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The Role of Trade Facilitation in Central Asia: A Gravity Model

by

Jesus Felipe
Utsav Kumar
Asian Development Bank*

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Levy Economics Institute
P.O. Box 5000
Annandale-on-Hudson, NY 12504-5000
http://www.levyinstitute.org

ABSTRACT
With a decrease in formal trade barriers, trade facilitation has come into prominence as a policy tool for promoting trade. In this paper, we use a gravity model to examine the relationship between bilateral trade flows and trade facilitation. We also estimate the gains in trade derived from improvements in trade facilitation for the Central Asian countries. Trade facilitation is measured through the World Bank's Logistic Performance Index (LPI). Our results show that there are significant gains in trade as a result of improving trade facilitation in these countries. These gains in trade vary from 28 percent in the case of Azerbaijan to as much as 63 percent in the case of Tajikistan. Furthermore, intraregional trade increases by 100 percent. Among the different components of LPI, we find that the greatest increase in total trade comes from improvement in infrastructure, followed by logistics and efficiency of customs and other border agencies. Also, our results show that the increase in bilateral trade, due to an improvement in the exporting country's LPI, in highly sophisticated, more differentiated, and high-technology products is greater than the increase in trade in less sophisticated, less differentiated, and low-technology products. This is particularly important for the Central Asian countries as they try to reduce their dependence on exports of natural resources and diversify their manufacturing base by shifting to more sophisticated goods. As they look for markets beyond their borders, trade facilitation will have an important role to play.

Keywords: Central Asia; Gravity Model; Trade Facilitation

JEL Classifications: F10, F15, F17

1. Introduction

As formal trade barriers, tariff as well as non-tariff, have come down, issues related to trade facilitation have caught the attention of policymakers. WTO (1998) defines trade facilitation as "the simplification and harmonization of international trade procedures, including the activities, practices, and formalities involved in collecting, presenting, communicating, and processing data and other information required for the movement of goods in international trade."[1] More generally, trade facilitation refers to the ease of moving goods across borders. This includes efficiency of customs administration and other agencies, quality of physical infrastructure as well as telecommunications, and a competent logistics sector. The importance of trade facilitation has also been recognized within the framework of the WTO, and negotiations were launched on trade facilitation in July 2004. This paper measures the impact of trade facilitation measures on trade flows with a focus on Central Asia.[2]

A challenge for all the Central Asian countries has been to generate sustainable economic growth by reducing reliance on natural resources and diversifying the economy into manufacturing activities through a process of structural transformation (Felipe and Kumar 2010). All the Central Asian countries, except Georgia, are also landlocked. Lack of a coastline increases the time and cost of transportation as well as the dependence on the quality of the infrastructure network across the region as a whole, particularly that of the neighboring countries. As the Central Asian countries strive to diversify their manufacturing base and seek markets beyond their own borders, it is imperative that an enabling environment comprising (but not limited to) a good infrastructure network, efficient customs and other agencies, and a well developed logistics industry are made available to facilitate trade across borders. Improvement in trade facilitation measures translates into gains in trade; the latter in turn contribute to income growth which

[1] Taken from ADB (2009). ADB. 2009. *CAREC Transport and Trade Facilitation—Partnership for Prosperity*. Manila

[2] For Purposes of our analysis, the Central Asian region includes the following countries: Armenia, Azerbaijan, Kazakhstan, Kyrgyz Republic, Mongolia, Tajikistan and Uzbekistan..

enhances human development (Wilson et al., 2003). It is in the context of the overall impact on economic growth that trade assumes importance.

In this paper, we examine the relationship between bilateral trade flows and trade facilitation (TF) as well as estimate the gains in trade from improvements in trade facilitation in the Central Asian countries. We estimate the gains in trade using a gravity model of bilateral trade flows rather than relying on a computable general equilibrium approach. A key issue relates to the definition and measurement of trade facilitation. In this paper we use the World Bank's Logistic Performance Index (LPI), World Bank (2007a), as a measure of trade facilitation.

Our results show that there are significant gains in trade from improving trade facilitation in Central Asian countries. These gains in trade vary from 28% in the case of Azerbaijan to as much as 63% in the case of Tajikistan. Furthermore, intra-regional trade increases by 100%. Overall, while exports increase more than imports, most of the gains in total trade come from imports.

The LPI also allows us to identify the effect of different components of TF. We find that the greatest increase in total trade comes from improvement in infrastructure, followed by logistics and efficiency of customs and other border agencies.

We also find that the role of trade facilitation differs within the manufacturing sector: a bilateral trade increase that results from an improvement in trade facilitation is higher in highly sophisticated, more differentiated and high-technology products.

The rest of the paper is organized as follows. Section 2 reviews some of the characteristics of the Central Asian countries as well as the economic challenges that they face. Section 3 provides a discussion of the previous work on gravity models as well as the work on the role of trade facilitation. Section 4 discusses the estimation strategy and the key estimation issues. Section 5 provides an overview of the data. Section 6 presents

the results as well as estimates of the gains in trade derived from improvement in trade facilitation in Central Asia. Section 7 concludes and provides policy implications.

2. Central Asia's Growth Challenges and Regional Integration

Since independence, the Central Asian economies have faced the challenge of how to generate sustained economic growth through a process of structural transformation and reduced reliance on natural resources. As shown in Figure 1, exports of natural resources constitute the bulk of total trade in the case of some of the Central Asian countries. As much as three-fourths of Azerbaijan's exports and two-thirds of Kazakhstan's are accounted for by natural resources.[3] The process of structural transformation involves a change in what a country produces and a shift away from low-productivity, low-wage activities to high-productivity and high-wage activities. A very clear example of structural transformation is found in Asian economies such as the PRC, Vietnam, Malaysia, or the NIEs. The output and employment structures are changing very fast in the direction of high value-added sectors.

While the resource-rich Central Asian countries will continue to rely on natural resources as the driver of economic growth, this has long term implications. First, is the well known problem of the so-called Dutch disease. This refers to the negative effect that natural resources tend to have on a country's growth prospects. Resource exports cause the country's currency to appreciate making manufacturing activities uncompetitive. These, however, might have had the potential to induce structural change. Second, reliance on natural resources exposes the country to the vagaries of international markets. Third, abundance in natural resources poses the problem of resource management and rent seeking.

