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Assessing Barriers to Trade in Services in India*

Prabir De**

Abstract: International trade in services has become more important in recent years as advances in technology have permitted new means of providing services across borders. Services have emerged as crucial economic activities in India, more prominently since the last decade. Apart from providing the bulk of employment and income in India, the services sector also serves as vital input for producing other goods and services. While a large part of India's services sector is untapped and rarely explored to the international market, a growing number of barriers at the same time have been slowing down India's international market access in the services sector. There is little doubt that services trade is an essential ingredient to economic growth. It is widely accepted that it can only make such positive contribution if appropriately liberalised and facilitated across countries. In this study, we have performed an empirical analysis of the linkages between India's services trade flow and its probable barriers. The results of the analysis show that the linkages between services export and services trade barriers are multiple and complex. One of the findings of this paper suggests that improved trade facilitation may help unlock the unrealized trade potential, and, therefore, more effective policy approaches toward improved services trade infrastructure would be needed to facilitate services export from India. The study finds that recreating favourable domestic policies that are responsible for services trade facilitation and reforming domestic regulations in trade and infrastructure sectors need utmost attention.

JEL codes: F13, F 18

Key words: India, services trade, trade facilitation, services trade facilitation index, domestic regulations, gravity model

1. Introduction

International trade in services has become more important in recent years as advances in technology have permitted new means of providing services across borders. While there is little doubt that services trade is an essential

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ingredient to economic growth, it is widely accepted that it can only make such positive contribution if appropriately liberalized and implemented across countries (Copeland and Mattoo, 2008). An efficient services sector is crucial for the growth and competitiveness of individual firm as well as an economy. Francois and Hoekman (2010) commented in a seminal paper:

> "There is increasing evidence that services liberalization is a major potential source of gains in economic performance, including productivity in manufacturing and the coordination of activities both between and within firms. The performance of service sectors, and thus services policies, may also be an important determinant of trade volumes, the distributional effects of trade, and overall patterns of economic growth and development." (p. 642)

Services have emerged as crucial economic activities for a developing country like India since the last decade. It not only provides the bulk of employment and income in India, services sector also serves as vital input for producing other goods and services. The importance of services is, therefore, increasingly reflected in the policy agenda – ranging from liberalization and promotional efforts to regulation at national and international levels.[1] While a large part of India's services sector is untapped and rarely explored to the international market, a growing number of barriers at the same time have been slowing down India's international market access in the services sector.[2]

One precondition of trade-led globalization process is that trade liberalization has to be actively supported by trade facilitation in order to maximize the welfare gain. Falling short of adequate trade facilitation would lead to suboptimal trade, or, in other words, the trade potential would remain unexploited. Removal of these barriers through liberalization, and complementary regulatory reforms can lead to both sectoral and economy-wide improvements in performance and generate pro-poor growth. This in fact motivates us to assess the barriers to India's services export in this study.

In view of the above, the objective of this study is to assess the barriers to trade in services in India. We attempt to achieve this objective through an augmented gravity model, which relates the level of trade between countries to their physical and economic characteristics. The rest part of the paper is

arranged as follows. Section 2 presents an overview of the India's services trade sector. A brief discussion on literature is then provided in Section 3. Section 4 presents data and methodology. Measuring the services trade facilitation is discussed in Section 5. The determinants of India's services export and the barriers, based on augmented three-stage gravity model estimates, are then discussed in Section 6. Finally, conclusions are provided in Section 7.

2. Services Trade in India: An Overview

India has witnessed a gradual structural shift towards the services sector in the past decades, with services comprising a growing share of GDP and employment. Today, services sector in India represents an essential component of competitive, knowledge-based economy, accounting for 57.2 per cent of GDP.[3]

Trade in services in India has been growing rapidly since beginning of the last decade, following significant domestic liberalization on one hand, and access to a growing overseas market for services, on the other. India's services export currently constitutes about 38 per cent of the country's total export. Services export not only grew more rapidly than the country's merchandise exports, but also increased much faster than the world average during the past decade and a half. Due to such rapid growth in services exports, India has succeeded in raising its penetration in global markets more rapidly for services than for goods. For example, India's exports of services in 2010 stood at over US$ 225 billion (Table 1), of which export and import were US$ 116 billion and US$ 109 billion, respectively. In 2010, India's share in world services trade was around 3 per cent, increased from a little above of 1 per cent witnessed in beginning of the last decade. Therefore, expansion of services trade in India in the last decade was phenomenal; both export and import in services increased much faster than that of world export and import (Table 1). Today, services trade contributes over 12 per cent of India's GDP; it increased from a mere 3 per cent when India embraced to globalization process in beginning of 1990 (Table 2). Faster export growth over import in services has also led to generate a growing surplus in trade balance except for the year 1995-96 (Table 2).

Table 1: Services Trade Growth

Year	World			India			
	Export	Import	Total	Export	Import	Total	Share in World
	(US$ billion)			(US$ billion)			(%)
1991	870.33	916.20	1786.53	4.93	5.95	10.88	0.61
2000	1529.34	1538.37	3067.71	16.69	19.19	35.88	1.17
2001	1535.80	1559.15	3094.95	17.34	20.10	37.44	1.21
2010	3745.44	3560.10	7305.54	116.32	108.59	224.91	3.08
CAGR (%)							
1991-2000	5.80	5.32	5.56	12.97	12.42	12.67	6.74
2001-2010	9.32	8.61	8.97	20.97	18.38	19.64	9.79

Source: Calculated based on UNCTAD (2011)

Table 2: India's Services Trade

Year	Services Trade Share in GDP	Exports		Imports		Balance of Trade
		Volume	Share in World	Volume	Share in World	
	(%)	(US$ billion)	(%)	(US$ billion)	(%)	(US$ billion)
1990-91	3.381	4.551	0.557	3.571	0.708	0.98
1995-96	4.799	7.344	0.547	7.544	0.827	-0.20
2000-01	7.843	16.268	1.092	14.576	1.265	1.69
2001-02	7.859	17.140	1.128	13.816	1.316	3.32
2002-03	7.962	20.763	1.195	17.120	1.299	3.64
2003-04	8.176	26.868	1.256	16.724	1.393	10.14
2004-05	8.460	46.031	1.230	31.832	1.332	14.20
2005-06	8.894	60.610	1.281	38.345	1.355	22.27
2009-10	12.356	161.25	2.076	82.33	1.830	78.92

Source: Calculated based on RBI (2010)

Table 3: Composition of India's Services Exports

Major components	Value 2000 (US$ billion)	Share* 2000 (%)	Value 2005 (US$ billion)	Share* 2005 (%)	Value 2010 (US$ billion)	Share* 2010 (%)	CAGR (2000-2010) (%)
Transportation	1.98	11.86	5.75	10.95	13.25	10.70	18.87
Travel	3.46	20.74	7.49	14.26	14.16	11.44	13.67
Communications Services	0.60	3.59	1.57	2.98	1.41	1.14	8.10
Construction Services	0.50	3.01	0.35	0.66	0.52	0.42	0.40
Financial Services	0.28	1.65	1.14	2.18	6.00	4.85	32.31
Insurance Services	0.26	1.54	0.94	1.79	1.78	1.44	19.25
Computer and Information Services, of which	4.73	28.33	21.87	41.64	56.70	45.81	25.34
Computer Services	4.63	27.76	21.71	41.33	56.11	45.34	25.45
Information Services	0.09	0.57	0.16	0.31	0.59	0.48	18.11
Personal, Cultural, and Recreational Services	0.01	0.06	0.11	0.21	0.33	0.27	37.59
Services Export Total	16.69		52.53		123.76		19.98

* Share in total services exports.

Source: Calculated based on IMF (2011)

Services export from India has grown faster than imports in the last decade, thus widening the positive balance of trade. For example, computer and information technology services, which increased from US$ 4.73 billion in 2000 to US$ 56.70 billion in 2010, grew at a CAGR of 25.34 per cent per annum during 2000 and 2010 (Table 3). Today, this sector alone contributes to almost half of India's total services export, which, a decade ago contributed about 1/4th of total services export. Barring the recent global financial crisis years, the strong demand over the past few years in developed economies has placed India among the fastest growing information technology market in the world. With 11 per cent share in India's services export, travel and transportation services come next. In the import side, about 44 per cent

of India's services import in 2010 came from the transportation services (Table 4). India's imports of transportation services outweigh its exports heavily. Therefore, transportation and computer and information technology services are two prominent sectors in India's services trade. At the same time, financial and insurance are also fast emerging as key services imports in India. Finally, India' services trade has been attached to one big surplus in computer services (US$ 54 billion in 2010) and another high deficit in transportation services (US$ 23 billion in 2010).

Table 4: Composition of India's Services Imports

Major components	Value 2000 (US$ billion)	Share* 2000 (%)	Value 2005 (US$ billion)	Share* 2005 (%)	Value 2010 (US$ billion)	Share* 2010 (%)	CAGR (2000-2010) (%)
Transportation	8.70	45.36	20.68	43.73	36.36	44.05	13.88
Travel	2.69	14.02	6.19	13.08	9.41	11.40	12.06
Communications Services	0.10	0.55	0.42	0.88	1.19	1.45	24.76
Construction Services	0.13	0.66	0.60	1.27	0.99	1.20	20.53
Financial Services	1.28	6.66	0.87	1.84	6.79	8.22	16.40
Insurance Services	0.81	4.24	2.33	4.93	5.00	6.06	17.96
Computer and Information Services, of which	0.58	3.01	1.27	2.68	2.53	3.07	14.39
Computer Services	0.00	0.00	1.05	2.22	2.18	2.64	147.93
Information Services	0.00	0.00	0.22	0.46	0.36	0.43	159.21
Personal, Cultural, and Recreational Services	0.00	0.00	0.10	0.22	0.47	0.57	165.75
Services import total	19.19		47.29	100.00	82.54		14.18

* Share in total services imports.

Source: Calculated based on IMF (2011)

What are the factors driving such a rapid rise in India's services export? Besides an important role played by the World Trade Organization (WTO) as an institution in promoting services trade, international exchange is increasingly taking the form of trade in services tasks as opposed to trade in goods, as the production process is sliced into different parts that are performed in different locations such as in India.[4] Ghani and Kharas (2010) argued that India's 'services revolution' has been supported by deregulation of services sectors. Telecommunication has been substantially opened up to competition in mid of 1990s. Newer sectors such as information technology (IT) and IT-enabled services (Business Process Outsourcing, Knowledge Process Outsourcing, and Business Transformation Services) are largely liberalized. Knowledge-based segments have been prominent among the faster growing services sectors, assisted by technological advances and a low-cost educated workforce with good English language capabilities. Noted in Mishra *et al.* (2011), technology has changed the very nature of the production frontier of services and in particular service exports, which has resulted in a rapid increase in the service exports and growing share of services in GDP growth in India. This study also shows that service exports sophistication is positively related to growth.

