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Export Performance of South and East Asia in Modern Services

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Abstract

Advancements in information and communications technologies (ICTs) have increased the possibilities for trade in modern services and many Asian emerging and developed economies are participating increasingly in these new trade activities. This paper examines the export performance of these emerging and developed Asian economies in selected modern services: computer and information services, business and professional services, and telecommunications services, using a stochastic frontier gravity type model. Estimation results show that performance of emerging economies in South Asia and the ASEAN region, in terms of realization of export potential, is considerably lower than that of the developed world in North America and Europe. The results also show that the number of graduates and the ICT infrastructure in emerging countries are amongst key factors for modern services exports. These findings suggest that emerging economies need to remove 'behind the border' constraints and adopt advanced technologies in order to catch up with the high performing developed countries.

Keywords: Services exports, stochastic frontier gravity model, Asia, North America, and Europe.

JEL Classifications: F14, C24.

1. Introduction

Over the past two decades, technological developments, liberalization of services trade and increasing shares of services in most economies have resulted in the increasing globalization of services. In terms of world GDP, the share of services has increased from 59 percent in 1985 to the current level of over 70 percent, underlying the tremendous scope for trade in services. Also, the unprecedented advancements in information and communications technologies (ICTs) have made it possible to provide many services across borders without physical movement of persons. ICTs have revolutionized the services trade possibilities especially in modern services including telecommunications, computer and information, banking, insurance, and business services (Ghani and Anand 2009). Given these developments, modern services exports are growing more than traditional services exports such as transport and travel services and reached US$ 1.8 trillion in 2009, showing annual average growth of 26.5 percent in the period 1990-2009. In 2009, the share of modern services was 56 percent of the total services trade, an increase from 35 percent in 1990. Overall, the modern services trade is growing even faster than the goods trade. Since 1990, modern services trade has increased 6.3-fold compared to a 3.6-fold increase in goods trade.[1]

The regions of South Asia, East Asia and ASEAN[2] are participating increasingly in the growing market of modern services exports. In particular, the world share of South Asia in the export of computer and information services has increased from 10 percent in 2000 to over 25 percent in 2009. However, there are differences in the export growth across countries and within a country across different modern services exports. For example, in the period 2000-2008, India and Pakistan in South Asia, experienced significant growth in the export of business and professional services (BPS) while there was almost no growth in these exports from Indonesia and Malaysia. In this context, in particular, Malaysia has invested heavily on infrastructure including creation of 'Cyberjaya'[3] to promote IT related production and exports. Important questions then are: How far have countries involved in the export of computer and information services and BPS achieved their potential? How are the countries in South Asia and ASEAN performing with respect to their peers and the developed world in terms of utilization of their export potential in modern services? This analysis is important for emerging countries that are experiencing an increasing role of services exports in their overall economic growth. The efficient utilization of a country's export potential increases its exports and overall economic growth. The analysis of export potential bears useful policy implications for export growth: countries with less utilization of their potential bilateral services exports initially need to remove 'behind the border' constraints before following the advanced technologies and trade practices of high performing countries. Furthermore, countries that are close to their potential should exert more efforts in R&D and development of new technologies to shift their potential frontiers.

The exciting developments and growth in modern services have attracted much research, in particular, on the issue of job losses in the developed world, due to outsourcing of services to emerging economies. To our knowledge, no study has analyzed the export potential in modern services from emerging countries, although there are a limited number of studies on the estimation of gravity models for modern services. Most studies use the aggregate levels of services trade and have less coverage of exports from emerging countries. Grunfeld and Moxnes (2003), Mirza and Nicoletti (2004) and Kimura and Lee (2006) find gravity

[1] Figures are based on data from the World Bank (2010a).
[2] The Association of Southeast Asian Nations (ASEAN).
[3] 'Cyberjaya' is an IT theme city in Malaysia with state of the art infrastructure and IT systems.

estimates only for aggregate services and goods using an OECD dataset for up to 20 OECD reporting countries.

One of the limitations with aggregate services analysis is that we cannot analyze the impact of sector specific services trade restrictions on services exports. For example, Grünfeld and Moxnes (2003) use the services trade restrictiveness index (STRI) developed by Findlay and Warren (2000), but their analysis has inherent bias because these STRIs only cover 35 percent of total services. Kimura and Lee (2006), using 1999-2000 data for 10 OECD countries,[4] apply the Economic Freedom of the World (EFW) index as a crude proxy for barriers to trade in services. A recent study by Nordas (2008) uses sector specific STRIs and estimates a gravity type model at a disaggregated level for computer and information services, and business services, using sector specific STRIs. Another study by Head et al. (2009) calculates the gravity estimates for 'other commercial services',[5] IT and miscellaneous business services, using Eurostat data for the years 1992-2006. However, bilateral coverage of data, for most countries before 2000, is small and may influence estimations. Moreover, they do not include services trade restrictions in their gravity model specification.

Characteristics of services vary between different categories. For example, the nature of BPS is very different from transport services. Therefore, aggregate analysis used in earlier studies, with due acknowledgement, is of limited help for policymakers. The quality and coverage of services data has improved only recently. In earlier studies, the limited number of observations at the disaggregated level might have compromised the estimations. Therefore, the current study is expected to contribute in three ways. First, it provides a systematic analysis of performance of emerging countries in modern services exports in terms of utilization of their potential, using the stochastic frontier approach. Second, it uses a larger and more complete dataset than used in earlier studies. Finally, it explains the potential and determinants of modern services exports at a disaggregated level.

The remainder of the paper is structured as follows. The following two sections provide information about the size and structure of services trade, and details on the data availability of bilateral services trade flows. In the next section, we briefly discuss the analytical framework for the estimation of services trade in a gravity model framework and the application of the stochastic frontier approach to gravity modeling along with details of explanatory variables included in the empirical model. The results of the maximum likelihood estimation and export performance are also discussed in this section and a final section brings out the overall conclusions of this study.