Fourth, resource-rich countries make for "bad neighbors" because of limited spillovers to surrounding countries. This is important from the perspective of promoting greater

[3] Natural resource exports covers SITC Rev 2 categories 0, 2, 3 and 4 which are food and live animals chiefly for food, crude materials (inedible) except fuels, mineral fuels and related materials, and animal and vegetable oils, fats and waxes, respectively.

regional integration among the Central Asian countries. Notwithstanding the standard arguments about trade creation and trade distortion, enhancing intra-regional trade may offer better potential for export upgrading than extra-regional trade. Increasing trade within the same geographical region can be more conducive to diversification, structural change and industrial upgrading than trade with countries outside the region. It is not only the relative pace of trade expansion but also the composition of intra-regional exports that makes regional integration a promising strategy for accelerating economic development. Recent literature (e.g., Hausmann et. al, 2007) has shown that the composition of exports impacts long-term growth. In other words, countries with a more sophisticated export basket tend to grow faster. Such a strategy relying on regional integration will require regional production networks, a spatially coordinated expansion of regional infrastructure, and better trade facilitation to encourage greater and timely flows of goods across borders.

Table 1 examines the extent of regional integration, as measured by intra-regional trade, among the Central Asian countries. Intra-regional trade in Central Asia is lower than within other regional arrangements such as the EU or ASEAN. Intra-regional trade in manufacturing products accounted for only 1.6% of the total trade of Central Asian countries in 2005, as opposed to 68% and 25% in case of the EU and ASEAN, respectively.

Figure 2 shows the average un-weighted tariff rates for different groups of countries categorized by income, and for a mixed group of countries in Central Asia, the CAREC countries.[4] In all countries, including those in the CAREC region, tariffs have fallen rapidly over the last decade. Tariffs in the CAREC countries are just above those of the high income countries and far below those of the middle income and low income countries. While tariffs are not prohibitively high in the CAREC countries, all of them are

[4] The Central Asia Regional Economic Cooperation (CAREC) includes: Afghanistan, Azerbaijan, Kazakhstan, the Kyrgyz Republic, Mongolia, Tajikistan, Uzbekistan and the Chinese autonomous regions of Xinjiang Uygur and Inner Mongolia.

landlocked which substantially increases trading cost and time as well as dependence on infrastructure beyond one's own borders.

The Central Asian countries, however, perform poorly when it comes to artificial non-tariff barriers. These barriers take the form of inefficient customs administration and other border agencies, long-delays at the ports, transit fees, unofficial payments, poor physical infrastructure, and absence of a competent logistics sector. Artificial non-tariff barriers, such as those listed above, pose significant obstacles to trade. For example, using the World Bank's Doing Business Survey (World Bank, 2007b), the cost of exporting (importing) a 20-foot container from/to is among the highest for the Central Asian countries (see Figure 3).

Figure 4 provides a comparison of trade facilitation (measured by the LPI) in the Central Asian countries with other countries. Not only are the Central Asian countries ranked the lowest in terms of the overall index but are also at the bottom of the list when we compare different components of LPI (see Figure 5). Clearly, there is scope for improving trade facilitation in the region.

3. Literature Review

Gravity models are a widely used empirical approach to model bilateral trade flows. The first empirical attempt to explain trade flows by the market size of the trading partners and the distance between them goes back to Tinbergen (1962) and Pöyhönen (1963).[5] The standard specification of the gravity model estimation involves GDP per capita (to account for intra-industry trade and level of income), a measure of remoteness (this captures the idea that it is the relative cost of trading that matters), adjacency and geographical characteristics such as being landlocked. In this paper, we add a variable to examine the impact of trade facilitation on bilateral trade flows. Recent developments in

[5] Anderson (1979) and Anderson and van Wincoop (2003) provide theoretical foundations for the gravity model confirming its usefulness in empirical testing of bilateral trade flows.

the literature focus on choosing the right estimation procedure. We discuss some of the estimation issues and the new developments in the next section.[6]

Using a gravity model approach, Wilson et al. (2003) find that enhancing facilitation in the Asia-Pacific Economic Cooperation (APEC) countries will increase intra-APEC trade by as much as $254 billion or a 21% increase. In a follow up paper (Wilson et al., 2005), using global bilateral trade data, the authors show that improving the different components of trade facilitation increases trade flows by $377 billion.

Djankov et al. (2006) use data on time taken to export and import from the World Bank's Doing Business Survey to estimate the impact of delays on trade. They show that each additional day taken to move the goods from the firm's warehouse to the ship reduces trade by at least 1%. This is equivalent to increasing the distance of a country from its trade partners by 70 km.

Limão and Venables (2001) show that deterioration in the infrastructure from the median to the 75th percentile reduces trade volumes by 28%, which is equivalent to being 1,627 km away from trading partners. Fink et al. (2005) show that international variations in bilateral communications costs have a significant influence on bilateral trade flows. Hertel and Mirza (2009) show that trade facilitation reforms in South Asia translate into a 75% increase in intra-regional trade and a 22% increase in trade with the other regions.

In general, past studies on trade facilitation using different measures (either incorporating all the possible dimensions of trade facilitation or by focusing on the specific components) show that there are gains in trade from improving trade facilitation. Wilson et al. (2003, 2005) include different measures from a variety of sources to include the different components of trade facilitation. Djankov et al. (2006) use time taken to export

[6] An alternative to using the gravity model approach is to use CGE models to estimate the gains in trade from improved trade facilitation. CGE models involve modeling trade facilitation as a reduction in the costs of international trade or an improvement in the productivity of the international transportation sector (Wilson et al., 2003).

and import, from the World Bank's Doing Business Survey, to measure the ease of moving goods from firm's warehouse to the ship. Other studies quoted above use different components of trade facilitation. Hertel and Mirza (2009), like this paper, use the World Bank's LPI (World Bank, 2007a) to capture the quality of trade facilitation. LPI and its sub-components provide the first cross-country assessment of the logistics gap. It provides a comprehensive picture of the different aspects of trade facilitation, ranging from customs procedures to logistics costs, infrastructure quality to competency of the domestic logistics industry.

There are, however, important differences between this study and that of Hertel and Mirza (2009). First, we tackle directly the problems arising from zero trade observations by using a sample selection estimation procedure. Hertel and Mirza (2009) do not include zero trade observations in their sample.[7] This might result in biased estimates arising from sample selection, an issue which we discuss in the next section. Second, while looking at the different components of LPI we incorporate them in the same equation, whereas Hertel and Mirza (2009) estimate a different equation for each component. This allows us to compare the effectiveness of the different components of LPI directly. Third, we use 2005 data (Hertel and Mirza's (2009) use 2001 data) for 140 countries (Hertel and Mirza (2009) use a sample of 95 countries).