Unfortunately, things are not so easy for an economy to raise its international competitiveness in services trade. Trade in services is distinguished from trade in merchandise by the intangible and "disembodied" nature of many transactions. Unlike physical goods, which must cross borders and thus are subject to customs procedures and tariffs, services often involve direct transactions between the consumer and producer and not necessarily cross the border. This fact complicates measurement of both service flows and their corresponding impediments. The challenge is thus to remove barriers to services trade. However, contrary to popular belief, the measurement of impediments to services trade is problematic.[5] Given severe data limitations, econometric studies on services trade and barriers facing it are rare. A proper analysis of the barriers to India's services trade is essential to formulate appropriate trade policies in this sector. We make an attempt, despite tremendous data limitation, to assess barriers to India's services exports in next few sections.

3. Literature Review on Services Trade Barriers

While the expanding importance of services in the economy has certainly been noticed, services trade do not figure prominently in research on economic growth and development. For example, growth theory accord no special role of services activities, with the exception of financial services (Marchetti and Ray, 2008). Trade theories have paid much greater attention to goods trade for the simple reason that most of the services were non-tradeables for a long time (Mattoo *et al*., 2008). However, with the improvement in information and communication technology (ICT), trade in services has become significantly easier in the last couple of decades. A number of theoretical models have come up, which basically use the traditional comparative cost theories of either Ricardo or Heckscher-Ohlin to prove that liberalization of trade in services is welfare improving for both the source as well the recipient countries. In this study, we use a theoretically consistent gravity model to assess the barriers to India's services export.

The gravity model has been used extensively in empirical international trade since it was introduced by Tinbergen (1962) - the study had empirically shown that the trade between two countries was determined by their masses and distance between the two partners.[6] Over time this model has been used extensively in explaining the effects of different policies and other determinants of trade flows with the help of key variables related to economic size and distance. Its popularity in empirics increased rapidly with the introduction of "theoretical" gravity model by Anderson and van Wincoop (2003, 2004), which has become the *de facto* standard in empirical work.[7]

In contrast to the estimation approach to the analysis of trade costs, Jacks, Meissner, and Novy (2008) demonstrate that there is a simple analytical solution to the gravity model of Anderson and van Wincoop (2003), which allows for bilateral trade costs to be determined computationally instead of being estimated. The solution to their "gravity redux" rests on the assumption that a country's total exports are inversely related to its trade barriers with other countries, which in turn is reflected in the amount of that country's trade within its own national boundaries, or economic activity. The equilibrium solution of their model yields a remarkably lean specification

of the gravity model that can be solved directly for trade costs as a function of observable exports and income variables, suitable for direct calculation. More specifically, Jacks, Meissner, and Novy (2008) show that an "iceberg" measure of bilateral trade costs (τ_{ij}) can be derived as the geometric average of the ratio of bilateral trade flows and the product of the countries' intra-national trade, defined as share of tradable goods in national income net of total exports.

The gravity model literature in empirical international trade now covers a wide spectrum of trade flows and trade barriers. A minute scrutiny indicates most of them have focused on "policy" barriers such as tariffs and non-tariff barriers, regional integration agreements, currency unions, and the GATT/WTO, time delays at export/import and trade facilitation, governance, corruption, and contract enforcement. On the other hand, very few have dealt with "non-policy" barriers exception being Moreira et al (2008); De (2008a), Francois, *et al.* (2009), Francois and Manchin (2006), Nordas and Piermartini (2004). To a great extent, "Gravity" has become the workhorse of empirical international trade.

The existing literature on the application of the gravity model to services trade is quite limited. The results of these studies vary greatly and are often contradictory. Some early papers on the subject were from Francois (1999, 2001), with the methodology further developed in Francois *et al.* (2003). Francois (1999) has fit a gravity model to bilateral services trade for the United States and its major trading partners. The differences between actual and predicted imports were taken to be indicative of trade barriers. In another papers, Francois (2001, 2003) models the demand for imports of services as a function of the recipient country's GDP per capita and population, where the data on services trade flows are taken from the Global Trade Analysis Project (GTAP) database.

Grunfeld and Moxnes (2003) apply a gravity model to the bilateral export of services and FDI flow using data from the Organization for Economic Cooperation and Development (OECD, 2003). The regressors include the level of GDP and GDP per capita in the importing and exporting countries, the distance between them, a dummy variable if they are both

members of a regional trade area (RTA), a measure of corruption in the importing country and a trade restrictiveness index to measure the barriers to services trade in the importing country. The results suggest that the standard gravity model effects found in studies on trade in goods apply to services too. Trade in services between two countries is positively related to their size and negatively related to the distance between them and barriers to services. They find that the presence of RTA is not significant in the case of services.

Kimura and Lee (2006) apply the gravity framework to services trade with the aim of comparing the results to the estimates for trade in goods. As in Grunfeld and Moxnes (2003), they use OECD statistics on trade in services. Kimura and Lee (2006) estimate their gravity equation using a mixture of OLS and time-fixed effects. The major difference they find is that distance between countries is more important in services trade than goods trade. They suggest that there are higher transport costs for services but fail to provide any reason why this may be the case. Common language between the importer and the exporter is not found to be significant. This last result differs from Park (2002) who, using data from GTAP, finds language to positively influence trade in several service sectors. Kimura and Lee (2006) find that RTA membership is positively correlated with trade, which contradicts the finding of Grunfeld and Moxnes (2003). The authors argue that while many RTAs do not explicitly cover trade in services, their presence may indirectly facilitate the process.

Lejour and de Paiva Verheijden (2004) also compare gravity model estimates for trade in goods and services, examining intra-regional trade in Canada and the European Union (EU) using the OECD services trade statistics used in the above studies and data from the official Canadian statistical agency. Unlike Kimura and Lee (2006), distance is found to be less important for services compared to goods.

The opposing nature of the results regarding the importance of distance in services trade is reflected elsewhere in the literature. Portes and Rey (2005) examine international equity flows and find distance to be negative and significant, which they note is counter-intuitive given the weightlessness of the commodity. The overlap in time zones is also included,

on the reasoning that countries with similar opening hours should trade more. This variable is positive and significant. They argue that distance proxies informational frictions that restrict international equity flows. Park (2002) also finds distance to be negative and statistically significant across all service sectors examined. Tharakan *et al.* (2005) find distance to be insignificant in comparing Indian software exports to overall goods trade flows.

4. The Three-stage Gravity Model and Data

Trade costs matter, but difficult to measure (Anderson and van Wincoop, 2004). Any attempt to measure trade costs needs consistent observable data, which in many cases are not available. To overcome this limitation, Anderson and van Wincoop (2003) derive a theoretically consistent gravity model to infer unobservable trade costs directly from observable trade flows. In this study, we consider a world of *N* countries and a continuum of differentiated services. We assume that countries specialize in a range of services and that consumers have constant elasticity of substitution (CES) preferences.[8] Under the simplifying assumptions of a one-sector economy with consumers holding constant elasticity of substitution preferences, and common elasticity among all homogenous goods, the gravity model for using panel data of exports from economy *i* to economy *j* (X_{ij}) takes the following shape:

$$X_{ij} = \frac{Y_i Y_j}{Y^w}\left(\frac{t_j}{\prod_i P_j}\right)^{1-\sigma} \quad (1)$$

where Y_i and Y_j are the income levels of countries *i* and *j*, Y^w is total world income, and $\sigma > 1$ is the elasticity of substitution. The trade cost factor, $t_{ij} \geq 1$, is defined as the gross bilateral cost of importing services so that if p_i is the supply price of a service produced in country *i*, then $p_{ij} = t_{ij}p_i$ is the price faced by consumers in country *j*. $\prod_i$ and P_j are country *i*'s outward and country *j*'s inward multilateral resistance terms, respectively. These capture countries' average international trade barriers. The important insight of the model is that bilateral services trade flows X_{ij} depend on the bilateral trade barrier t_{ij} relative to average international trade barriers. Taking log of equation (1) and applying it to sector *k*, we get

$$Ln\left(X_{ij}^k\right) = Ln\left(E_j^k\right) + Ln\left(Y_i^k\right) - Ln\left(Y_w^k\right) + (1-\sigma_k)Ln\left(t_{ij}^k\right) - (1-\sigma_k)Ln\left(P_j^k\right) - (1-\sigma_k)Ln\left(\prod_i^k\right) + e_{ij}^k \quad (2)$$

where Y^k_i is output of economy *i* in sector *k*, E^k_j is expenditure of economy *j* in sector *k*, Y^k_w is aggregate (world) output in sector *k*, σ_k is elasticity of substitution in sector *k*, t^k_{ij} is trade costs facing exports from economy *i* to economy *j* in sector *k*, ω^k_i is economy *i*'s output share in sector *k*, ω^k_j is economy *j*'s expenditure share in sector *k*, and ω^k_{ij} is random error term, satisfying the usual assumptions. Inward resistance $\left(P^k_j\right)^{1-\sigma_k} = \sum_{i=1}^{N} \prod_i^{\sigma_k - 1} \omega^k_i \left(t^k_j\right)^{1-\sigma_k}$ captures the fact that country *j*'s imports from country *i* depend on trade costs across all suppliers. Outward resistance $\left(\prod^k_i\right)^{1-\sigma_k} = \sum_{j=1}^{N} P_j^{\sigma_k - 1} \omega^k_j \left(t^k_j\right)^{1-\sigma_k}$, by contrast, captures the dependence of exports from *i* to *j* on trade costs across all importers.

Before implementing this model in an empirical setting, we need to specify bilateral trade costs t_{ij} in terms of observable variables. We assume from equation (2) that t_{ij} captures several trade costs components and other border effects. Assuming monopolistically competitive market, the term (1- σ) should be negatively related to volume of trade. Additional factors are captured using a set of bilateral (economy – pair) fixed effects (α_{ij}).

$$Ln\left(t^k_{ij}\right) = \beta_1 Ln\left(tc^k_{ij}\right) + \sum_{i \neq j} \alpha_{ij} \tag{3}$$

Substituting (3) into (2) and including sector fixed effects in addition to economy-pair fixed effects gives our baseline estimating equation:

$$Ln\left(X^k_{ij}\right) = \sum_{i \neq j} \alpha_{ij} + \beta_1 Ln\left(Y_i\right) + \beta_2 Ln\left(Y_j\right) + \beta_3 Ln\left(tc^k_{ij}\right) + \beta_5 Ln(D_{ij}) + \sum \gamma_k + e^k_{ij} \tag{4}$$

Therefore, trade is a product of the scale and structure of partner economies, their geographic, political and institutional proximities, openness of their economies to trade, and trade barriers. One case estimates country's trade potential by using equation (4). In our particular case, the final estimable equation, modifying the equation (4) suitably, takes following shape:

$$Ln\left(X_{ij}\right) = \sum_{i \neq i} \alpha_{ij} + \beta_1 Ln\left(GDP_i\right) + \beta_2 Ln\left(GDP_j\right) + \beta_3 Ln(D_{ij}) + + \sum_m \lambda_m B + \sum_k \delta_k C + \sum_l \phi_l Z_{ij} + e_{ij} \tag{5}$$

where *GDP* is gross domestic product, taken at current US$, *D* is bilateral distance, B is set of services trade barrier variables, C is set of control variables, Z is set of dummy variables, and *e* is the random error term. Here, *i* and j represent countries. To control for country-level heterogeneity, we introduce country dummies in equation (5). The dummies are as follows: *ADJ* is a dummy variable to identify a pair of countries that are geographically adjacent or contiguous or share a border (=1 if they are adjacent, 0 otherwise), *LAN* is a dummy variable to capture language similarity between a pair of countries (=1 if they have language similarity, 0 otherwise), *RTA* is a dummy variable which represents if a pair of countries have any regional trading arrangement in the form of PTA/FTA, and *LLD* is landlocked dummy (=1 if country is landlocked, 0 otherwise).