2. Trends in Services Trade

The services sector has been the most dynamic segment of the global economy in the last decade. In the domestic economy, the services share in the GDP of middle and high income countries has been rising and the services sector has contributed 72 percent of the global GDP growth during the period 2001-2009. In the external economy, services have been dominating the landscape of both trade and FDI; most FDI in the last decade has been in the services sector and growth of modern services trade has surpassed growth in the goods trade. At the aggregate level, total world trade in commercial services has increased from US$ 0.82 trillion in 1990 to US$ 3.4 trillion in 2009, representing a growth of 319 percent. Modern services

[4] These countries report services trade data for most of their partner countries.

[5] 'Other commercial services' are calculated by subtracting transport, travel and government services from total services.

are the main source of this growth with their current volume of over US$ 1.8 trillion, which covers more than 53 percent of total global services trade. High income countries are dominant players in commercial services with their current share of 80 percent in world trade, which was even higher at 87 percent in 1990 (see Table 1).

The outsourcing of services to developing countries has been raised as a concern by some policy makers in the developed world. If we look at the aggregate figures, only 8 percent of world exports of modern services are from lower middle income countries. It is only in the ICT services where lower middle income countries have a share of 23 percent, most of which is contributed by India. Lower middle income countries, excluding India, have not experienced a significant change in their share of world modern services exports, showing that the benefits of the increase in modern services is still limited to a few emerging countries.[6]

Telecommunications, computer and information services, and business and professional services (BPS) cover more than 60 percent of modern services. These are the fastest growing segments of services trade for the emerging economies engaged in outsourcing activities. The increase in IT and BPS exports of these countries has been largely due to the increasing trend of outsourcing activities. Total world market estimates for the trade in computer and information services reached over US$ 225 billion in 2009, increasing from US$ 18.5 billion in 1997 and an average annual growth of 25 percent was recorded for this period. India, Ireland, the UK, Germany, the US, the Netherlands, Sweden, Canada and China are among the top exporters of computer and information services. With the exception of India, other emerging economies in South Asia and ASEAN have a small share in the world trade of computer and information services. However, these countries have improved their world share over the years and showed an average annual growth rate of more than 29 percent in the period 2000-2009. Currently, in the world market of BPS exports, the US, the UK, Germany and Japan are the main players while in South Asia and ASEAN regions India, China and the Philippines are high growth achieving countries. Other emerging countries can also exploit their potential and benefit from these expanding markets.[7]

3. Data on Bilateral Services Trade

Unlike the systematic and sufficiently disaggregated data on bilateral goods trade, the services trade data are insufficient both in terms of disaggregation and coverage. Three primary sources for bilateral services trade data are: Eurostat, OECD and UN services trade data. Eurostat provides bilateral services trade data for 27 EU countries and 66 possible partners. Although Eurostat provides bilateral services data from 1985 there are very few observations in earlier years and most early data is for total services only. The OECD

[6] Figures in this paragraph are based on Balance of Payments data reported by the World Development Indicators and the IMF's Balance of Payments statistics and cover cross-border mode of services trade.

[7] The trade in ICT and BPS services can take place through all four modes (definitions can be seen in Appendix 4A) of trade in services. In our analysis, we have used BOP data on services exports that covers Mode 1 i.e. cross-border trade between residents and non-residents. According to the WTO (2005), the BOP data on services exports can be seen as an upper limit of outsourcing of these services because outsourcing of ICT and BPS services is a sub-component of overall activities covered in the export of these services. Therefore, data reported for outsourcing would differ from that of cross-border trade. For example, UNCTAD (2009) estimates that the total world market of the offshoring of ICT and business processes was US$ 93 billion in 2008, which represents less than half the ICT cross-border trade of over US$ 224 billion. India, Canada, the Philippines, Ireland and China have the major share (80%) of this offshoring market, although this is declining over time as new countries enter the market.

database provides data for the period 1996-2007, has 30 reporter countries, and more than 200 possible partner countries. However most OECD data is reported for the same 66 partner countries as Eurostat. The UN disaggregation of bilateral services trade data is improving over time, however, there are few observations for disaggregated categories of services. The UN currently provides bilateral services data for the years 2000-2008, and there are 49 reporter countries of which 15 are developing countries. The UN includes all the UN classified list of countries as partner countries. However, again, the number of partner countries with data availability varies for each reporter country. None of the reporter countries reports the data for all the partner countries in any of the datasets.[8]

The reporting for services trade is not free from country bias, concealing of data, and over and under estimation. For example, in 2003, the US reported US$ 420 million imports of business, professional and technical (BPT) services from India whereas India reported US$ 8.7 billion for BPT exports to the US (GAO 2005). These differences in reporting of data are due to several reasons, including weak reporting systems on the imports of services, intentional under or over reporting, use of different definitions of cross-border services trade, and sensitivity of information in data. Further, sample surveys of the firms exporting services are more representative compared to surveys for the imports of services by firms. Exporting firms can easily be covered in surveys, while importing firms are usually more than the exporting ones due to the nature of use of imported services by domestic firms.

In our dataset for bilateral services, we find significant differences in the reporting of bilateral trade flows. For example, the US, despite being the major trading partner for many countries in the world, reports few bilateral trade flows. Vast differences in the reporting highlight underlying weaknesses in the compilation and coverage of bilateral services trade flows. As a result of these issues and the non-reporting of certain bilateral trade figures by individual countries in the reported data, we used data extracted from OECD, Eurostat and UN data sources, which facilitate drawing of bilateral services trade figures.