4. Estimation Strategy

The gravity model that we estimate is as follows:

$$\ln(T_{ij}) = \beta_0 + \beta_1 \ln(d_{ij}) + \beta_2 \ln(GDP_i) + \beta_3 \ln(GDP_j) + \beta_4 \ln(GDPpc_i) + \beta_5 \ln(GDPpc_j) + \beta_6 \ln LPI_i + \beta_7 \ln LPI_j + \beta_8 Landlocked_i + \beta_9 Landlocked_j + \beta_{10} Border_{ij} + \beta_{11} \ln remote_i + \beta_{12} \ln remote_j + \varepsilon_{ij} \quad (1)$$

where i denotes the exporter and j denotes the importer. The variables are defined as follows. The dependent variable, T_{ij}, is the bilateral trade flow in manufacturing products

[7] Their sample comprises of 95 countries which translates into 8,930 bilateral trading pairs. The number of observations they report is only 3,614.

from country i to country j.[8] D_{ij} is the distance between countries i and j. Size is captured by the gross domestic product of the exporting (and the importing) country, GDP_i (GDP_j). $GDPpc_i$ ($GDPpc_j$) is the GDP per capita of the exporting (and the importing country). LPI_i (LPI_j) is the logistics performance index of the exporter (and the importer). We are most interested in the coefficients of LPI, our measure of trade facilitation. Landlocked is a dummy variable that takes on the value 1 if either the exporting (i) or the importing (j) country is landlocked, and 0 otherwise. Border is also a dummy variable that takes on the value 0 if the trading partners share a common border, and 0 otherwise.[9]

In a seminal paper, Anderson and van Wincoop (2003) argue that bilateral trade is determined by *relative* trading costs. In other words, it is not just the distance between the two countries that matters; but also the bilateral distance *relative* to the distance of the pair from their other trading partners. For example, consider two trading pairs, Australia-New Zealand and Portugal-Slovakia. The distance between the trading partners in the two pairs is similar. However, both Portugal and Slovakia have other trading partners close by, whereas Australia and New Zealand do not. In other words, Australia and New Zealand have fewer alternatives and therefore are likely to trade more with each other. One way to control for the relative trading cost or the multilateral resistance term is to use importer and exporter fixed effects. The main focus of this paper is to study the impact of trade facilitation, which is measured at the country level. Using importer and exporter fixed effect will wipe out the effect of trade facilitation due to perfect multicollinearity. Instead, we control for remoteness using the $remote_i$ ($remote_j$) variable for the exporting country (and the importing country). It is defined as the GDP-weighted average distance

[8] We also estimate the model using total trade and find that our results are qualitatively similar. However, we restrict ourselves only to the bilateral trade in manufacturing products. This is because trade facilitation measures for enhancing trade in natural resources are unlikely to be the same as for manufacturing goods. For example, a gas pipeline will be exclusively used for exporting gas whereas improvements in domestic logistics will help the manufacturing sector at large.

[9] We do not consider the issue of "closed borders" or the "quality of the border," i.e., countries that share a border but, due to disputes, the border might be closed for trading purposes; or countries might share a border but may be unusable due to geographic difficulties (e.g., mountains separating them).

to all other countries (Figure 6 compares the remoteness of a selected group of countries). Except for the indicator variables, all the other variables used are in logarithm.

A key issue estimating gravity models is how to deal with zero bilateral trade. Approximately 30% of the observations in our sample are zeros. This is important both theoretically and econometrically. Theoretically, zero trade might not be missing information and zero-trade may actually be reflecting the absence of any trade between country pairs. If the zero trade data were randomly distributed, there would be little need to worry about the issue. Figure 7 shows the distribution of zero trade across four different sub-regions of the world. Clearly, the zeros are not randomly distributed, which leads to the problem of selection bias if zero trade observations were to be dropped. In other words, one needs to correct for the sample selection problem as zero trade might be conveying important information. Recent papers such as Helpman et al. (2008) provide theoretical underpinnings for zero trade. These papers argue that zero trade arises because of the presence of fixed costs associated with establishing trade flows.

Econometrically, it is well known that zero values of the dependent variable can create large biases (Tobin, 1958) and therefore, the choice of the estimation procedure becomes important. Past studies using the gravity models suggest different ways of treating zero trade observations. Common approaches include simply discarding them from the sample (truncation), or adding a constant factor to each bilateral trade flow data so that zero trade data does not drop out of the sample when working with logarithms. However, when moving from a truncated sample to a sample containing zero values it is important to change the estimation procedure and acknowledge the presence of zeros in the sample. Not doing so will result in estimates being biased downwards. One such estimation procedure is the Tobit technique. Limão and Venables (2001) used a Tobit estimator to take into account the censored nature of the data. They replaced the zero trade observations with the minimum value of trade flows in the sample.

More recently, Santos Silva and Tenreyro (2006) show that a log linear model estimated by OLS leads to biased estimates in the presence of a heteroscedastic error term (a

consequence of Jensen's inequality). They recommend using a Poisson Pseudo Maximum Likelihood (PPML) estimator. Martin and Pham (2008) argue that while the PPML estimator solves the problem of heteroscedasticity, it yields biased estimates when zero trade values are frequent. Martin and Pham argue that standard threshold-Tobit estimators perform better as long as the heteroscedastic nature of the error term is taken into account adequately. They show that Heckman Maximum Likelihood estimators also perform well if true identifying restrictions are available.

In this paper, we use the Heckman Maximum Likelihood (ML) estimator and use common language, colonial ties and common colonizer as the exclusion restrictions. Common language captures the cost related to cultural and linguistic barriers between two countries. A firm exporting to a foreign country with connections from the past is likely to be able to face lower fixed costs of entry into that country, as it does not incur large adjustment costs arising from the unfamiliarity and the insecurity related to transaction contingencies. All the three are indicator variables. Common language takes the value 1 if importer and exporter share a common language and zero otherwise. If importer (or exporter) colonized its trading partner, then colonial ties takes the value 1 and 0 otherwise, and if both importer and exporter shared a common colonizer then common colonizer takes the value 1 and 0 if not.

5. Data Sources

Data used in this paper comes from a variety of sources. The key data on bilateral trade flows comes from Gaulier et. al (2008) for the year 2005.[10] BACI data contains bilateral trade flow data for almost 5,000 products (6-digit Harmonized System) and 200 countries. BACI data is based on the COMTRADE database. Each bilateral trade flow is a weighted average of the exports and the corresponding mirror flow (adjusted for CIF). Estimated qualities of reporting data are used as weights in the averaging of exports and the corresponding mirror flows. Our key results are based on bilateral trade flows of

[10] Dataset is referred to as BACI (Base pour l'Analyse du Commerce International) in the paper.

manufacturing goods corresponding to SITC Rev 2 categories 5 to 8 except 68.[11] Given the data availability for other countries, especially the LPI, we are left with 140 countries. This results in 19,460 observations. According to the documentation accompanying the BACI dataset, data does not include trade flows below US$ 1,000. Consequently, after aggregating manufacturing trade flows, any trade flow less than US$ 1,000 is treated as zero trade.

We use GDP and GDP per capita for the year 2004 (to address any reverse causality concerns) and both are measured in PPP terms. They are taken from the World Development Indicators. Remoteness is calculated as the GDP-weighted average distance to all other countries. Landlocked, common border, common language, colonial ties and colonizer come from CEPII.