We use the aforesaid augmented gravity model to analyze the trade flows, and the coefficients thus obtained are then used to assess services trade barriers under various scenarios. The augmented gravity model considers a panel data for the years 2000 to 2006. The data for the gravity model are collected from several secondary sources and taken in bilateral pairs.

The primary sources of services trade data used in this analysis is *Statistics on International Trade in Services* assembled by the OECD (2003). This covers imports and exports of services between 27 OECD countries and up to 55 non-OECD partner countries. The collection of the data is based on Manual on Statistics of International Trade in Services guidelines, which extend the International Monetary Fund (IMF) balance of payments methodology to account more fully for service transactions.

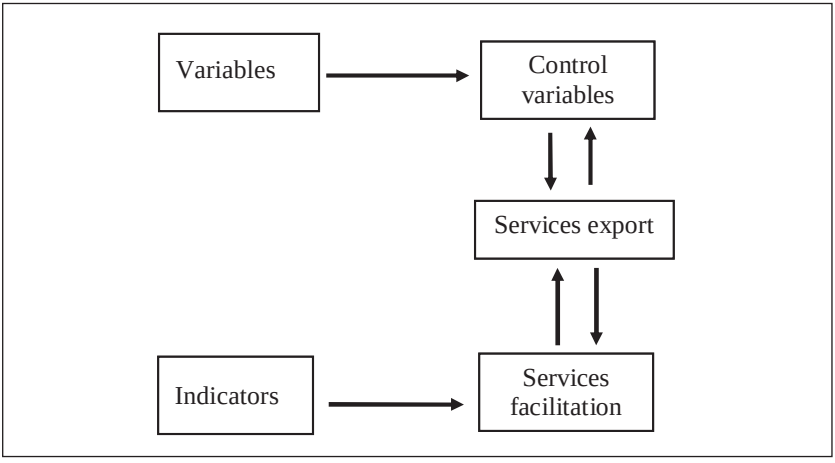
Our methodological approach imposes the assumption that the error terms are normally distributed. However this assumption is often violated in large datasets where the error term is heteroskedastic. We thus use robust standard errors without specifying a cluster group in all the regressions.

Robustness checks

The relationships cannot be interpreted as causal until we rule out the possibility of endogeneity in equations (5). To address this problem, we use

a dynamic Hausman-Taylor estimation to analyze changes across countries and over time. Figure 1 briefly presents our estimation strategy.

Figure 1: Estimation Strategy



Source: Author.

Recognizing the nature of trading flows between countries as relationships that develop and change over time has resulted in an increasing use of panel data approaches to the estimation of gravity models. This method is chosen in this study. The use of different panel data methods, such as random, fixed effects or Hausman-Taylor estimators, allows for various assumptions regarding trade flows to be analyzed and tested. In particular, in panel data analysis of gravity models possible heterogeneity and endogeneity issues can be examined by isolating country pair effects (factors that influence trade between two countries). As Egger and Nelson (2006) show, this allows the analysis of what they describe as between country pair effects (the cross sectional element) and within country pair effects (the time series element).

The equation (5) has been estimated using the Hausman-Taylor model (HTM) with the dependent variable of services export between India and its partner countries. A cross-section model does not explain the variance

in bilateral trade flows when we have time-specific impact on trade flows. Since there are significant and systematic variations of export patterns across trade partners, a satisfactory model of bilateral exports should explain substantial heterogeneity of exports at the country level. We, therefore, use panel data since it can better explain the relevant relationships between trade flows and trade barriers over time when we have both time-variant and time-invariant exogenous variables. We use individual country effects interchangeably in the model.

HTM fits panel-data random-effects models in which some of the covariates are correlated with the unobserved individual-level random effect. The estimators, originally proposed by Hausman and Taylor (1981) and Amemiya and MaCurdy (1986), are based on instrumental variables. Although the estimators implemented in HTM use the method of instrumental variables, each command is designed for different problems. The HTM estimators that are implemented assume that some of the explanatory variables are correlated with the individual-level random effects, u[i], but that none of the explanatory variables are correlated with the idiosyncratic error e[i, t].

It is also worth noting that the fixed effects approach does not allow for estimating coefficients on time invariant variables such as distance or common language dummies, though the consistent estimation of such effects are equally important in many situations. Cheng and Wall (2005) simply suggest estimating the regression of the (estimated) individual effects on individual-specific variables by the OLS, though this approach clearly ignores the potential correlation between individual specific variables and (unobserved) individual effects such that the resulting estimates are likely to be severely biased. In order to properly address this issue we need to employ the HTM estimation technique. Most recent empirical studies also emphasise the importance of explicitly allowing for the presence of time specific effects in order to capture business cycle effects.

According to Cheng and Wall (2005), OLS suffers from heterogeneity bias in gravity model context. Trade between any pair of countries is

likely to be influenced by certain country-specific unobserved information (country effects). However, these country effects are appeared to be correlated with explanatory variables, thus making the OLS a biased estimator. The explanatory variables are considered to be endogenous as they are correlated with the error term. To overcome these shortcoming, according to Egger (2002, 2005), HTM is the most appropriate estimator for trade in goods and services. The HTM employs an instrumental variable approach that uses information solely from within the dataset to eliminate the correlation between explanatory variables and the unobserved individual effects that undermines the appropriateness of the random effects model in the gravity model context. The HTM is increasingly applied in gravity models of trade in goods and services.[9] This also resolves the endogeneity problem.

5. Measuring Services Trade Facilitation

Barriers to trade interfere with the ability of firms from one country to compete with firms from another (Deardorff and Stern, 2008). Deardorff (2001) argues that international trade patterns depend more on the unobservable trade transaction costs than on factor endowments and technology. The underlying assumption of the majority of the models is trade barriers affect transaction costs in both trade and production. In developing countries context, services trade restrictiveness is important, and in some literature it has been termed as a barrier similar to tariff in goods.[10] However, supply-side bottlenecks (read trade barriers) are equally important, removal of which would lead to increase services trade. We in this study construct an index (STFI) which captures some important trade facilitation elements that influence the services trade flow between countries.

A country may have a very good network of telecommunication services but the banking infrastructure that is not so good, for example. Therefore, the statistical technique of principal component analysis (PCA) becomes handy in constructing a unique single index that captures the variance or information contained in different variables capturing different aspects of infrastructure. PCA finds linear combinations of the original

variables to construct the principal components or factors with a variance greater than any single original variable.[11]

Here, the Services Trade Facilitation Index (STFI) is comprised of five indicators, viz. (i) internet users (per 100 people) (tnt_usr) (ii) international internet bandwidth (bits per person) (int_bw), (iii) electric power consumption (kWh per capita) (pce), (iv) air transport passengers carried (per 100 people) (air_p), and (v) fixed line and mobile phone subscribers (per 100 people) (tel). Each of the five services trade facilitation indicators is normalized for the size of the economy so that it is not affected by the scale. Here, W_{jt} are estimated with the help of PCA. The weights are calculated by dividing the rotated factor loading of any variable by the sum of rotated factor loadings. Thus, weights make intuitive sense since they express the contribution of each variable to the total variance of the common factor ($STFI_{it}$ in this case). The data sources include issues of the World Bank's World Development Indicators 2010. The estimated index is provided in Table 5 and the Appendix 1 provides the corresponding PCA weights. Following observations are worth noting.

First, among India's 33 services trade partners, developed and developing economies occupy the top and bottom positions in STFI, respectively. Their relative ranks over time also did not altered much barring few countries such as Belgium, Ireland and Japan.[12] This directly suggests that there has not been major any changes in services trade facilitation among the India's major services trade partners. However, this is also not to deny that there was a slight change in services trade facilitation level if compared between 2000 and 2006.[13] Nevertheless, higher income countries are having better infrastructure (represented by STFI), compared to lower or middle income countries. The performance of the countries in services trade facilitation between the years 2000 and 2006 has been improved (better fit in 2006 in Figure 2). The correlation is positive in both the years (Figure 2). Services trade facilitation is also positively associated with services export. Countries with higher per capita income and higher services export are endowed with better services trade facilitation, and their association has remained unchanged over time (Figure 3).[14]

Table 5: Services Trade Facilitation Index (STFI)

Country	2000		2001		2002		2003		2004		2005		2006	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Norway	2.693	1	2.797	1	2.607	2	2.562	2	2.540	2	2.162	2	3.029	1
Luxembourg	2.014	8	2.294	4	2.252	4	2.253	5	2.511	3	1.790	1	3.001	2
Sweden	2.592	2	2.615	2	2.657	1	2.777	1	2.722	1	0.041	3	2.697	3
Denmark	1.957	9	2.185	5	2.473	3	2.458	3	2.493	4	1.809	4	2.474	4
Netherlands	2.560	3	2.345	3	2.096	8	2.236	6	2.235	5	0.610	5	2.474	5
Canada	2.181	5	2.033	9	1.973	10	2.184	7	2.172	7	2.233	6	2.237	6
Japan	1.416	18	1.469	19	1.569	18	1.568	18	1.678	18	0.450	18	2.144	7
Ireland	1.735	14	1.882	11	2.077	9	2.278	4	2.199	6	1.339	8	2.136	8
USA	2.183	4	2.114	7	2.119	7	2.082	9	2.105	10	2.472	9	2.133	9
Finland	2.053	7	2.104	8	2.205	6	2.172	8	2.128	8	2.086	11	2.110	10
HK	1.819	10	1.835	12	1.921	12	1.971	12	2.066	11	1.565	10	2.082	11
Australia	1.696	15	1.751	14	1.972	11	1.974	11	2.016	12	1.775	7	2.047	12
UK	1.752	12	1.754	13	1.839	13	1.955	13	1.959	13	1.200	12	2.008	13
Slovak Republic	2.176	6	2.118	6	2.212	5	2.081	10	2.126	9	2.105	13	1.850	14
Germany	1.580	16	1.568	17	1.581	17	1.720	17	1.741	16	1.124	16	1.818	15
Austria	1.737	13	1.685	15	1.740	14	1.817	14	1.777	14	0.142	15	1.813	16