Initially, we extracted bilateral services imports and exports data for all possible reporting and partner countries from three data sources, namely the OECD, Eurostat and the UN for the years 2002–2008. For our analysis, we selected the main modern services sub-categories: business and professional services, computer and information services, and telecommunications services. We merged bilateral data flows for these sub-categories from three databases and compiled a single dataset. We used this basic dataset to extract bilateral services exports of emerging and developing countries.

4. Analytical Framework

In the international trade literature, the gravity model has been widely used to examine the trade flows between trading partners. The basic gravity model was introduced by Tinbergen (1962) and its log-linear form specifies that the trade flows between two trading partners can be explained by the economic size of the trading partners, the distance between them, and other factors that can affect trade. The empirical application of this model has been very successful in economics (Anderson and Wincoop 2003).

[8] These three data sources for bilateral services trade broadly follow the BOP classification for services trade provided in Appendix 4B.

Anderson (1979) provided a basic theoretical framework for a gravity model of trade flows which later was extended by others.[9] With the basic assumptions of homothetic preferences for trade goods across countries and using the constant elasticity of substitution (CES) preferences, Anderson (1979) derived the following specification of a gravity type equation:

$$X_{ij} = \frac{m_i \phi_i Y_i \phi_j Y_j}{\sum_j \phi_j Y_j} \cdot \frac{1}{f(d_{ij})} \cdot \left[\sum_j \frac{\phi_j Y_j}{\sum_j \phi_j Y_j} \cdot \frac{1}{f(d_{ij})} \right]^{-1} u_{ij} \quad (1)$$

where,

$$X_{ij} = Exports\ of\ country\ i\ to\ country\ j$$

$$Y_i = Income\ in\ country\ i$$

$$d_{ij} = Distance\ between\ country\ i\ and\ country\ j$$

$$\emptyset_i = The\ share\ of\ expenditure\ on\ all\ traded\ goods\ and\ services\ in\ total\ expenditure\ of\ counrtry\ i = F(Y_i, N_i), where\ N_i is\ the\ population\ in\ counrty\ i$$

The standard form of the gravity equation used in empirical studies can be given as:

$$X_{ij} = \alpha Y_i^{\beta_1} Y_j^{\beta_2} N_i^{\beta_3} N_j^{\beta_4} d_{ij}^{\beta_5} U_{ij} \quad (2)$$

According to Anderson (1979), with the log linear function of $\emptyset$ and m, Eq. (1) resembles Eq. (2), with an important difference. This difference is the square bracket term in Eq. (1) $\left[\sum_j \frac{\emptyset_j Y_j}{\sum_j \emptyset_j Y_j} \cdot \frac{1}{f(d_{ij})}\right]^{-1}$. This is missing in the generally used empirical specification of the gravity model presented in Eq. (2). Anderson (1979, p. 113) describes this term as 'the flow from *i* to *j* depends on economic distance from *i* to *j* relative to a trade weighted average of economic distance from *i* to all points in the system'.

Omission of this important relative economic distance term in the empirical specification of the gravity model leads to biased estimates. This is because the error term is affected by the relative economic distance term, therefore, $E(U_{ij}) \neq 0$ and the normality assumption of OLS is violated. This problem leads to 'heteroskedastic error terms and the log-linearization of the empirical model in the presence of hetersckedasticity leads to inconsistent estimates because the expected value of the logarithm of a random variable depends on higher-order moments of its distribution', (Kalirajan 2007, p. 92). Therefore, the OLS estimation on such gravity equations will be biased.

Measuring the correct specification of the relative economic distance term is difficult because researchers do not know all the factors affecting this term. The economic distance can be affected by many factors, including institutional, regulatory, cultural and political, which are difficult to measure completely. These factors are referred to as 'behind the border'

[9] For example, Bergstrand (1985, 1989) and Deardorf (1995) derive gravity equation from the Heckscher-Ohlin model while Eaton and Kortum (2002) develop a theoretical justification of the gravity equation from the Ricardian model.

constraints. The correct empirical specification of the gravity equation is still a challenge despite many proposing to partly solve the inherent bias in the standard gravity model. For example, some suggest fixed effects models (e.g. Bayoumi and Eichegreen 1997), while Egger (2008) suggests use of panel data models which are non-linear in trade costs, and Feenstra (2002) uses price differences between trading partners in his specification of the gravity model. Since McCallum (1995) many empirical papers have used 'remoteness' variables, generally defined by $\sum_{m \neq j} d_{im}/y_m$, where *d* is distance and *y* is GDP and the whole term represents the weighted average distance of country *i* from all its trading partners, except the particular partner j. Anderson and Wincoop (2003) criticize these remoteness variables and suggest another multilateral resistance term. However, these solutions are either not based on the basic theory of the gravity model or cannot fully capture the inherent bias in the empirical estimation. These also give biased results by not taking care of heteroskedasticity and non-normality of the error term, as previously discussed.

Drawing on Kalirajan (2007), this study uses a stochastic frontier approach (SFA)[10] for estimation of the gravity model, taking into account of the heteroskedasticity and non-normality because we do not know the structure of heteroskedasticity in a gravity equation. With a stochastic frontier approach, the gravity equation can be written as:

$$X_{ij} = \quad f(Z_{ij};\, \beta)\exp(v_{ij} - u_{ij}) \tag{3}$$

where,

X_{ij} = Actual exports from country *i* to country *j*

Z_{ij} = Potential exports from country *i* to country *j*

β = A vector of unknown parameters

u_{ij} = Single sided error term for the combined effects of inherent economic distance bias or 'behind the border' constraints, which is specific to the exporting country with respect to the particular importing country, creating the difference between actual and potential bilateral trade. u_{ij} is normally assumed to have a truncated normal distribution.

v_{ij} = Double sided error term that captures the impact of inadvertently omitted variables and measurement errors that are randomly distributed across observations in the sample. v_{ij} is assumed to follow a normal distribution with mean zero and constant variance.