The key variable of interest in this paper is the measure of trade facilitation. We use the World Bank's Logistic Performance Index (World Bank, 2007a). We use the overall LPI as well as examine the impact of its components separately. LPI is a composite measure comprised of 7 components: efficiency of customs and other border agencies, quality of transport and information technology (IT) infrastructure, ease and affordability of international shipments, competence of local logistics industry, ability to track and trace, domestic logistics costs (this component is not used in the overall LPI as reported), and timeliness of shipments in reaching destination. LPI is provided on a 5-point scale.

As shown in Table 2, these variables are highly correlated and any specification that includes all the six components (domestic logistics is not used) will suffer from multicollinearity problems. This will result in some of the components being statistically insignificant or having a perverse sign. To avoid this problem we aggregate the components into 3 categories: customs efficiency, infrastructure, and logistics. Customs

[11] Concordance from CEPII (Centre d'Etudes Prospectives et d'Informations Internationales) and Jon Haveman.
(http://www.macalester.edu/research/economics/page/haveman/Trade.Resources/tradeconcordances.html) , with modifications, is used to map HS-6 to SITC Rev 2 (4-digit).

efficiency and infrastructure correspond to efficiency of customs and other border agencies, and quality of transport and IT infrastructure respectively. Logistics is a simple average of ease and affordability of international shipments, competence of local logistics industry, and the ability to track and trace.

Table 3 presents the summary statistics. The average trade flow within Central Asia is almost 36 times smaller than that of the whole world. Countries in Central Asia region are well below the world average for the LPI and its components (see Figures 4 and 5). In our sample of 140 countries, there are 28 landlocked countries of which 7 are in Central Asia.[12]

6. Results

6.1 Estimation Results

Table 4 shows the results from the estimation of equation 1. Estimates from the Heckman ML estimation, our preferred estimator, are presented in Column 4. The first two columns of Table 4 show the OLS estimates of equation 1 on the truncated sample, and the censored OLS model in logarithms (with 1 added to all values of the dependent variable to avoid the log-of-zero problem). Column 3 presents the results from Tobit estimation, which replaces zero trade values in the sample with the minimum of the sample. Comparing the coefficients in Columns 1 and 2 with those in Column 3 confirms that in the case of a sample containing zero trade values, standard estimation procedures are likely to bias downwards the estimated coefficients.

Column 4 presents the main results of the paper and the beta coefficients (to allow for direct comparison of the importance of different variables) are shown in Table 5. Our

[12] Our sample has 19,460 bilateral trade observations. Of these, 432 have a common border with each other, 1,590 share a common language, 266 had a trading partner which colonized the other trading partner, and 1,546 share a common colonizer. Out of 42 trading relationships in Central Asia, 12 have a common border, 2 share a common language, none had colonial ties with their partners, but 30 of them (all the trading pairs excluding Mongolia) shared a common colonizer (note that the definition of colonizer here is as defined in CEPII).

results are in line with the results found previously in the literature. Specifically, decrease in distance by 1% increases trade by 1.56%. The size of the trading partners positively impacts trade flows. While GDP per capita of the exporter has a positive and a statistically significant impact on trade flows, GDP per capita of the importer does not have any impact. Landlocked exporters (importers) trade 25% (38%) less than coastal exporters (importers). Countries with a common border trade 2.4 times more than countries that do not share a common border. In other words, having a common border is equivalent to a reduction in distance of about 3,147 km (evaluated at the mean distance). Remoteness of the exporter has a positive and a statistically significant impact on trade flows. Other things equal, if country A is farther from the rest of the world than country B by 1%, then A's exports to (imports from) a common third country C will be higher than those of B by 0.43% (1.13%).

Our key variable of interest is LPI. We find that an improvement in trade facilitation (LPI) of the exporting country by 1% increases exports by 5.5%. Trade facilitation of the exporter has a higher impact on trade flows. An improvement in trade facilitation (LPI) of the importing country by 1% boosts imports by 2.8%. [13]

Column 5 shows the results using total trade as the dependent variable rather than trade in manufacturing goods. Results using total trade as the dependent variable are qualitatively similar to the ones obtained using trade in manufacturing goods only. The difference lies in the magnitude of the coefficients of our variables of interest, namely the LPI of the exporter and the importer. While LPI for the exporter is lower for total trade, LPI for the importer is higher. There is no a priori reason to expect why the LPI of the exporter should matter any less or why the LPI of the importer should matter more in the case of

[13] We also estimate a specification with an additional variable, log of tariffs (results not shown). The data on MFN tariffs is taken from CEPII's MacMap database. Tariffs at the product level are averaged using the corresponding share in total imports by country A from country B. We lose significant number of observations due to lack of data on tariffs as well as lose the "square matrix" nature of our sample. We no longer have 139 trading partners for each country. However, our results continue to hold qualitatively even in the reduced sample.

total trade when compared with trade in manufacturing products. Since the difference between the two columns is the trade in primary commodities, clearly that seems to be the driving force. As discussed above, trade facilitation measures in the case of primary commodities are likely to be different from those required for manufacturing products which may be causing the difference in the estimated coefficients. We try to uncover these differences across sectors in section 6.3 where we examine the role of trade facilitation across different sectors.

We also examine the impact of the individual components of LPI. As discussed in section 5 due to potential multicollinearity, we use three categories of LPI—customs, infrastructure, and logistics. Estimation results are presented in Table 6. The first column reports the estimated coefficients, and the second shows the beta coefficients. Coefficients on other variables are qualitatively similar to the benchmark result reported in Table 4.

As expected, customs efficiency of the exporter has no impact on trade flows. It is the customs efficiency of the importer, where all the documentation takes places, that matters. Our results show that an improvement in customs efficiency of the importing country by 1% improves trade flows by 1.04%. On the exporter side, it is infrastructure that seems to have the greatest impact on trade flows, followed by the logistics of the exporting country. On the other hand, for the importing country it is customs that matter the most. Infrastructure and logistics of the importing country have a positive and a statistically significant impact on trade flows but the impact is smaller than that derived from improvement in customs efficiency.

Estimation results discussed above suggest that trade facilitation plays a very significant role in enhancing trade flows. Further, different aspects of trade facilitation impact trade differently. In the next section, we quantify the gains in trade from improvements in trade facilitation.

6.2 A "What-if" exercise

To quantify the effects of improvements in trade facilitation we do a simple "what-if" exercise. The design of the exercise follows Wilson et al. (2003). The gravity model results discussed above show that trade facilitation has a statistically significant trade-enhancing effect. In this section we show that the gains are economically significant as well. We quantify the potential increase in trade (both total trade and intra-regional trade) derived from improving the overall LPI as well as from improving the different components of LPI. This will shed light on differences in benefits from various aspects of trade facilitation and inform policymakers about gains from different kinds of trade facilitation measures.