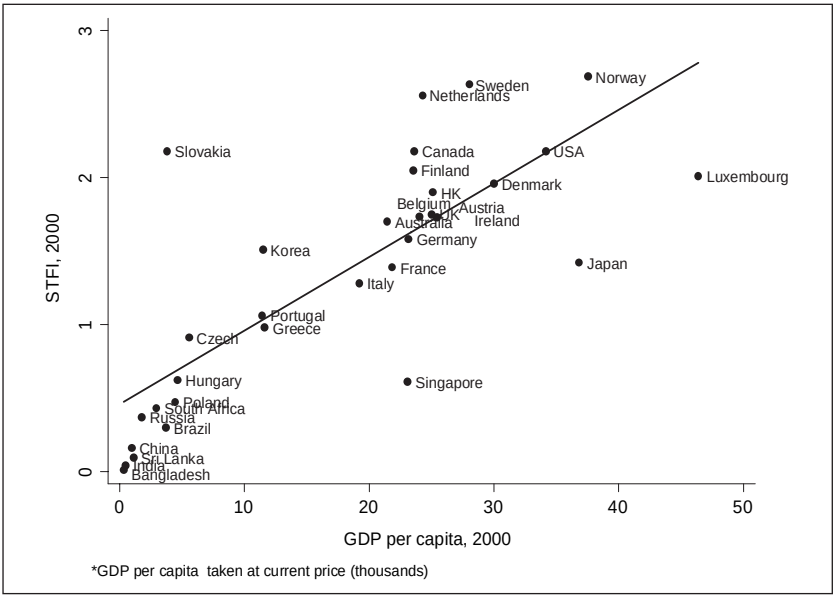
Table 5 continued...

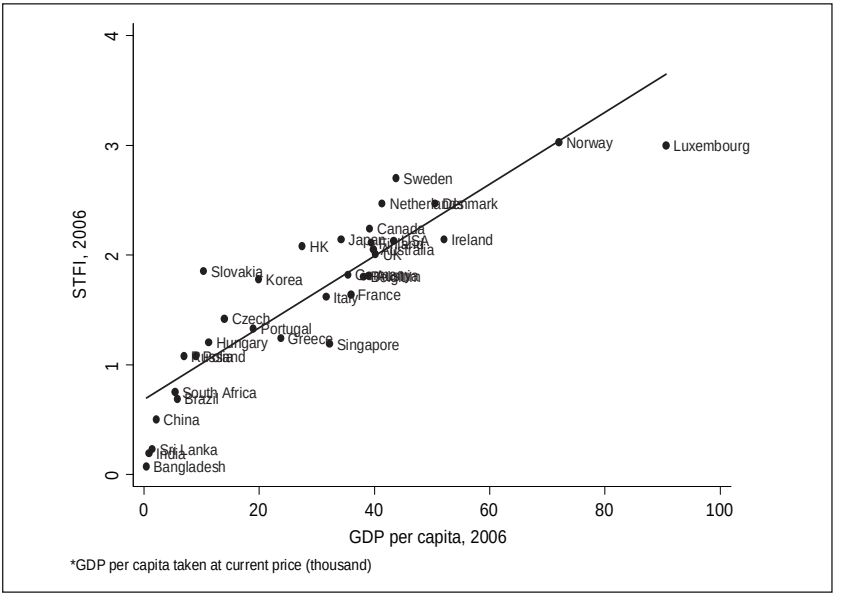
Table 5 continued...

Belgium	1.781	11	1.915	10	1.678	15	1.740	15	1.717	17	2.148	14	1.800	17
Korea	1.505	17	1.578	16	1.670	16	1.725	16	1.760	15	1.630	17	1.779	18
France	1.394	19	1.543	18	1.512	19	1.560	19	1.526	20	1.705	20	1.640	19
Italy	1.283	20	1.355	20	1.462	20	1.553	20	1.590	19	1.768	19	1.622	20
Czech Republic	0.906	23	1.028	22	1.256	21	1.272	21	1.294	21	3.022	21	1.415	21
Portugal	1.061	21	1.102	21	1.164	22	1.262	22	1.232	22	2.366	22	1.335	22
Greece	0.977	22	1.020	23	1.162	23	1.151	23	1.186	23	2.748	23	1.237	23
Hungary	0.622	24	0.778	24	0.882	24	1.046	24	1.084	25	0.962	25	1.199	24
Singapore	0.608	25	0.756	25	0.845	25	1.025	25	1.105	24	1.284	24	1.191	25
Poland	0.475	26	0.536	26	0.762	26	0.810	26	0.875	26	0.954	26	1.078	26
Russia	0.366	28	0.394	28	0.453	28	0.575	27	0.764	27	1.889	27	1.076	27
South Africa	0.429	27	0.446	27	0.486	27	0.526	28	0.568	28	1.166	28	0.749	28
Brazil	0.302	29	0.340	29	0.403	29	0.447	29	0.510	29	0.729	29	0.690	29
China	0.164	30	0.208	30	0.274	30	0.339	30	0.398	30	0.159	30	0.500	30
Sri Lanka	0.067	31	0.076	31	0.085	31	0.102	31	0.123	31	2.724	31	0.229	31
India	0.044	32	0.048	32	0.064	32	0.075	32	0.101	32	2.005	32	0.195	32
Bangladesh	0.009	33	0.011	33	0.013	33	0.015	33	0.020	33	2.126	33	0.074	33

Source: Author.

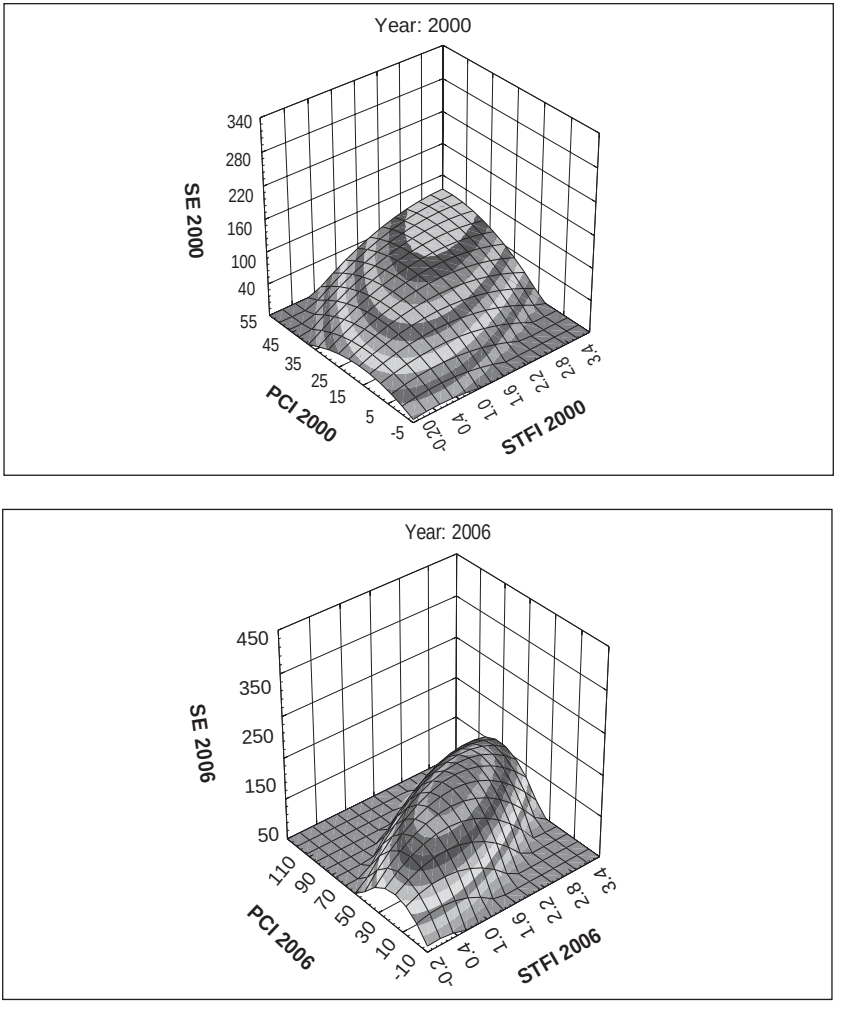
Figure 2: Services Trade Facilitation and GDP Per Capita





Source: Author.

Figure 3: Services Trade Facilitation, GDP Per Capita and Services Export



Source: Author.

* SE, PCI and STFI present services export, per capita income and service trade facilitation index, respectively.

Table 6: Services Trade Facilitation Indicators: 2006

Country	int_usr		int_bw		pce		air_p		tel	
	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank
Australia	0.746	4	0.000	32	0.471	7	0.117	6	0.713	17
Austria	0.512	14	0.150	13	0.327	11	0.055	14	0.770	11
Bangladesh	0.003	33	0.000	33	0.006	33	0.001	33	0.065	33
Belgium	0.477	17	0.279	6	0.349	8	0.018	22	0.678	20
Brazil	0.227	26	0.004	26	0.083	29	0.011	25	0.364	29
Canada	0.709	7	0.154	12	0.709	2	0.074	11	0.591	25
China	0.105	29	0.001	27	0.073	30	0.006	29	0.314	30
Czech Republic	0.348	22	0.049	19	0.260	17	0.025	21	0.733	15
Denmark	0.589	10	0.789	1	0.273	16	0.006	30	0.817	7
Finland	0.561	11	0.098	15	0.660	3	0.074	10	0.716	16
France	0.496	15	0.075	17	0.325	12	0.050	15	0.694	18
Germany	0.473	18	0.155	11	0.292	14	0.062	13	0.836	5
Greece	0.185	27	0.022	22	0.215	23	0.044	17	0.771	10
HK	0.555	13	0.164	9	0.241	20	0.164	3	0.957	2
Hungary	0.351	21	0.022	23	0.155	27	0.013	24	0.658	22

Table 6 continued...

Table 6 continued...

India	0.079	31	0.001	30	0.021	31	0.002	32	0.093	32
Ireland	0.340	23	0.137	14	0.256	19	0.613	1	0.791	8
Italy	0.495	16	0.023	21	0.232	22	0.032	20	0.839	4
Japan	0.691	9	0.463	4	0.338	10	0.042	18	0.610	24
Korea	0.711	6	0.023	20	0.319	13	0.037	19	0.689	19
Luxembourg	0.741	5	0.468	2	0.654	4	0.104	7	1.034	1
Netherlands	0.898	1	0.464	3	0.286	15	0.087	8	0.739	13
Norway	0.882	2	0.211	8	1.030	1	0.150	4	0.757	12
Poland	0.291	25	0.013	25	0.141	28	0.005	31	0.629	23
Portugal	0.306	24	0.019	24	0.191	26	0.046	16	0.773	9
Russia	0.182	28	0.066	18	0.237	21	0.010	26	0.581	26
Slovak Republic	0.386	20	0.160	10	0.342	9	0.225	2	0.736	14
Singapore	0.422	19	0.001	29	0.202	24	0.007	28	0.559	27
South Africa	0.095	30	0.000	31	0.199	25	0.014	23	0.440	28
Sri Lanka	0.022	32	0.001	28	0.016	32	0.008	27	0.182	31
Sweden	0.776	3	0.395	5	0.633	5	0.073	12	0.821	6
UK	0.559	12	0.262	7	0.256	18	0.083	9	0.848	3
USA	0.701	8	0.075	16	0.559	6	0.125	5	0.673	21

Source: Author.

