both observed and unobserved). However, we cannot control for all unobserved exporter-importer and time varying determinants. Therefore the estimated coefficient on the India-US dummy could reflect some of these omitted variables e. g. the under-exporting by US which we find post 1990 could be capturing reduced US traders' business confidence in India.

In the case of FDI as well, there is a distinct China effect. The US has above predicted levels of foreign direct investment into China. The FDI outflows to India from the US are in conformity with model predictions. On the other hand, all emerging markets tend to under-invest in the US to varying degrees.

What are the policy implications of our findings? After 1990, we find US as under-exporting to India, and India's exports to the US as being in line with its fundamentals. Do these results mean that Indian policymakers can be content while those in the US need to be concerned? Note that although US remains the most important destination for Indian exporters, the converse is not true. US exports to India still constitute a very small fraction of overall US exports. Therefore while India's exports to the US being in line with predicted is potentially good news for India, the under-exporting by US may not be of that much economic significance to her. Moreover, there is no denying that India's potential might itself be lower than other competitors like China and Indonesia. Therefore, policies to enhance the potential (e. g. improve infrastructure, institutional quality etc.) may be of paramount importance and over-ride any concerns about under-trading relative to a given potential.

India also has a disappointing record for FDI. Significant and rising outflows of capital from India might as well be a symptom of a subpar investment climate affecting both Indian as well as foreign investors. On the other hand, with smaller countries attracting more capital from the US than India, our findings of US FDI inflows into India being in line with gravity-predicted levels is perhaps a bit puzzling. On a closer look, the predicted level might itself be comparatively low given the state of factors that determine FDI flows (e. g. infrastructure, investment climate).

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