Figures 4 and 5 show that trade facilitation in Central Asia, as measured by the LPI, is among the poorest in the world and far below the average (Table 3). Some of the trade facilitation measures, especially those related to infrastructure, are costly and time consuming to implement. As a result, improvement in trade facilitation and its various components in the Central Asian countries may happen in a phased manner rather than as a one-off improvement in trade facilitation. Taking into account this feasibility aspect, the exercise estimates the effect on total trade of improvement in the LPI of all the Central Asian countries (as exporters and importers) *up to halfway* of the distance between each country's LPI and the average of all countries in the sample. Consequently, the extent of the improvement in LPI differs across the different countries. For example, Tajikistan, which has the lowest LPI, sees the highest improvement. The Kyrgyz Republic, which has the highest LPI among the Central Asian countries, has the smallest increase in LPI.

Further, the estimated gains in trade are calculated taking into account improvements in a country's LPI as an exporter, and also considering the improvement in its trading partners' index. Note that the gravity equation contains the LPI of both the exporter and the importer. For example, Azerbaijan's exports increase as a result of improving its trade

facilitation but also as a result of the improvement in its trading partners trade facilitation (i.e., those importing from Azerbaijan) in Central Asia.[14]

Table 7 shows the gains in total trade with the rest of the world (exports plus imports) from improvement in the overall LPI are significant. Overall trade of the Central Asian countries increases by 44%. Tajikistan's total trade increases by as much as 63%, followed by Mongolia, 51%, Armenia, 49%, Kazakhstan and Uzbekistan, 47%, Kyrgyz Republic, 34%, and Azerbaijan's total trade increases by 28%. Increase in total trade due to increase in imports is higher, as shown in Columns 2 and 3 of Table 7. This is because imports are a greater share in total trade than exports. Column 1 of Table 5 shows that the exporter's estimated coefficient on LPI is higher than that of the importer. This is reflected in the change in exports and imports seen separately (Table 8) and as expected exports increase more than imports. Central Asia's exports increase by 74% and imports by 36%.

We also calculate the gains in intra-regional trade and find that intra-Central Asian trade (from improvements in LPI) increases by as much as 100% (by construction, both intra-Central Asian exports and imports increase by 100%). Change in intra-Central Asian trade for the nine countries is shown in Table 9 (Table 10 shows the changes in exports and imports).

Use of LPI as a measure of trade facilitation allows us to look at the different aspects of the trade facilitation agenda such as customs efficiency, infrastructure and logistics. Table 6 shows the estimated coefficients for the different components using the gravity model. We estimate the gains in trade by repeating the same "what-if" exercise discussed above, except that this time each of the three components, in the case of the Central Asian countries, are improved to halfway of the sample average for the respective component. Table 11 shows the gains in trade. The largest gains in total trade come from improvement in infrastructure, followed by logistics and then improvement in the

[14] Azerbaijan benefits from improvements in LPI of its trading partners in Central Asia only because LPI is assumed to change only for countries in the Central Asia.

customs efficiency of customs and other border agencies. However, one has to keep in mind the cost aspect, time taken to complete, and ease of implementation. Regional infrastructure will bring the maximum gains but the time taken to complete infrastructure projects, costs involved and political economy issues of cross-border infrastructure projects need to be weighed in. On other hand, improving customs efficiency, though it results in smaller gains, may be easier to achieve as it relies largely on domestic reforms and are less costly to implement.

6.3 Results by sector

The results so far discuss the gains in manufacturing sector trade from improving trade facilitation. However, the importance of trade facilitation might differ across different sectors within manufacturing. Table 12 shows the results of the gravity model estimated for seven different sectors within the manufacturing sector. Here we discuss only the coefficients on the trade facilitation measures, for all other variables results are similar as in the benchmark regression. Column 1 of Table 12 reproduces the benchmark results from Column 4 of Table 4. Column 2 shows the estimates using primary commodity exports.[15] The LPI of the exporting country in the case of primary commodity exports has less impact on trade flows than in the case of trade in manufacturing goods. This is also reflected in the lower coefficient of LPI for exporter when using total trade in Column 5 of Table 4. This could be due to different trade facilitation requirements in the case of primary exports.

Within the manufacturing sector (columns 3 to 8, Table 12) we find that the LPI of the exporting country for textiles & garments (column 3) and metals (column 4) has a similar or a lower impact on bilateral trade flows than for total manufacturing trade. In the rest of the sectors, with the exception of chemicals (column 5), LPI of the exporting country has

[15] Primary commodities correspond to SITC Rev 2 categories 0 to 4 and 68. These correspond to food and live animals chiefly for food (SITC Rev 2 category 0), beverages and tobacco (SITC Rev 2 category 1) crude materials (inedible) except fuels (SITC Rev 2 category 2), mineral fuels and related materials (SITC Rev 2 category 3), animal and vegetable oils, fats and waxes (SITC Rev 2 category 4), and non-ferrous metals (SITC Rev 2 category 68).

a greater impact on trade flows than for total manufacturing trade. In all sectors, the impact of LPI of the importing country is similar to that for overall manufacturing. This highlights that the trade facilitation measures in the exporting country are more important and this difference is greater in sectors such as machinery (column 6), transport (column 7), and medical apparatus and optical instruments etc (column 8).

In Table 13, we present results for manufacturing goods classified according to their sophistication level (PRODY), use of high technology, and degree of differentiation.[16] Our main focus is on the LPI variables and results on other variables are similar to those in the benchmark regression. In Columns 1 and 2 of Table 13, we classify products as being highly sophisticated if they are in the top quartile of the sophistication distribution and less sophisticated if they are in the first quartile. We find that trade facilitation in the case of the exporting country has a greater influence in the case of high PRODY products (Column 1) than in the case of low PRODY products (Column 2) and for total manufacturing exports (benchmark regressions).[17] Among the manufacturing sectors, most of the goods under machinery, transport, medical apparatus and optical instruments etc., and a few of the chemical sector fall into high PRODY category. On the other hand, most of the goods in textiles & garments fall into the low PRODY category.

In Columns 3 and 4 products are classified as high-tech and low-tech. We find that the LPI of the exporting country matters more in the case of the high-tech products.[18] In the case of the high PRODY products and high technology products, LPI of the importing country has a smaller impact on trade flows than in the case of overall manufacturing trade flows (see benchmark regression). On the other hand, in the case of the low

[16] Sophistication of the product (PRODY) is computed as the weighted average of the GDP per capita of all countries exporting that product, where the weight reflects the revealed comparative advantage of the respective country in that product (see Hausmann et al. (2007) for further details).