Second, performance in services trade facilitation varies across countries (Table 6). For example, the Netherlands in Internet users, Denmark in Internet bandwidth, Norway in electric power consumption, Ireland in air passengers, and Luxembourg in telephone rank first in 2006. India's global rank has been remained static over time, thus suggesting ample scope for improvement.

Third, access to Internet, telephone and electricity are three important factors that influence the indexation compared other indicators over time (see Appendix 1). While countries performance in Internet users or telephone are relatively balanced than other indicators, the same in Internet bandwidth, electric power consumption or air passengers are relatively skewed towards top 11-12 countries.[15]

Therefore, the foregoing analysis, which presents services trade facilitation indicators and global ranks of countries, clearly indicates that the performance is mixed and varied across countries. In general, countries are characterized by lack of infrastructure relating to services trade. Services trade facilitation indicators focus on both the policy and market structure, where private sector is the main service provider. The assessment of the services barriers through PCA thus reflects a variety of barriers might influence the trade flow, which we test in the next section.

6. Do Barriers Matter for Services Export?

The quality and performance of services trade sectors differ markedly across countries, and more prominently between developed and developing countries. These variations stem from differences in the quality and cost of infrastructure services as well as differences in policies, procedures, and institutions. Surely, they have a significant effect on trade competitiveness and market access. While there is a strong anecdotal evidence that the lack of adequate trade infrastructure might have altered the trade potential due to rise in trade cost, we try to asses the effect of trade facilitation/trade costs elements on bilateral trade with the help of an augmented gravity model. This study uses an augmented gravity model (AvW type) and then

determines the important trade remedies.[16] The regressions are based on panel data, where all the variables are taken for the years 2000 to 2006. We use a three-stage regression process to understand the impact of trade facilitation comprising several of the services trade facilitation indicators and it shows that it captures essentially all the explanatory power of the indicators used separately. Definition of variables and corresponding data sources are briefed in Appendix 2, while the list of partner countries of India is presented in Appendix 3. Following basic diagnostics were carried out: (i) linearity assumption between response variable and predictors is checked; (ii) statutory hypothesis tests are carried out on the parameter estimates; (iii) Ramsey test is done to check model specification; (iv) normality of residuals is tracked through Kernel density plot; (v) all estimates are checked for heteroscedasticity through Cameron and Trivedi's decomposition of IM-test; (vi) multicollinearity problems are checked by looking at variance inflation factor (VIF); and (vii) D-W stat was used to check any presence of serial correlation.

Appendix 4 presents some of the basic facts about the variables (taken in log scale). Most of the data do not show large variation as given by standard deviations. However, there is strong correlation among some of the variables (Appendix 5), and at the same time there are some variables (for example, export) are not highly correlated with independent variables. The initial augmented gravity results are presented in Table 7. Following observations are worth noting.

First, specification 1 in Table 7 contains the initial set of models fitted, before any of the trade facilitation or logistics indicators or additional variables are included. Specification 1 contains regressions of bilateral trade on GDP in the exporting and importing countries, while specification 2 shows the simple gravity model with distance. Specifications 3 and 4 represent augmented gravity models with market size (GDP) and consumption power (GDP per capita) along with dummies which might influence the trade flows between countries. Specifications 5–12 in Table 7 include, one at a time, the set of services trade facilitation indicators. Distance, language and landlocked dummies, and GDPs of exporting and importing countries are statistically

significant and having correct sign in all the specifications in Table 7. The dummy variable representing regional trade agreement (RTA) including bilateral FTA is not significant, but has appeared with correct (positive) sign except model 8. Among the services trade facilitation indicators, we could found partner country's (i) air transportation infrastructure, (ii) information and technology quality, (iii) regulatory quality, and (iv) overall competitiveness are statistically significant. Rest services trade variables are not statistically significant and showing no statistical relation with services trade flow. Therefore, it can be said that most of the services trade facilitation indicators have a significant effect on bilateral trade between India and her partner countries in the expected direction.

Table 7: Initial Augmented Gravity Model Estimations
Dependent variable: Bilateral exports (ln_ex)

	1	2	3	4	5	6
ln_gdp_r	1.650***	1.433***		1.558***	0.407	2.561
	(0.473)	(0.46)		(0.484)	(0.759)	(2.427)
ln_gdp_p	0.716**	0.962***		0.783***	0.769***	0.766***
	(0.282)	(0.268)		(0.154)	(0.152)	(0.150)
ln_gdppc_r			2.253***			
			(0.572)			
ln_gdppc_p			0.241			
			(0.313)			
ln_dis		-1.778***	0.466	-0.938**	-0.961**	-0.894**
		(0.583)	(0.582)	(0.371)	(0.389)	(0.352)
rta_dummy			0.213	0.27	0.243	0.356
			(0.750)	(1.131)	(1.127)	(1.139)
ll_dummy			-3.243**	-2.426**	-2.440**	-2.445**
			(1.229)	(1.085)	(1.085)	(1.072)
lan_dummy			1.342*	1.577***	1.588***	1.630***
			(0.657)	(0.434)	(0.437)	(0.452)
b_dummy			2.062	0.752	0.999	1.334
			(1.475)	(1.244)	(1.312)	(1.316)
ln_intusr_r					0.298	
					(0.310)	
ln_intusr_p					0.0781	
					(0.248)	

Table 7 continued...

Table 7 continued...

ln_iibw_r						-0.263
						(0.548)
ln_iibw_p						0.107
						(0.107)
Observations	224	224	224	224	224	224
R-squared	0.207	0.273	0.395	0.524	0.525	0.529
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Country effect	Yes	Yes	Yes	Yes	Yes	Yes

	7	**8**	**9**	**10**	**11**	**12**
ln_gdp_r	6.905*	1.298	-4.397	9.344*	1.545**	1.626**
	(4.034)	(1.557)	(3.627)	(5.200)	(0.598)	(0.635)
ln_gdp_p	0.783***	1.780***	0.783***	0.716***	0.817***	0.731***
	(0.152)	(0.264)	(0.155)	(0.154)	(0.149)	(0.157)
ln_dis	-0.939**	-0.397	-0.946**	-0.913**	-1.175**	-0.995**
	(0.388)	(0.415)	(0.379)	(0.423)	(0.446)	(0.418)
rta_dummy	0.27	-0.143	0.255	0.386	0.332	0.294
	(1.159)	(0.787)	(1.136)	(1.051)	(1.115)	(1.063)
ll_dummy	-2.425**	-1.967**	-2.426**	-2.222**	-2.429**	-2.318**
	(1.102)	(0.844)	(1.089)	(0.969)	(1.061)	(1.027)
lan_dummy	1.578***	2.077***	1.585***	1.431***	1.526***	1.503***
	(0.435)	(0.335)	(0.446)	(0.494)	(0.455)	(0.455)
b_dummy	0.762	1.858**	0.797	2.529**	1.48	1.683
	(1.232)	(0.855)	(1.204)	(1.16)	(1.067)	(1.032)
ln_pce_r	-16.71					
	(11.54)					
ln_pce_p	0.00379					
	(0.239)					
ln_air_r		0.138				
		(0.977)				
ln_air_p		1.015***				
		(0.243)				
ln_tel_r			2.698			
			(1.715)			
ln_tel_p			0.0183			
			(0.246)			
ln_ictexp_r				-4.81		
				(3.025)		
ln_ictexp_p				0.507*		
				(0.258)		
ln_reg_r					-0.661	
					(1.506)	

Table 7 continued...

Table 7 continued...

ln_reg_p					0.626*	
					(0.308)	
ln_gci_r						-0.794
						(2.92)
ln_gci_p						3.169*
						(1.604)
Observations	224	224	224	224	224	224
R-squared	0.525	0.595	0.528	0.552	0.535	0.543
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
Country effect	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author.

***, **, * significant at 1%, 5%, and 10% level respectively. Robust standard errors are in parentheses. Constant terms are not shown.

Second, most of the specifications in Table 7 explain over 50 per cent of the variability in bilateral trade, thereby showing considerably a better fit. However, some of the specifications in Table 7 slightly suffer from omitted variable bias such as specifications 1 to 4. We can conclude that India's services trade is very much contingent upon trade facilitation.

We now select the set of those services trade facilitation indicators shown to be significantly related to bilateral trade in Table 7 in the remaining gravity analysis. Table 8 includes these critical services trade facilitation and logistics indicators along with the standard variables described earlier. Based on the finding by de Groot *et al*. (2004) and motivated by Rodrik *et al*. (2002) that institutional quality is important in explaining bilateral services trade flows, the Control of Corruption (cc) is added to the model to represent institutional quality for both the exporting and the importing country (Table 8). STFI better represents the functional relation between bilateral export and aforesaid explanatory variables. A three-stage augmented gravity estimation is then selected for the remaining part of the analysis.

Here, the STFI (through regressions) for export of India is estimated in three stages. The first stage involves fitting a simple gravity model that includes most of standard variables in Table 8. The second stage attempts to explain the residuals of the first-stage regression using services trade

facilitation indicators, which represent the components of trade cost such as services trade infrastructure, and distance (a surrogate for trade barrier). The second-stage regression derives the optimal coefficients (weights) for these variables to best explain the residuals from the first stage. If the components of these variables are important determinants of bilateral trade, this second-stage regression would be expected to have statistically significant explanatory power. The third stage uses the coefficients derived in the second stage to create a single STFI in an augmented gravity model. If this single index performs reasonably well in explaining bilateral trade flows, it can then be argued that the index systematically captures the various components of total trade cost. To find out the relative robustness, we also use STFI constructed based on principal component analysis in Section 6.