If u_{ij} is zero, then the economic distance bias or 'behind the border' constraints are not important and if u_{ij} is close to 1, then these constraints are important and are constraining the trade from reaching its potential (Kalirajan 2007). Thus, unlike the conventional method of the gravity estimation, the stochastic frontier approach does not exclude the effect of economic distance on bilateral trade in the gravity estimation. Eq. (3) can be re-written as:

$$\ln X_{ij} = \alpha + \beta_1 \ln \mathrm{Y_i} + \beta_2 \ln \mathrm{Y_j} + \beta_3 \ln \mathrm{d_{ij}} + \gamma R - u_{ij} + v_{ij} \tag{4}$$

[10] Aigner et al. (1977) and Meeusen and van den Broeck (1977) were the first to introduce stochastic production frontier models, which have been used extensively in the production economics literature. Kalirajan (2000) formally introduced this approach in trade to address the inherent bias in the conventional gravity model of trade and to estimate potential trade flows.

'*R*' is a vector of other variables normally used in augmented gravity models. Maximum likelihood estimates of Eq. (4) can be obtained in software such as STATA or Frontier 4.1.

There are two advantages of SFA as described by Kalirajan (2007). First, it estimates the complete impact of the 'economic distance' term, separating it from the statistical error term. This enables us to see the trade impact of 'behind the border' constraints, when the researchers does not have full information on the 'behind the border' constraints. Second, it provides potential trade estimates by using the upper limit of data that comes from countries that have least 'behind the border' resistances.

4.1. Data on Explanatory Variables

The empirical specification of our gravity model includes the basic explanatory variables suggested by the analytical framework discussed in the previous section. These include the Gross Domestic Product (GDP) of the trading partners, the distance between them, and language and colony variables.[11] We focus on the IT and IT enabled services exports that are greatly affected by the availability of a tertiary educated population and the use of IT infrastructure. Therefore, in our empirical specification, we included a stock of tertiary graduates and internet subscribers per 100 persons. Data for the variables on GDP and the internet were from the World Bank's on-line database of World Development Indicators. The country stocks of tertiary graduates were estimated using the base stocks of graduates from Barro (2010) and tertiary enrollment, obtained from the online database of the United Nations Educational, Scientific and Cultural Organization (UNESCO).[12] Distance, common language and colony variables were downloaded from the French Research Centre in International Economics, the CEPII. We also compiled a variable for the time difference between trading partners using information on time zones. Due to strong collinearity between the distance variable and the time difference, we dropped this variable from the main regressions.

The model also specifies the variables that are either expected to augment or diminish trade between the trading partners. These include the services trade agreement between the trading partners and the STRIs of importing countries. To create a dummy variable for trade agreements in services between the trading partners, we used the information on the World Trade Organization (WTO) website for the effective bilateral/regional trade agreements for goods and services. The dummy variable takes the value one if the trading partners are part of an effective trade agreement that also includes services. For our analysis, we excluded the trade agreements that are only for goods trade and do not cover services. Finally, we used STRIs to include barriers to services trade in our model. An explanation of STRIs is provided below.

Barriers to trade in services are difficult to measure, compared to tariffs and non-tariff barriers to trade in goods. Most barriers to services trade are in terms of regulations. Construction of an STRI first requires careful selection of policies and regulations potentially restricting trade in services. Applied regulations and policies are quantified and are then converted into an index, by assigning appropriate weights to each policy. To obtain mode specific STRIs, we also need to separate policy measures affecting different modes of services trade. The first comprehensive effort to construct sector specific STRIs was made by

[11] GDP is in constant 2000 prices and the GDP deflator of base year 2000 has been used to deflate services exports.

[12] There are missing observations in the data for graduates and enrolment of tertiary education. We fill missing observations for a country using available information on the respective country or regional averages.

the Australian Productivity Commission (Findlay and Warren 2000) and has been widely quoted in the services trade literature. The index covers six service sub-sectors and 34 countries. Grunfeld and Moxnes (2003) use this STRI in their gravity model for total services trade but have been criticized by Kimura and Lee (2006) because use of six service industry STRIs for overall services trade can provide misleading results. With the availability of more disaggregated bilateral services trade, it is possible to test the index for individual sub-categories of services. However, the index is based on information for the later years of the 1990s and is not suitable for the recently available larger coverage of bilateral services trade data.

Recent attempts in the construction of STRIs include ongoing projects by the OECD (OECD 2009) and the World Bank (Gootiiz and Mattoo 2009). The STRIs derived by the OECD are only for OECD countries, while the World Bank covers 32 developing and transition countries and 24 OECD countries. The World Bank survey covers financial services, telecommunications, retail distribution, transportation and professional services. The OECD provides STRIs for telecommunications, construction, business and professional services, and computer related services. The World Bank project has larger coverage of services and countries than the OECD project, however, country and sector specific STRIs are not yet available from the World Bank. Therefore, we used STRIs compiled by the OECD for our estimations as OECD countries are the trading partners considered for the gravity models used in this chapter. The OECD STRIs cover restrictions on foreign ownership and market entry, restrictions on the movement of people, discriminatory measures, public ownership, barriers to competition and regulatory transparency and licensing (OECD 2009). Further, these policy measures are categorized by the modes of supply. In our analysis, we used the STRIs that pertain to cross-border trade.

4.2. Maximum Likelihood Estimates

The gravity type stochastic frontier model discussed above was estimated using the maximum likelihood methods. Separate stochastic frontier models were estimated for the export of computer and information services, BPS and telecommunications services (see Tables 3 to 5). The estimations were performed on annual bilateral services exports for the period 2002-2008. We provide estimation results for the regions of South Asia, East Asia and ASEAN. As the STRI variable is available only for OECD countries, each exporting country's trading partners are limited to OECD countries.[13] The stochastic frontier model was estimated, using the STATA software version 11.