[17] If we also classify products as being more sophisticated if their PRODY is above median in the distribution of PRODYs and less sophisticated if PRODY is below the median, our results continue to hold qualitatively.

[18] Classification of goods as high technology goods comes from OECD (2008). We assume the rest, i.e. the non-high technology products, to be low technology products.

PRODY and the low technology products, we find the opposite to be true i.e., LPI of the importing country matters more for bilateral trade. In fact, in the low technology and the low PRODY products, LPI of the importing country matters more.

Finally, in columns 5 to 7 three groups of products are formed using the classification developed by Rauch (1999).[19] This classification uses all products and not just manufacturing sector. This classification categorizes products as being homogeneous and differentiated. The homogenous goods are in turn divided into two categories—goods traded on organized exchanges (e.g., commodities traded on London metal exchange such as lead, steel, copper, aluminum) and goods not traded on organized exchanges but still have a reference price (e.g., some chemicals). Our results show that trade facilitation measures of the exporting country matter more for differentiated goods (Column 5). In the case of the homogeneous goods (both traded on commodity exchanges and those with a reference price), LPI of the importing country matters more. This could be due to the fact that for commodities with organized exchanges and reference prices, there is little role of trade facilitation and hence less incentive to improve the trade facilitation measures in the exporting country. In the case of the differentiated goods, on the other hand, trade facilitation measures by the exporting country act as a differentiation mechanism from other countries.

In general, our results in Tables 12 and 13 show that an improvement in the exporting country's trade facilitation leads to a greater increase in bilateral trade in more sophisticated goods, high technology products and more differentiated commodities.

7. Conclusions and policy implications

[19] Rauch (1999) classification is available online at http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/Data/Classification/rauch_classification_rev2.xlsx. Some products that did not match with our trade data were dropped. We use the liberal classification which maximizes the products categorized as homogeneous. Results using Rauch's conservative classification are qualitatively similar. It is to be noted that categorization of products as highly sophisticated and high technology is based on HS-6 classification, Rauch classification is based on SITC Rev 2.

Using a standard gravity model of bilateral trade flows, augmented to include a measure of trade facilitation, we show that trade facilitation has a positive and a statistically significant impact on bilateral trade flows. We also look at the different components of trade facilitation. Our results show that, on the exporter side, infrastructure has the greatest impact on trade flows; and on the importer side, customs efficiency has the greatest impact on trade flows.

Our focus in this paper has been on the gains in trade in the case of the Central Asian countries. These countries are ranked the lowest in terms of trade facilitation on the basis of the World Bank's cross-country LPI. Overall trade in the Central Asian countries increases by 44% from improvements in LPI and intra-Central Asia trade doubles. The increase in exports is greater than imports. However, because the share of imports in total trade is higher imports contribute a larger share of the increase in total trade. In terms of the different components, infrastructure improvements lead to the largest gains in trade, followed by logistics and then customs. However, the gains should be weighed against the ease of implementing. For example, from a short term perspective, improvements in customs efficiency are relatively easier and cheaper to implement as opposed to infrastructure. Though improvements in customs efficiency may deliver quicker results, infrastructure is very important from the perspective of Central Asian countries, especially given their landlocked nature. In what is a corollary of our findings, developing regional infrastructure will provide transport corridors for trade within and outside the region, help reduce trading time, further integrate countries in the region as well with the rest of the world.

Further, our results show that the gains in trade resulting from improvement in trade facilitation differ within the manufacturing sector. Increase in bilateral trade, due to an improvement in the exporting country's LPI, in more sophisticated, more differentiated and high technology products is higher than the increase in trade in less sophisticated, less differentiated and low technology products. This is particularly important for the Central Asian countries as they try to reduce dependence on natural resources, diversify manufacturing and move towards higher value added. This will require these countries to

have access to international markets and in doing so trade facilitation has an important role to play.

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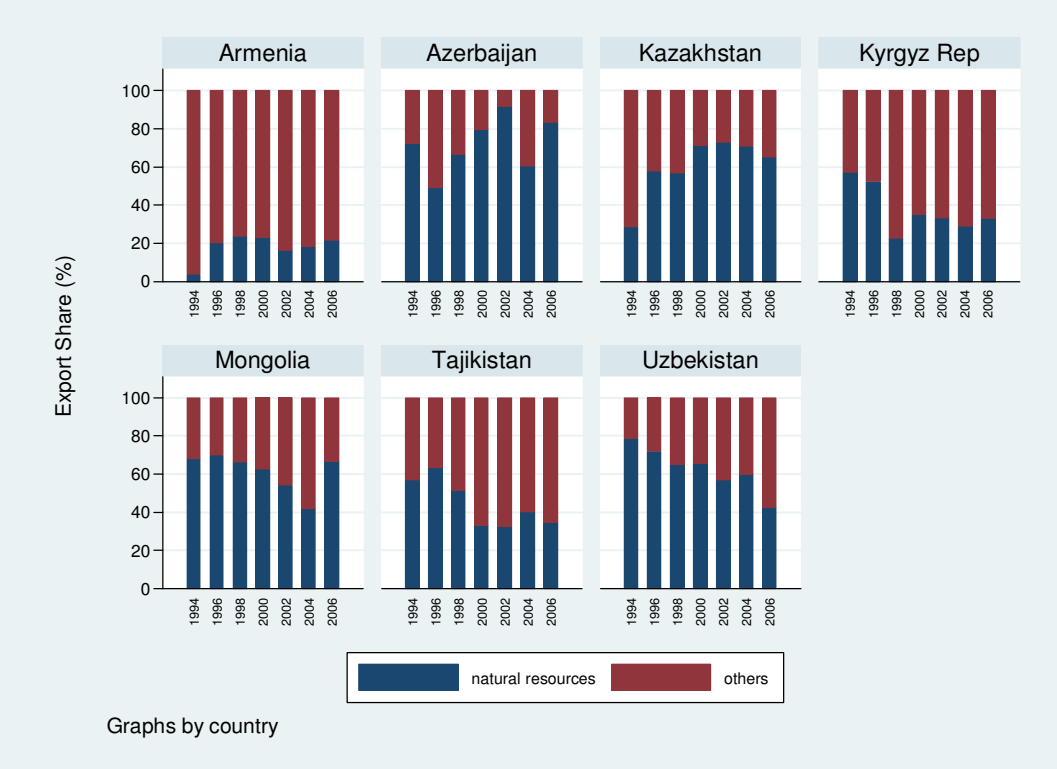
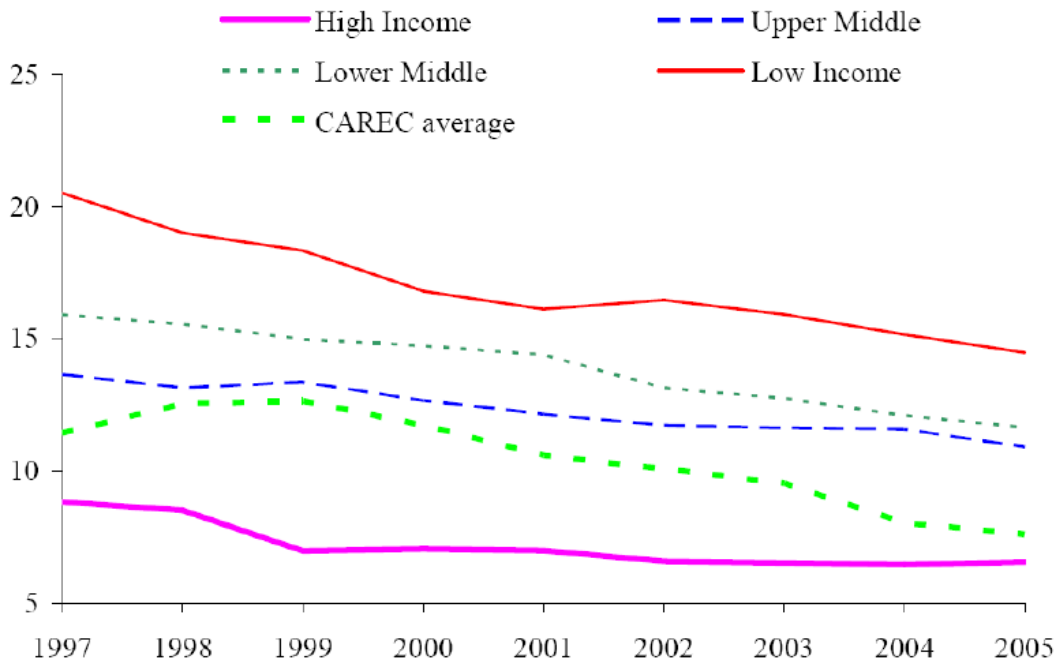
Figure 1: Share of natural resources in total trade