Table 8: Three-stage Augmented Gravity Estimations

Dependent variable for first and third stages is bilateral exports (in logs). Dependent variable for second stage is first-stage residuals

	First stage	Second stage	Third Stage (I)	Third Stage (II)	Third Stage (III)
ln_gdp_r	1.657		1.667	2.862	-0.371
	(1.154)		(1.168)	(3.246)	(1.428)
ln_gdp_p	0.683***		0.682***	0.707***	0.686***
	(0.13)		(0.129)	(0.125)	(0.127)
ln_cc_r	0.286		0.276	0.543	6.931
	(2.727)		(2.736)	(2.186)	(5.011)
ln_cc_p	0.486		0.484	0.923*	0.644
	(0.468)		(0.468)	(0.483)	(0.442)
ln_er_r	5.642		5.656	6.972	-0.725
	(4.097)		(4.117)	(5.644)	(2.145)
ln_er_p	-0.258*		-0.255*	-0.293**	-0.278*
	(0.141)		(0.144)	(0.138)	(0.148)
b_dummy	1.871**		1.836*	0.941	1.582
	(0.913)		(0.901)	(1.205)	(1.116)
lan_dummy	1.379**		1.381**	1.294**	1.386**
	(0.56)		(0.564)	(0.549)	(0.555)
ll_dummy	-1.746*		-1.774*	-1.587*	-1.692*
	(0.931)		(0.972)	(0.829)	(0.882)
rta_dummy	1.447		1.45	1.499	1.461
	(1.035)		(1.046)	(0.998)	(1.024)

Table 8 continued...

Table 8 continued...

ln_dis		-0.595			
		(0.657)			
ln_air_r		-3.685***			
		(1.132)			
ln_air_p		0.619***			
		(0.223)			
ln_ictexp_r		3.090***			
		(0.672)			
ln_ictexp_p		0.119			
		(0.499)			
ln_rq_r		-1.333***			
		(0.446)			
ln_rq_p		-1.114			
		(1.086)			
ln_gci_r		14.23***			
		(3.496)			
ln_gci_p		2.926			
		(2.572)			
stfi1_r			0.0621		
			(0.327)		
stfi1_p			0.0171		
			(0.135)		
stfi2_r				0.508	
				(1.101)	
stfi2_p				0.527	
				(0.354)	
stfi3_r					1.504
					(0.99)
stfi3_p					0.486
					(0.733)
Observations	224	224	224	224	224
R-squared	0.514	0.418	0.545	0.554	0.549

Source: Author.

***, **, * significant at 1%, 5%, and 10% level. Robust standard errors are in parentheses. Constant terms are not shown.

Table 8 shows the results of these three stages. The second-stage adjusted R^2 is 0.418, clearly highly significant. The third stage (1) augmented gravity model using the single STFI together with the first-stage variables

explains 55 per cent of the variability in bilateral trade. The results were also improved in third stage (1). Therefore, the single STFI successfully replaces several separate services trade facilitation indicators.

The gravity model with the STFI can be used to evaluate the effectiveness of initiatives to improve services logistics and to help guide the allocation of resources to and deployment of such initiatives. For example, India has to reduce the trade transaction costs by removing barriers to services trade. Countries can tackle transaction costs through improved services trade infrastructure, which is responsible for faster movement of services across the countries, and good institutional quality.

However, the aforesaid analysis may suffer from endogeneity. As discussed before, we use HTM. The estimated results for total services export are presented in Table 9. Estimated coefficients in HTM are appeared with correct signs. The size of importing countries income strongly determines export of services from India. Apparently, 1 per cent rise in importing country's market size (income) would lead to 3 to 4 per cent rise in India's export of services (Table 9).

Table 9: HTM Estimates
Dependent variable: bilateral exports (ln_ex)

	(1)	(2)	(3)	(4)	(5)
ln_cc_r	0.616	0.726	8.72	1.075	8.688
	(2.558)	(2.538)	(6.994)	(2.869)	(7.06)
ln_cc_p	-0.763	-0.72	-0.582	-0.59	-0.628
	(0.771)	(0.761)	(0.782)	(0.869)	(0.79)
ln_gdp_r	0.0309	0.0696	2.621	1.354	2.578
	(1.052)	(1.061)	(2.38)	(4.87)	(2.396)
ln_gdp_p	3.604***	3.530***	4.069***	3.406***	4.203***
	(1.027)	(0.989)	(1.156)	(1.120	(1.203)
ln_er_r	6.129	6.519*	0.258	7.501	0.000182
	(3.864)	(3.838)	(7.671)	(5.937)	(7.745)
ln_er_p	1.207	0.781	1.058	0.939	1.455
	(0.888)	(0.89)	(0.978)	(1.058)	(0.979)
ln_dis		-1.055*	-1.276*	-1.361*	
		(3.255)	(3.786)	(3.489)	

Table 9 continued...

Table 9 continued...

rta_dummy	-0.878	-0.852	-1.046	-1.017	-1.075
	(0.783)	(0.775)	(0.775)	(0.781)	(0.784)
b_dummy	2.002	-2.214	-4.23	-1.827	0.196
	(3.642)	(4.06)	(5.365)	(4.87)	(4.583)
lan_dummy	2.113	2.489	2.536	2.315	2.187
	(1.971)	(1.869)	(2.244)	(2.063)	(2.329)
ll_dummy	-1.292	-1.163	-0.995	-1.408	-0.955
	(3.234)	(3.057)	(3.576)	(3.317)	(3.742)
stfi1_r	1.957*	1.855*			
	(0.364)	(0.36)			
stfi1_p	0.118	0.122			
	(0.0909)	(0.0902)			
stfi2_r			1.343		1.316
			(1.611)		(1.627)
stfi2_p			2.186		2.334
			(1.94)		(1.98)
stfi3_r				1.634	
				(2.373)	
stfi3_p				1.0898	
				(0.757)	
Observations	224	224	224	224	224
Number of reporters	32	32	32	32	32
Wald chi2 (p-value)	59.31 (0.00)	61.03 (0.00)	56.90 (0.00)	55.63 (0.00)	55.64 (0.00)

Source: Author.

***, **, * significant at 1%, 5%, and 10% level. Robust standard errors are in parentheses. Constant terms are not shown.

The stock of India's services trade facilitation positively affects India's services exports. This is not surprising to note that India tremendously suffers from poor quality of services trade infrastructure. The estimated results show that 1 per cent improvement in services trade facilitation measures would lead to 2 per cent rise in services export in India. At the same time, India's partner countries services trade infrastructure are relatively better, thus positively associated with services import. Hence, exporting country's services trade infrastructure is more important than that of importing country. Bilateral distance has strong negative influence on services export. Shorter the distance between each pair of partners, higher the services export.

Finally, drawing from the past literature, a comprehensive measure of trade costs is derived from a theory-founded gravity model of international trade. This section calculates the need for improved services trade facilitation. The analysis reveals that better services trade facilitation in exporting countries would help increase India's services trade.

The shortcoming of the estimation is that most of the estimated coefficients are not statistically significant. The HTMs are relatively better fit (Wald Chi2 statistic significant at 1 per cent level). However, the good fit in HTM tells us that services trade barriers influence the services export, of which distance between India's services trade partners are most important. This indirectly also suggests strong presence of unobserved trade costs those are negatively affecting India's services export.

7. Concluding Remarks

In this study, we have performed an empirical analysis of the linkages between India's services trade flow and the barriers it faces. The results of the analysis show that the linkages between services export and services trade barriers are multiple and complex. The study indicates that the income of partner country (importing country) is crucial for services export from India. Findings of this paper suggest that improved services trade facilitation helps unlock the unrealized trade potential; more effective policy approaches toward improved trade infrastructure are, therefore, needed to facilitate services export from India. The results make it abundantly clear that services trade facilitation reform is a key factor affecting services export from India. For example, going beyond bilateral FTA spree, India has to sign formal MRAs on professional qualification with partner countries, particularly with developed countries where India's services export market is largely concentrated. India should also ask its trading partner (or region) to relax barriers on services exports such as stringent visa regulations for services professionals in IT sector, aviation tax on air services, foreign ownership caps, restrictions on types of commercial presence, discriminatory registration requirements and licensing procedures, nationality and residency requirements, economic needs tests and discriminatory treatment advantaging domestic companies over the foreign ones, to mention a few. Prolong barriers on services export force India to have large trade imbalance as happened with China.

Two sectors are very important for India: software and information technology (in export) and transportation services (in import). Recreating favourable domestic policies that are responsible for services trade facilitation and reforming domestic regulations in trade and infrastructure sector in tandem need utmost attention. Domestic regulations behave like pseudo tariff in services such as restrictions on inter-state movement of goods and services (in case of transportation services) and lack in proper competition policy (in case of software and information technology services). Stronger and unfriendly regulations are highly detrimental to expansion or diversification of services trade. Therefore, we need to intensify the reforms in domestic regulations.

This analysis also calls for a sectoral analysis in order to understand the intensity of trade barriers, particularly for services sectors which serve as vital input for producing other goods and services, and are crucial for the overall growth of the Indian economy. More research is also needed on the interaction between services trade policies and regulation.

This study is not without limitations, and a number of issues require further consideration. First, future studies are needed to understand the relationship between disaggregated services trade facilitation indicators and services trade flow. Second, an analysis of the causality between services export and services trade barriers such as STFI would also be worthwhile to try. Third, the analysis presented in this paper may need to be verified with new STF indicators from alternative sources. Fourth, one should make an attempt to estimate tariff equivalent of STFI. Fifth, a more sophisticated dynamic analysis may be attempted to verify the findings of this paper.

Endnotes

[1] See an excellent literature in Francois and Hoekman (2010). Also refer, Bhagwati (1987).

[2] Refer, for example, Chanda (2006)

[3] Refer, Government of India (2010), Chapter 1, p. 5. Data relates to the year 2009-10.

[4] Refer, for example, Gene M. Grossman and Esteban Rossi-Hansberg (2008a, 2008b)

[5] Refer, Konan and Maskus (2006), Warren and Findlay (2000) and Hoekman (2000), which provide excellent surveys of these measurement issues. See also Brown and Stern (2001) and Stern (2002) for discussion of measurement and modelling in services.

[6] Drawing analogy from Newtonian physics, the gravity model was first introduced in economics

by Tinbergen (1962). Poyhonen (1963) and Linnemann (1966) are the next two studies which attempted to explain trade flows by augmenting the gravity model. Since then, thousands of studies and analysis on international trade carried out based on augmented gravity model.

[7] Anderson (1979) was first attempt to provide theoretical foundation to gravity model. Since our objective is to estimate trade potential using gravity model, a detailed discussion on the evolution of gravity model is thus beyond the scope of our analysis.

[8] We assume all services are differentiated by place of origin and each country is specialized in the production of only one service. Therefore, supply of each service is fixed ($n_i = 1$), but it allows preferences to vary across countries subject to the constraint of market clearing (CES).

[9] Refer, for example, Egger and Pfaffermayr (2004) applied HTM to FDI flows.

[10] Refer, for example, Mattoo *et al* (2008)

[11] Specifically, it is $STFI_{it} = \sum W_{jt} X_{jit}$, where $STFI_{it}$ = Services Trade Faciliation Index of the i-th country in t-th time, W_{jt} = weight of the j-th aspect of services trade facilitation indicator in t-th time, and X_{jit} = value of the j-th aspect of services trade facilitation indicator for the i-th country in t-th time point.