First, the gamma coefficient, which is the ratio of the variation in exports due to the 'behind the border' constraints to total variation in exports, in all the regressions is close to one and significant. A significant and larger gamma coefficient shows that use of the stochastic frontier method is appropriate for the sample data. This also shows that there are country-specific 'behind the border' constraints, which are not captured by the other explanatory variables. For example, exports of modern services from developing countries may face weak regulations, lack of modern infrastructure, and domestic political interests. These factors constrain developing countries from reaching their export potential.

The coefficients of the standard gravity variables generally exhibit signs according to the gravity trade theory. Services exports increase with a rise in the GDP of exporter and importer countries and decrease with an increase in the distance between them. The GDP

[13] Among OECD countries we excluded the Czech Republic, Slovenia and Slovakia.

coefficients for both exporters and importers are highly significant. The coefficient of distance in the regression for South Asia is insignificant and positive for computer and information services and BPS, and is significant for telecommunications. This is in line with the idea that most computer, IT and business processes related exports from South Asia are based on off-shoring of services to India and are delivered online. Second, an increase in distance also provides opportunities for South Asia to provide customer support services, back office services, some data processing and processing of medical transcripts to countries in different time zones.[14] [15] Compared to South Asia, the distance coefficient for East Asia and the ASEAN region is negative and significant in the regression for BPS exports and telecommunications. This may be because most BPS exports of East Asian countries are more dependent on personal interaction compared to South Asia's BPS exports.

New ICTs have played a central role in the increase in trade in modern services. In the model we included internet use as a proxy for the availability and use of ICTs in a country. The coefficients for internet use are positive for both the exporting and importing countries, however, are more significant for the exporting countries. The results show that use of the internet in both trading partners is essential to augment the trade of modern services between them.

Other explanatory variables included in the empirical model also exhibit theoretically correct signs of their coefficients. Although the significance of the results varies across different services categories, these are expected results. For example, sector specific STRIs have negative and statistically significant coefficients in the regressions for BPS and computer services. In contrast, telecommunications seem little affected by the STRIs. Trade agreements that include services generally have insignificant effects on bilateral services trade. This ineffectiveness could be due to the trade agreement variable being general and not sector specific. The stock of tertiary graduates is found to significantly and positively contribute to the export of computer related services and BPS. For South Asia, the coefficient is larger than for the other regions, showing that an increase in graduates can result in a greater rise in South Asia's exports compared to that of East Asia and the ASEAN region.

4.3. Export Performance

This section describes the export performance of the countries in our sample in terms of realizing their bilateral export potential, using country specific stochastic frontier estimates. As described by O'Donnell et al. (2008), countries exhibit different technology sets 'production opportunities' due to differences in the physical, social and economic environment in which trade or production takes place. Therefore, estimation of separate stochastic frontiers for individual countries, under the assumption that each country has a different trade technology, is reasonable for our analysis.

Country wise realization of export potential is provided in Table 2 for BPS, computer and information services, and telecommunications services. In general, results reveal that emerging countries that have seen a significant growth in their services exports due to the

[14] We also used the time difference between the bilateral trade partners in separate regressions and found that the coefficient of time difference was also insignificant and positive for South Asia while it was negative and significant for our overall sample.

[15] Business Process Outsourcing (BPO) includes a large number of services that firms can outsource offshore. Exports of services that come from BPO operations can have entries under different service categories of BOP service classifications, for example, computer services, information services, other business services, and telecommunications services.

outsourcing phenomenon are still well behind in utilizing their full potential. There is also heterogeneity in individual country performance across the three services. In business and professional services exports, performance of the ASEAN countries is low, with average realization of export potential below 50 percent. The performance of India is relatively better than that of the ASEAN countries, however, it is still considerably lower than East Asia, Western Europe and North America. For example, the top performing countries including the US, Canada, the UK, Switzerland and Ireland realize around 80 percent of their export potential in BPS compared to 53 percent for India and an average of 50 percent in the ASEAN region.

South and East Asian countries are performing relatively better in the export of computer and information services, compared to BPS. On average, countries in East Asia have higher realization of their potential than the European countries while the ASEAN countries seem on a par with the European average. Again, India despite being amongst the top offshore destinations for the outsourcing of computer and related services is lagging behind some other countries in terms of its realized export potential. By making use of its unrealized potential and removing 'behind the border' constraints, India could pursue its export growth, led by computer related and BPS services.

In telecommunications services, the average export performance of East Asian countries is notably the highest among all other regions included in the study. This may be because countries in East Asia including Korea, Japan, Hong Kong and China are active players in the provision of global transmissions of voice and data, using advanced technologies. India is also doing well compared to ASEAN countries, however, it is well below the performance of East Asia, Europe and North America. Countries, including Pakistan and Indonesia, that have very low efficiencies in terms of utilization of their export potential can borrow advanced technologies and learn from the experience of their high performing neighbors.

5. Conclusion

In the three services included in our analysis, the traditional exporters of services from North America and Europe show the highest performance. East Asian countries, including Hong Kong, Korea, Japan and China are also relatively efficient in their modern services exports, particularly in telecommunications services. ASEAN countries that are performing well in manufacturing are found to be less efficient in terms of realization of their export potential in modern services. India, despite its unprecedented growth rates in the export of computer, IT and BPS services, is also not efficiently realizing its export potential. The unrealized potential of India's modern services exports reveals that the country can comfortably continue its services, based export led growth.