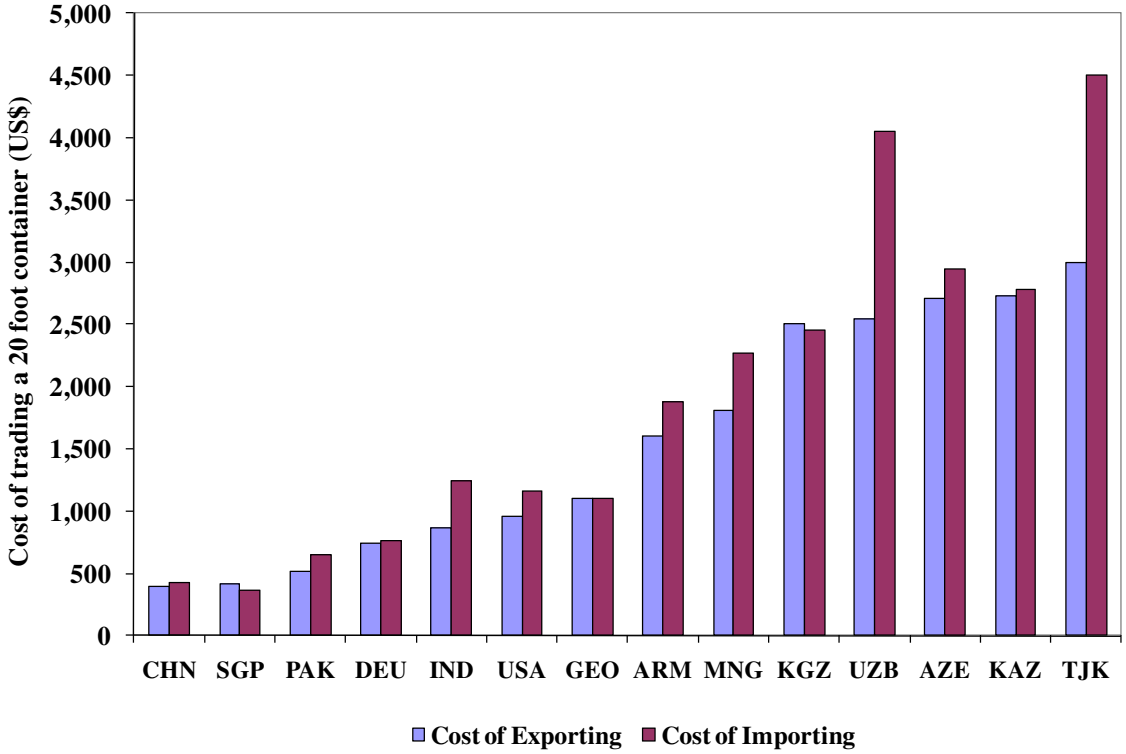
Source: UN COMTRADE

Figure 2: Tariff in CAREC countries



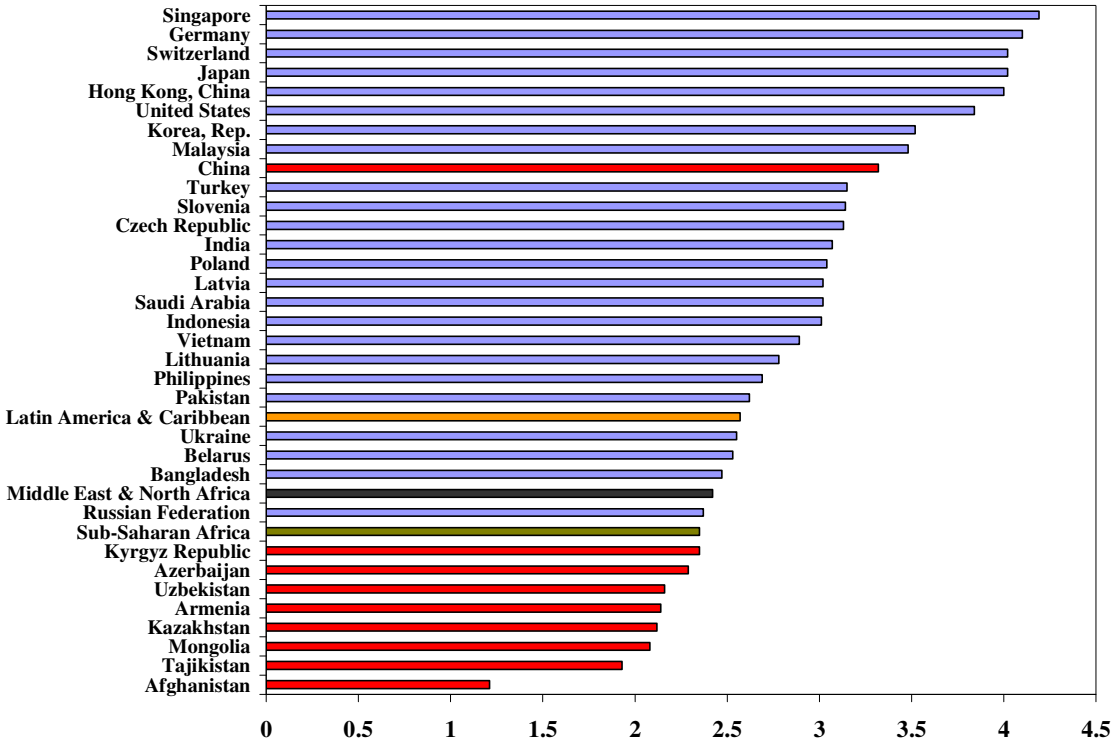
Source: van der Ploeg and Venables (2009)