[12] Rank correlation remained static (0.98) over time from 2000 to 2006, and significant at 1 per cent level.

[13] Rank correlation coefficient was 0.94.

[14] This however does not indicate any causal relation and its direction of movement.

[15] Number of countries above median was 17 in Internet users, 12 in Internet bandwidth, 12 in electric power consumption, 11 countries in air passengers, and 21 in Telephone.

[16] Since the objective is to assess the effect of trade barriers using the gravity model, a detailed discussion on the evolution of the model is thus beyond the scope of this paper.

References

Amemiya, T. and T. E. MaCurdy. 1986. “Instrumental Variable Estimation of an Error Component Model”. *Econometrica* Vol. 54, pp. 869–880

Anderson, J. E. 1979. “A Theoretical Foundation for the Gravity Equation”. *American Economic Review*, Vol. 69, pp. 106-116.

Anderson, James, and E. van Wincoop. 2003. “Gravity with Gravitas: A Solution to the Border Puzzle”. *American Economic Review*, Vol. 93, No. 1, pp. 170-192,

Anderson, J. E. and E. van Wincoop. 2004. “Trade Costs”. *Journal of Economic Literature*. Vol. XLII, No. 3, pp. 691 - 751.

Bhagwati, J. N. 1987 “Trade in Services and the Multilateral Trade Negotiations”. *World Bank Economic Review*, Vol. 1(4), pp. 549–69.

Brown, Drusilla K., Stern, Robert M. 2001. “Measurement and Modeling of the Economic Effects of Trade and Investment Barriers in Services”. *Review of International Economics* 9, 262– 286.

Brown, D., A. Deardorff and R. Stern. 2002. *Computational Analysis of Goods and Services Liberalization in the Uruguay Round and the Doha Development Round*. Discussion Paper No. 489. Research Seminar in International Economics, School of Public Policy, The University of Michigan.

Chanda, Rupa. 2006. (ed.) *Trade in Services and India: Prospects and Strategies*. New Delhi: Wiley-India.

Cheng, I.-H, and H. Wall. 2005. "Controlling for Heterogeneity in Gravity Models of Trade and Integration". *Federal Reserve Bank of St. Louis Review*, Vol. 87, pp. 49-63.

Copeland, B. and A. Mattoo. 2008. "The Basic Economics of Services Trade" in Mattoo *et al.* (2008).

De, P. 2008a. "Trade Costs and Infrastructure: Analysis of the Effects of Trade Impediments in Asia". *Integration & Trade Journal*, Vol. 12, No. 28, pp. 241-266.

De, P. 2008b. "Empirical Estimates of Trade Costs for Asia" in Brooks, D and Menon, J. (eds.) *Infrastructure and Trade in Asia*. Cheltenham: Edward Elgar.

De Groot, H. L. F., et al. 2004. The Institutional Determinants of Bilateral Trade Flows. *Kyklos* 57(1): 103–123.

Deardroff, A. 2001. "International Provision of Trade Services, Trade and Fragmentation". *Review of International Economics*, Vol. 9, No. 2, pp. 233-248

Deardorff, A. V. and R. M. Stern. 2008 "Empirical Analysis of Barriers to International Services Transactions and the Consequences of Liberalisation" in Mattoo *et al.* (2008).

Dihel, Nora and Ben Shepherd. 2007. "Modal Estimates of Services Barriers." OECD Trade Policy Working Paper 51, OECD, Paris.

Egger, P. 2002 "An Econometric View of the Estimation of Gravity Models and the Calculation of Trade Potentials." *The World Economy*, Vol. 25, No. 2, pp. 297-312.

Egger, P. 2005. "Alternative Techniques for Estimation of Cross-Section Gravity Models". *Review of International Economics*, Vol. 13, pp. 881-891

Egger, P and M. Pfaffermayr. 2004 "Distance, Trade and FDI: A Hausman-Taylor SUR Approach". *Journal of Applied Econometrics*. Vol. 19, pp. 227-246.

Egger, P. and D. Nelson. 2006. "The Effect of Antidumping on Bilateral Trade in the Multilateral Trading System: Evidence from Panel Data". Paper presented at the Annual Conference on the European Trade Study Group, September 2006.

Egger, P. 2000 "A Note on the Proper Econometric Specification of the Gravity Equation". *Economic Letters*, Vol. 66, pp. 25-31.

Findlay, C. and T. Warren. 2000. *Impediments to Trade in Services: Measurement and Policy Implication*. New York: Routledge.

Fink, C., A. Mattoo and I. C. Neagu. 2002. "Trade in International Maritime Services: How much does Policy Matter?" *World Bank Economic Review*, Vol. 16; pp. 451-479.

Fink, C., A. Mattoo and I. C. Neagu. 2005 "Assessing the Impact of Communication Costs on International Trade?" *Journal of International Economics*, Vol. 67; pp. 428-445.

Francois, J. 1990. "Producer Services, Scale, and the Division of Labour". *Oxford Economic Papers*, Vol. 42, No. 4, October, pp. 715-729.

Francois, J. and B. Hoekman. 2010. "Services Trade and Policy". *Journal of Economic Literature*, Vol. 48 (September 2010), pp. 642 – 692.

Francois, J. 1999. Estimates of Barriers to Trade in Services, Erasmus University, Unpublished manuscript.

Gene M. Grossman and Esteban Rossi-Hansberg, 2008a. External Economies and International Trade Redux, NBER Working Papers 14425, National Bureau of Economic Research, Inc.

Grossman, Gene M., and Esteban Rossi-Hansberg. 2008b. "Trading Tasks: A Simple Theory of Offshoring." *American Economic Review*, Vol. 98(5), pp. 1978–97.

Ghani, E. and H. Kharas. 2010. "The Services Revolution in South Asia" in Ghani E. (ed.) *The Services Revolution in South Asia*. New Delhi: Oxford University Press (OUP).

Government of India. 2010. *Economic Survey 2009-10*, Ministry of Finance, New Delhi

Grunfeld, L. and A. Moxnes. 2003. "The Intangible Globalisation: Explaining Patterns of International Trade in Services". Norwegian Institute of International Affairs Paper # 657, Oslo.

Hausman, J. and W. Taylor. 1981. "Panel Data and Unobservable Effects". *Econometrica*, Vol. 49, pp. 1377-1398.

Helpman, Elhanan, Marc Melitz, and Yona Rubinstein. 2008. "Estimating Trade Flows: Trading Partners and Trading Volumes". *Quarterly Journal of Economics*, Vol. 123, No. 2, pp. 441-487.

Hoekman, Bernard. 2000. The Next Round of Services Negotiations: Identifying Priorities and Options. Multilateral Trade Negotiations: Issues for the Millenium Round. Federal Reserve Bank of St. Louis, St. Louis.

Hoekman, B. and A. Mattoo. 2008. "Services Trade and Growth" in J. A. Marchetti and M. Roy (eds.). *Opening Markets for Trade in Services: Countries and Sectors in Bilateral and WTO Negotiations*. Cambridge: World Trade Organisation and Cambridge University Press.

Hoekman, B. and C. A. Primo Braga. 1997. "Production and Trade in Services: A Survey". *Open Economies Review*, Vol. 8, pp. 285-308.

IMF. 2008. *Balance of Payment Statistic Yearbook, 2008* CD-ROM. International Monetary Fund, Washington, D.C.

IMF. 2009. *Balance of Payments Statistics Yearbook 2009 CD ROM*. International Monetary Fund, Washington, D.C.

IMF. 2011. *Balance of Payments Statistics Yearbook Online Database*. International Monetary Fund, Washington, D.C.

Jacks, D. S., Christopher, M. M. and D. Novy. 2008. "Trade Costs: 1870-2000". *American Economic Review*, Vol. 98, No. 2 pp. 529 – 534

Kimura, F. and H.-H. Lee. 2006. "The Gravity Equation in International Trade in Services". *Review of World Economics*, Vol. 142, pp. 92-121.

Konan, D. E. and K. E. Maskus. 2006. "Quantifying the Impact of Services Liberalization in a Developing Country" *Journal of Development Economics*, Vol. 81, pp. 142– 162

Lejour, A. and J.-W. de Paiva Verheijden. 2004. "Services Trade within Canada and the European Union : What do They Have in Common ?" CPB Discussion Paper # 42.

Linnemann, H. 1966. *An Econometric Study of International Trade Flows*, North Holland Publishing, Amsterdam.

Marchetti, A and M. Roy. 2008. *Opening Markets for Trade in Services: Countries and Sectors in Bilateral and WTO Negotiations*, Cambridge: Cambridge University Press (CUP).

Mattoo, A, R. Rathindran, and A. Subramanian. 2006. "Measuring Services Trade Liberalisation and its Impact on Economic Growth". *Journal of Economic Integration*, Vol. 21, No. 1, pp. 64 – 97

Mattoo, A., R. M. Stern, and G. Zanini (eds.) 2008. *A Handbook of International Trade in Services*. Oxford: Oxford University Press (OUP).

Mishra S., S. Lundstrom, and R. Anand. 2011. *Service Export Sophistication and Economic Growth*. Policy Research Working Paper 5606, The World Bank, Washington, D. C.

Moreira, M. M., C. Volpe and J. S. Blyde, 2008. *Unclogging the Arteries: The Impact of Transport Costs on Latin American and Caribbean Trade*. Inter-American Development Bank, Washington, D. C.

Novy, D. 2008. "Gravity Redux: Measuring International Trade Costs with Panel Data". Department of Economics, University of Warwick, Warwick.

Organization for Economic Cooperation and Development (OECD). 2003. *Statistics on International Trade in Services*, OECD, Paris.

Park, S-C. 2002. "Measuring Tariff Equivalents in Cross-Border Trade in Services". Korea Institute for International Economic Policy, Working Paper # 02-15, Seoul.

Poyhonen, P., 1963. "A Tentative Model for the Volume of Trade between Countries". *Weltwirtschaftliches Archiv*, vol. 90, No. 1, pp. 93-99.

Reserve Bank of India. 2008. "Invisibles in India's Balance of Payments: An Analysis of Trade in Services, Remittances and Income". *RBI Monthly Bulletin*, Reserve Bank of India (RBI), Mumbai.

Reserve Bank of India. 2011. *Database on Indian Economy*. Reserve Bank of India (RBI), Mumbai.

Rodrik, D., A. Subramanian, and F. Trebbi. 2002. Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development. NBER Working Paper 9305. Cambridge: NBER.

Stern, Robert M. 2002. "Quantifying Barriers to Trade in Services". in Hoekman, Bernard; Mattoo, Aaditya and English, Philip (eds.) *Development, Trade and the WTO: A Handbook*. World Bank, Washington DC.

Tharakan, P., I. van Beveren and T. van Outri. 2005. "The Determinants of India's Software Exports and Goods Exports". *Review of Economics and Statistics*, Vol. 87, pp. 776-780.