In order to catch up with the high performing countries in East Asia, Europe and North America, countries in South Asia and ASEAN should use the best trade strategies, adopt advanced technologies and remove 'behind the border' constraints. Improvements in the business environment, regulatory reforms and provision of modern infrastructure are a few of the measures that can reduce 'behind the border' constraints. Though modern services do not depend heavily on physical infrastructure such as port facilities, the poor quality of infrastructure, such as power shortages and chaotic urban transportation, hamper the growth of these services. Appropriate training and improved standards of graduates in IT and related disciplines are also important for the growth and sustainability of modern services exports from developing countries. Our results support the view that an increase in the stock of

graduates and the adoption of ICT technologies can have a significant and positive impact on modern services exports from developing countries, in general, and South Asia, in particular.

References

Aigner, D., Lovell, C.A.K., and Schmidt, P. 1977. 'Formulation and Estimation of Stochastic Production Function Models', *Journal of Econometrics*, 6: 21–37.

Barro, R.J. 2010. *A New Data Set of Educational Attainment in the World*, NBER Working Paper, No. 15902, National Bureau of Economic Research, Camberidge.

Bergstrand, J.F. 1985. 'The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence', *The Review of Economics and Statistics*, 67(3): 474–81.

Bergstrand, J.F. 1989. 'The Generalized Gravity Equation, Monopolistic Competition, and the Factor-Proportions Theory in International Trade', *The Review of Economics and Statistics*, 71(1): 143–53.

Coelli, T. 1996. *A Guide to FRONTIER version 4.1: A Computer Program for Stochastic Frontier Production and Cost Function Estimation*, Working Paper No. 07/96, Centre for Efficiency and Productivity Analysis, University of New England, Armidale, Australia.

Deardoff, A.V. *Determinants of Bilateral Trade: Does Gravity Work in Neoclassical World?*, NBER Working Paper, No. 5377.

Egger, P. 2008. 'On the Role of Distance for Bilateral Trade' *The World Economy*, pp. 653–62.

Feenstra, R.C., 2002. 'Border Effects and the Gravity Equation: Consistent Methods for Estimation', *Scottish Journal of Political Economy*, 49(5):491–506.

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

GAO 2005. *U.S. and India Data on Offshoring Show Significant Differences*, Report to Congressional Committees, United States Government Accountability Office.

Ghani, E. and Anund, R. 2009. *How Will Changes in Globalization Impact Growth in South Asia?* Policy Research Working Paper, No. 5079, World Bank, Washington, D.C.

Gootiiz, S. and Mattoo, A. 2009. *Services in Doha: what's on the Table?*, Policy Research Working Paper, No. 4903, World Bank.

Grünfeld L. and Moxnes, A. 2003. *The Intangible Globalization: Explaining the Patterns of International Trade in Services*, Norwegian Institute of International Affairs; Working Paper No 657.

Head, K., Mayer, T. and Ries, J. 2009. 'How Remote is the Offshoring Threat?', *European Economic Review*, 53:439–44.

Jones, R.W. and Kierzkowski, H. 1990. 'The Role of Services in Production and International Trade: A theoretical framework', in Ronald Jones and Anne Krueger, eds., *The Political Economy of International Trade*, Basil Blackwell, Oxford.

Jones, R.W. and Kierzkowski, H. 2000. *A Framework for Fragmentation*, Tinbergen Institute Discussion Paper, No. TI 2000-056/2.

Kalirajan, K. 2000. "Indian Ocean Rim Association for Regional Cooperation (IOR-ARC): Impact on Australia's Trade", *Journal of Economic Integration*, 15: 533–47.

Kalirajan, K. 2007. 'Regional Cooperation and Bilateral Trade Flows: An Empirical Measurement of Resistance', *The International Trade Journal*, 21(2):85–107.

Kimura, F. and Lee, H. 2006. 'The Gravity Equation in International Trade in Services', *Review of World Economics*, 142(1):92–121.

Meeusen, W., and van den Broeck, J. 1977. 'Efficiency Estimation from Cobb-Douglas Production Functions with composed Error, *International Economic Review*, 18: 435–44.

Mirza, D. and Nicoletti, Giuseppe, N. 2004. *What is so special about Trade in Service?*, Research Paper No 02, Leverhulme Centre for Research on Globalization and Economic Policy, The University of Nottingham.

OECD 2009. *Methodology for Deriving the STRI*, OECD Experts Meeting on The Services Trade Restrictiveness Index, downloadable at http://www.oecd.org/dataoecd/49/18/42935959.pdf.

UNCTAD 2009. *Information Economy Report 2009*, United Nations Publications, New York and Geneva.

United Nations 2010. Manual on Statistics of International Trade in Services 2010, Washington, D.C., downloadable at http://unstats.un.org/unsd/statcom/doc10/BG-MSITS2010.pdf

World Bank 2010. *World Development Indicators*, online data base.

WTO 2005. *World Trade Report 2005: Exploring the Links between Trade, Standards and the WTO*. Geneva, WTO.

Table 1: Commercial Services Exports and World Shares

	1990					2009				
	World	High income	Upper middle income	Lower middle income	South Asia	World	High income	Upper middle income	Lower middle income	South Asia
	US$ billion	%	%	%	%	US$ billion	%	%	%	%
Commercial services	816	87.3	6.5	5.2	0.8	3418	80.3	7.7	11.2	3.1
Modern Services	300	91.6	3.5	4.1	1.0	1811	87	4.2	7.8	3.9
1 Information and Communications Technology (ICT) Services						*303*	*70*	*4.9*	*23.5*	*18.5*
of which										
1.1 Computer and information services						*225*				
1.2 Telecommunications services						*58*				
2 Insurance and Finance	*44*	*89.5*	*6.1*	*3.8*	*0.8*	*278*	*92.2*	*5.0*	*2.5*	*1.7*
3 Other Modern Services	*256*	*92*	*3.0*	*4.2*	*1.1*	*1231*	*90.1*	*3.5*	*6.0*	*2.6*
3.1 Business and Professional Services	*176*					*891*				
3.2 Modern services not included elsewhere	*80*					*340*				
Traditional Services	516	83.4	7.9	5.6	0.7	1606	73	11.4	13.2	2.0
1 Transport	*231*	*85.9*	*6.8*	*5.5*	*0.8*	*717*	*80.2*	*8.1*	*10.9*	*2.7*
2 Travel	*285*	*81.4*	*8.9*	*5.7*	*0.7*	*889*	*67.2*	*14.2*	*15.1*	*1.4*

Note: Commercial services are obtained by excluding government services from total services exports; Figures for 2009 are estimates.