Tinbergen, Jan. 1962. *Shaping the World Economy: Suggestions for an International Economic Policy*. New York: The Twentieth Century Fund.

Warren, Tony, and Christopher Findlay. 2000. "Measuring Impediments to Trade in Services." in Sauvé and Robert M. Stern (eds.) *GATS 2000*: *New Directions in Services Trade Liberalization, Pierre* pp. 57–84. Cambridge: Harvard University Center for Business and Government; Washington, D.C.: Brookings Institution Press.

World Bank. 2010. *World Development Indicators CD-ROM 2010* Washington, D.C.

World Trade Organisation. 2011. *Services Gateway*. Geneva.

Appendix 1

PCA Weights (*w*)

Components	2000		2001		2002		2003		2004		2005		2006	
	w	Rank	*w*	Rank	*w*	Rank	*w*	Rank	*w*	Rank	*w*	Rank	*w*	Rank
Internet users	0.228	1	0.226	1	0.233	1	0.234	1	0.240	1	0.243	1	0.252	1
Internet bandwidth	0.159	5	0.160	5	0.155	5	0.174	4	0.165	4	0.189	4	0.186	4
Electric power consumption	0.199	3	0.203	3	0.204	3	0.204	3	0.209	3	0.216	3	0.224	3
Air passengers	0.188	4	0.186	4	0.177	4	0.156	5	0.148	5	0.120	5	0.111	5
Telephone	0.225	2	0.224	2	0.231	2	0.232	2	0.237	2	0.231	2	0.227	2
Eigen value (component 1)	3.226		3.177		3.000		2.976		2.848		3.186		3.124	
Proportion explained (%)	64.520		63.540		60.000		59.520		56.960		63.730		62.480	

Source: Author.

Appendix 2

Data Sources

Variables	Sources
Services export	*Statistics on International Trade in Services*, OECD
GDP and GDP per capita of exporter	*World Development Indicators 2010*, World Bank
GDP and GDP per capita of importer	
Services trade facilitation indicators comprising (i) internet users (per 100 people), (ii) international internet bandwidth (bits per person), (iii) electric power consumption (kWh per capita) , (iv) air transport passengers carried (per 100 people), (v) Fixed line and mobile phone subscribers (per 100 people), and (vi) ICT expenditure	*World Development Indicators 2010*, World Bank
Regulatory quality of exporter	*Worldwide Governance Indicators*, World Bank Institute
Regulatory quality of importer	
Global competitiveness index of exporter	*World Development Indicators 2010*, World Bank
Exchange rate of exporter	*World Development Indicators 2010*, World Bank
Distance between exporter and importer	CEPII
Language dummy	CEPII
Landlocked dummy	Authors own calculation
RTA/FTA dummy	
Adjacency dummy	
Control of corruption	Transparency International

Source: Author.

Appendix 3

List of India's Partner Countries

Sr. No.	Country
1	Australia
2	Austria
3	Bangladesh
4	Belgium
5	Brazil
6	Canada
7	China
8	Czech Republic
9	Denmark
10	Finland
11	France
12	Germany
13	Greece
14	Hong Kong, China
15	Hungary
16	Ireland
17	Italy
18	Japan
19	Korea
20	Luxembourg
21	Netherlands
22	Norway
23	Poland
24	Portugal
25	Russia
26	Slovak Republic
27	Singapore
28	South Africa
29	Sri Lanka
30	Sweden
31	UK
32	USA

Source: Author.

Appendix 4

Basic Facts of Data

Variable	Obs	Mean	Std. Dev.	Min	Max
ex	224	18.207	2.615	0.000	22.760
gdp_r	224	27.149	0.251	26.850	27.540
gdp_p	224	26.492	1.475	23.480	30.210
gdppc_r	224	6.344	0.224	6.110	6.710
gdppc_p	224	9.525	1.239	5.860	11.170
intusr_r	224	0.707	0.933	-0.610	2.060
intusr_p	224	3.128	1.293	-2.640	4.490
iibw_r	224	1.474	1.252	-0.190	3.190
iibw_p	224	6.608	2.654	-2.170	10.460
pce_r	224	6.089	0.080	6.000	6.220
pce_p	224	8.605	1.054	4.560	10.150
air_r	224	16.917	0.297	16.640	17.510
air_p	224	16.385	1.642	10.670	20.400
tel_r	224	2.006	0.555	1.270	2.930
tel_p	224	4.533	0.913	-0.590	5.350
ictexp_r	224	3.269	0.427	2.790	3.910
ictexp_p	224	6.695	1.391	1.920	8.250
reg_r	224	-0.231	0.086	-0.360	-0.110
reg_p	224	0.641	0.634	-3.200	1.120
gci_r	224	1.416	0.031	1.400	1.490
gci_p	224	1.567	0.153	1.040	1.780
cc_r	224	1.046	0.063	0.990	1.190
cc_p	224	1.766	0.503	-0.920	2.300
exr_r	224	3.826	0.030	3.790	3.880
exr_p	224	1.585	1.970	-0.690	7.160
dis	224	8.660	0.428	7.260	9.560

Source: Author.

*Taken in log scale

Appendix 5

Correlation Coefficients

	export	gdp_r	gdp_p	gdppc_r	gdppc_p	intusr_r	intusr_p	iibw_r
export	1							
gdp_r	0.2191*	1						
gdp_p	0.4278*	0.1506*	1					
gdppc_r	0.2138*	0.9939*	0.1489*	1				
gdppc_p	-0.0541	0.1605*	0.3514*	0.1625*	1			
intusr_r	0.2196*	0.9739*	0.1470*	0.9564*	0.1528*	1		
intusr_p	-0.0417	0.2194*	0.3935*	0.2108*	0.9027*	0.2273*	1	
iibw_r	0.2134*	0.9844*	0.1488*	0.9810*	0.1584*	0.9712*	0.2204*	1
iibw_p	-0.0582	0.2611*	0.2488*	0.2454*	0.8691*	0.2775*	0.8731*	0.2714*
pce_r	0.2153*	0.9970*	0.1501*	0.9955*	0.1611*	0.9744*	0.2163*	0.9814*
pce_p	-0.122	0.0377	0.3167*	0.0367	0.8684*	0.038	0.8925*	0.0379
air_r	0.2053*	0.9557*	0.1414*	0.9729*	0.1580*	0.9142*	0.1953*	0.9224*
air_p	0.2766*	0.0626	0.8851*	0.063	0.3034*	0.0595	0.3200*	0.0632
tel_r	0.2241*	0.9942*	0.1489*	0.9844*	0.1579*	0.9804*	0.2229*	0.9748*
tel_p	-0.1292	0.2070*	0.3000*	0.2027*	0.8567*	0.2093*	0.9385*	0.2068*
ictexp_r	0.2148*	0.9974*	0.1507*	0.9936*	0.1610*	0.9762*	0.2177*	0.9875*
ictexp_p	0.0985	0.1516*	0.3463*	0.1499*	0.9248*	0.1478*	0.9071*	0.1497*
reg_r	0.0194	0.2146*	0.0262	0.2987*	0.0581	0.0417	-0.0292	0.1414*
reg_p	-0.0915	0.0158	0.1228	0.0129	0.8072*	0.0166	0.8406*	0.0147
gci_r	0.1245	0.5529*	0.0756	0.5933*	0.0952	0.4890*	0.0934	0.4727*
gci_p	0.1095	0.0153	0.3192*	0.0156	0.8161*	0.0146	0.8195*	0.008
cc_r	0.1706*	0.8047*	0.117	0.8318*	0.1358*	0.7285*	0.1467*	0.7201*
cc_p	0.0809	0.0467	0.3371*	0.0446	0.6610*	0.0502	0.7316*	0.0464
exr_r	-0.0686	-0.5298*	-0.0823	-0.5809*	-0.1042	-0.3752*	-0.058	-0.5096*
exr_p	-0.1907*	-0.0482	-0.2244*	-0.0479	-0.4555*	-0.045	-0.3338*	-0.0476
dis	-0.0382	0	0.4655*	0	0.5513*	0	0.6194*	0

	iibw_p	pce_r	pce_p	air_r	air_p	tel_r	tel_p	ictexp_r
iibw_p	1							
pce_r	0.2532*	1						
pce_p	0.7830*	0.0373	1					
air_r	0.2116*	0.9693*	0.0338	1				

Appendix 5 continued...

Appendix 5 continued...

air_p	0.1626*	0.0629	0.2689*	0.0601	1			
tel_r	0.2658*	0.9912*	0.0375	0.9583*	0.0611	1		
tel_p	0.8371*	0.2052*	0.8590*	0.1917*	0.2469*	0.2088*	1	
ictexp_r	0.2585*	0.9975*	0.0377	0.9517*	0.063	0.9871*	0.2058*	1
ictexp_p	0.8484*	0.1512*	0.8637*	0.1419*	0.2330*	0.1493*	0.8538*	0.1520*
reg_r	-0.0977	0.2338*	0.0001	0.3864*	0.0157	0.1718*	0.0073	0.2151*
reg_p	0.7635*	0.0146	0.7695*	0.0108	0.0833	0.0169	0.8287*	0.0147
gci_r	0.0605	0.5843*	0.0151	0.7570*	0.0334	0.5930*	0.1029	0.5274*
gci_p	0.7517*	0.019	0.8132*	0.0345	0.2290*	0.0215	0.7458*	0.0123
cc_r	0.1301	0.8267*	0.0257	0.9282*	0.0496	0.8152*	0.1516*	0.7907*
cc_p	0.6440*	0.0466	0.7109*	0.0422	0.2742*	0.0478	0.7010*	0.0467
exr_r	-0.0387	-0.5361*	-0.0164	-0.5372*	-0.0408	-0.4448*	-0.0768	-0.5531*
exr_p	-0.4015*	-0.0479	-0.3711*	-0.0443	-0.1314*	-0.0464	-0.3673*	-0.0485
dis	0.4455*	0	0.6518*	0	0.4555*	0	0.5848*	0

	ictexp_p	reg_r	reg_p	gci_r	gci_p	cc_r	cc_p	exr_r	exr_p	dis
ictexp_p	1									
reg_r	0.0268	1								
reg_p	0.8733*	-0.0164	1							
gci_r	0.0738	0.5132*	0.004	1						
gci_p	0.9115*	0.003	0.8144*	0.0788	1					
cc_r	0.1173	0.5591*	0.0081	0.9051*	0.0556	1				
cc_p	0.7041*	-0.0094	0.6161*	0.021	0.6323*	0.0325	1			
exr_r	-0.0861	-0.7415*	0.0054	-0.2243*	0.025	-0.5121*	-0.0092	1		
exr_p	-0.4575*	-0.0132	-0.4270*	-0.0203	-0.3867*	-0.0366	-0.2555*	0.0356	1	
dis	0.5754*	0	0.5858*	0	0.5081*	0	0.4391*	0	-0.4764*	1

Source: Author.

*Significant at 5 percent level

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