Source: Authors' calculations, using World Development Indictors, World Bank, and IMF's Balance of Payments statistics.

Table 2: Realization of Potential Bilateral Exports (simple average in percentage)

Exporter	Region	Business and Professional Services	Computer and Information Services	Telecommunications Services
India	South Asia	53	60	55
Pakistan	South Asia	39	55	40
Australia	East Asia & Pacific	66	67	65
Hong Kong	East Asia	52	66	66
Korea	East Asia	69	85	--
Japan	East Asia	65	57	75
China	East Asia	65	61	69
Singapore	ASEAN	52	64	48
Indonesia	ASEAN	37	--	45
Malaysia	ASEAN	46	52	53
Philippines	ASEAN	57	--	--
Thailand	ASEAN	47	--	--
Canada	North America	77	82	66
US	North America	82	72	72
Austria	Europe	73	53	60
Belgium	Europe	48	53	63
Denmark	Europe	62	47	58
Finland	Europe	55	60	--
France	Europe	79	70	61
Germany	Europe	65	61	66
Hungary	Europe	60	65	81
Iceland	Europe	61	--	--
Ireland	Europe	86	--	--
Italy	Europe	72	--	--
Luxembourg	Europe	61	--	--
Netherlands	Europe	65	--	60
Norway	Europe	58	41	42
Poland	Europe	51	--	--
Romania	Europe	46	53	59
Sweden	Europe	57	64	60
Switzerland	Europe	84	--	67
UK	Europe	73	--	--

Source: Authors' calculations on the basis of individual country stochastic frontier models.

Table 3: Maximum Likelihood Estimation Results of Stochastic Frontier Model
(Exports of Business and Professional Services)

	All countries		South Asia		East Asia and ASEAN		Europe and Americas	
Log of exporters' real GDP	0.86***		1.24***		0.55***		0.95***	
	(0.035)		*(0.195)*		*(0.078)*		*(0.038)*	
Log of importers' real GDP	0.80***	0.81***	1.01***	1.01***	1.14***	1.14***	0.74***	0.72***
	(0.033)	*(0.040)*	*(0.099)*	*(0.102)*	*(0.101)*	*(0.114)*	*(0.039)*	*(0.027)*
Colony	0.01	0.25			-0.64	-0.62		
	(0.253)	*(0.315)*			*(0.750)*	*(0.907)*		
Common language	0.62***	0.63***	-0.56	-0.59	1.00***	0.53	0.60***	0.58***
	(0.155)	*(0.194)*	*(0.509)*	*(0.502)*	*(0.387)*	*(0.460)*	*(0.176)*	*(0.166)*
Log of distance	-0.89***	-0.88***	0.30	0.26	-0.87***	-1.14***	-0.97***	-0.81***
	(0.052)	*(0.068)*	*(0.856)*	*(0.858)*	*(0.305)*	*(0.361)*	*(0.058)*	*(0.048)*
Services Trade Restrictiveness Index (STRI)	-9.26***	-10.13***	-10.94***	-10.46***	-13.11*	-15.85**	-8.47***	-10.70***
	(1.805)	*(2.052)*	*(4.115)*	*(4.162)*	*(7.236)*	*(8.024)*	*(2.306)*	*(1.970)*
FTA_services	-0.08	-0.01			0.01	0.01	-0.17	-0.18
	(0.089)	*(0.096)*			*(0.198)*	*(0.200)*	*(0.112)*	*(0.114)*
Log of tertiary graduates		0.50***		1.25***		0.11*		0.70***
		(0.040)		*(0.193)*		*(0.068)*		*(0.0280*
Log of internet users per 100 persons_i	0.37***	0.56***	0.44**	0.51***	0.47***	0.56***	0.53***	0.64***
	(0.038)	*(0.044)*	*(0.201)*	*(0.209)*	*(0.070)*	*(0.073)*	*(0.083)*	*(0.096)*
Log of internet users per 100 persons_j	0.26***	0.23***	1.22***	1.30***	0.30	0.28	0.20**	0.18**
	(0.074)	*(0.077)*	*(0.266)*	*(0.270)*	*(0.254)*	*(0.258)*	*(0.085)*	*(0.079)*
Constant	3.14***	3.08***	-17.61***	-22.94***	2.41	6.73*	2.31**	-0.29
	(0.799)	*(0.788)*	*(7.098)*	*(6.880)*	*(3.389)*	*(3.928)*	*(0.991)*	*(0.586)*
Gamma	0.86***	0.91***	0.90***	0.90***	0.85***	0.89***	0.83***	0.94***
	(0.010)	*(0.007)*	*(0.055)*	*(0.057)*	*(0.021)*	*(0.017)*	*(0.015)*	*(0.013)*
Log likelihood	-2175	-2297	-96	-96	-640	-660	-1090	-1142
Wald Chi2	1665	814	293	320	371	256	1152	1203
No. of Obs.	2444	2444	133	133	636	636	1334	1334

Note: ***, ** and * indicate statistical significance at 1, 5 and 10 percent significance levels, respectively. Figures in italic are standard errors.

Table 4: Maximum Likelihood Estimation Results of Stochastic Frontier Model (Exports of Computer and Information Services)

	All countries		South Asia		East Asia and ASEAN		Europe and Americas	
Log of exporters' real GDP	0.88***		2.44***		0.50***		0.90***	
	(0.057)		*(0.236)*		*(0.106)*		*(0.060)*	
Log of importers' real GDP	0.83***	0.82***	1.12***	1.12***	0.69	0.65***	0.76***	0.78***
	(0.077)	*(0.061)*	*(0.130)*	*(0.131)*	*(0.125)*	*(0.122)*	*(0.042)*	*(0.049)*
Colony	-0.11	0.80**	1.90	1.84	0.16	0.33	1.21***	1.40***
	(0.646)	*(0.410)*	*(1.414)*	*(1.435)*	*(0.800)*	*(0.821)*	*(0.318)*	*(0.326)*
Common language	0.54**	0.19	-0.67	-0.53	0.28	0.24	0.07	0.10
	(0.244)	*(0.300)*	*(1.076)*	*(1.087)*	*(0.457)*	*(0.469)*	*(0.225)*	*(0.244)*
Log of distance	-0.84***	-0.83***	2.18	2.00	0.04	0.11	-0.80***	-0.86***
	(0.084)	*(0.121)*	*(1.429)*	*(1.436)*	*(0.328)*	*(0.343)*	*(0.077)*	*(0.082)*
Services Trade Restrictiveness Index (STRI)	-13.26***	-10.76***	-13.60*	-13.22*	-0.85	1.35	-9.22**	-10.45***
	(4.099)	*(4.468)*	*(7.858)*	*(8.011)*	*(7.971)*	*(8.128)*	*(3.835)*	*(3.879)*
FTA_services	-0.02	-0.03			1.22***	1.21***	-0.15	-0.13
	(0.145)	*(0.153)*			*(0.412)*	*(0.411)*	*(0.145)*	*(0.151)*
Log of tertiary graduates		0.66***		2.51***		0.35***		0.81***
		(0.063)		*(0.242)*		*(0.081)*		*(0.061)*
Log of internet users per 100 persons_i	0.58***	0.83***	0.57**	0.77**	0.54***	0.63***	0.53***	0.89***
	(0.072)	*(0.102)*	*(0.288)*	*(0.313)*	*(0.159)*	*(0.170)*	*(0.121)*	*(0.131)*
Log of internet users per 100 persons_j	0.14	0.16	-0.03	0.08	0.16	0.17	0.46***	0.38***
	(0.175)	*(0.141)*	*(0.515)*	*(0.513)*	*(0.313)*	*(0.319)*	*(0.137)*	*(0.141)*
Constant	0.33	-2.11*	-38.20**	-47.96***	-6.44*	-7.02*	-2.87***	-4.61***
	(1.930)	*(1.169)*	*(11.717)*	*(11.888)*	*(3.515)*	*(3.742)*	*(0.935)*	*(0.972)*
gamma	0.84***	0.90***	0.76***	0.75***	0.77***	0.78***	0.87***	0.89***
	(0.015)	*(0.021)*	*(0.141)*	*(0.142)*	*(0.046)*	*(0.045)*	*(0.029)*	*(0.025)*
Log likelihood	-1393.7	-1427	-125.1	-124.65	-327	-329.3	-685.3	-702.1
Wald Chi2	642.5	374	396.9	396.2	96.4	86.71	879.1	616.3
No. of Obs.	1220	1220	108	108	280	280	702	702

Note: ***, ** and * indicate statistical significance at 1, 5 and 10 percent significance levels, respectively. Figures in italic are standard errors.

Table 5: Maximum Likelihood Estimation Results of Stochastic Frontier Model (Exports of Telecommunications Services)

	All countries	South Asia	East Asia and ASEAN	Europe and Americas
Log of exporters' real GDP	0.743***	0.863***	0.167**	0.746***
	(0.051)	*(0.248)*	*(0.084)*	*(0.062)*
Log of importers' real GDP	0.762***	0.323***	0.997***	0.694***
	(0.055)	*(0.114)*	*(0.102)*	*(0.065)*
Common language	0.668***	-0.043	-0.050	0.474**
	(0.219)	*(0.538)*	*(0.610)*	*(0.237)*
Log of distance	-0.976***	3.522***	-1.879*	-0.865***
	(0.081)	*(0.989)*	*(1.145)*	*(0.094)*
Services Trade Restrictiveness Index (STRI)	-1.762	-6.584	-5.748	-2.648
	(1.881)	*(6.456)*	*(4.554)*	*(2.007)*
FTA_services	-0.094		-0.062	-0.035
	(0.148)		*(0.466)*	*(0.186)*
Log of internet users per 100 persons_i	0.270***	0.476*	0.367***	1.025***
	(0.064)	*(0.289)*	*(0.087)*	*(0.206)*
Log of internet users per 100 persons_j	0.551***	0.323	0.746***	0.338***
	(0.128)	*(0.427)*	*(0.238)*	*(0.137)*
Constant	0.755	-37.988***	8.418	-2.131
	(1.197)	*(8.250)*	*(10.794)*	*(1.596)*
gamma	0.832***	0.944***	0.586***	0.836***
	(0.017)	*(0.071)*	*(0.092)*	*(0.023)*
Log likelihood	-1038.1	-96.8	-211.4	-445.7
Wald Chi2	728.8	89.8	263.1	427.2
No. of Obs.	1016	83	201	559

Note: ***, ** and * indicate statistical significance at 1, 5 and 10 percent significance levels, respectively. Figures in italic are standard errors.