Figure 3: Cost of trading a 20-foot container



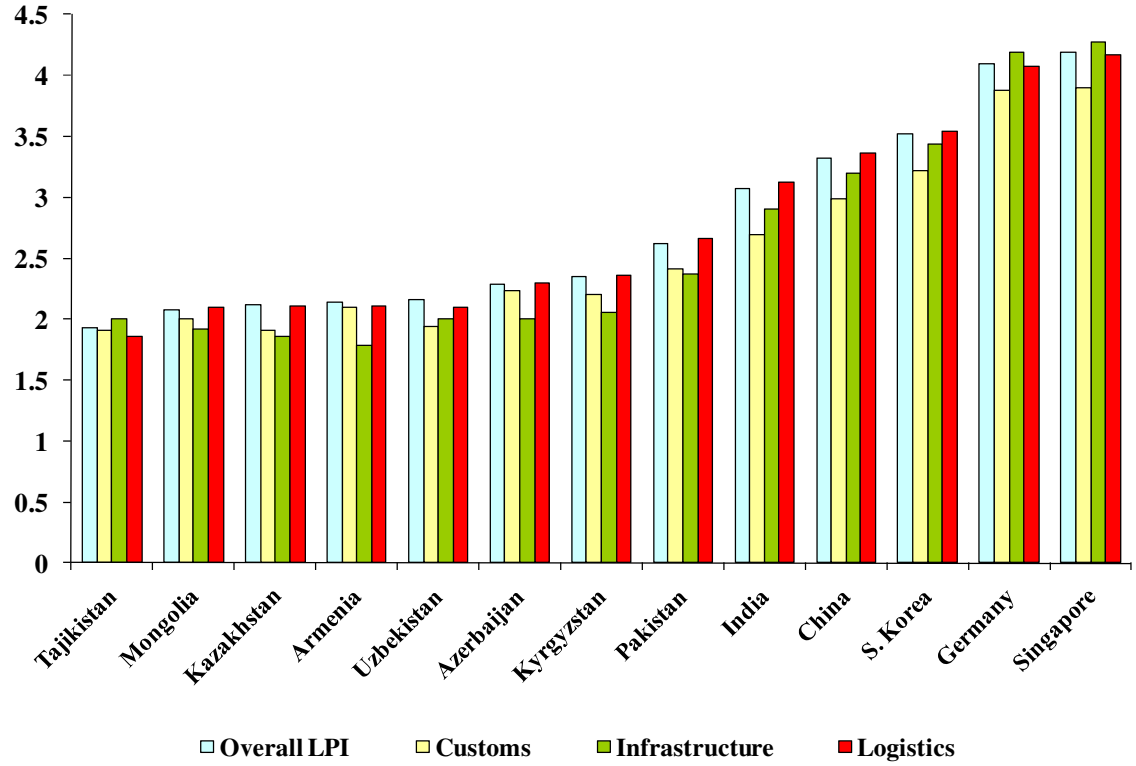
Source: World Bank (2007b).

Figure 4: Overall Logistics Performance Index (LPI), a measure of trade facilitation (TF) in Central Asian countries vis-à-vis other countries



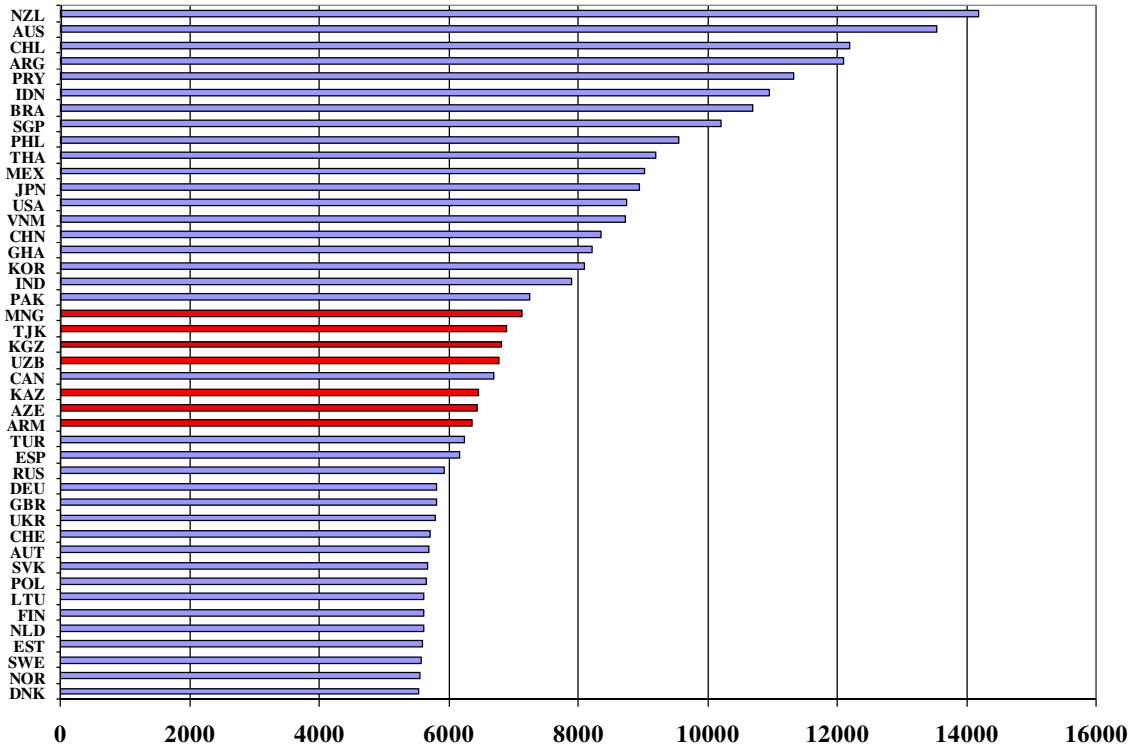
Source: World Bank (2007a)

Figure 5: Components of LPI



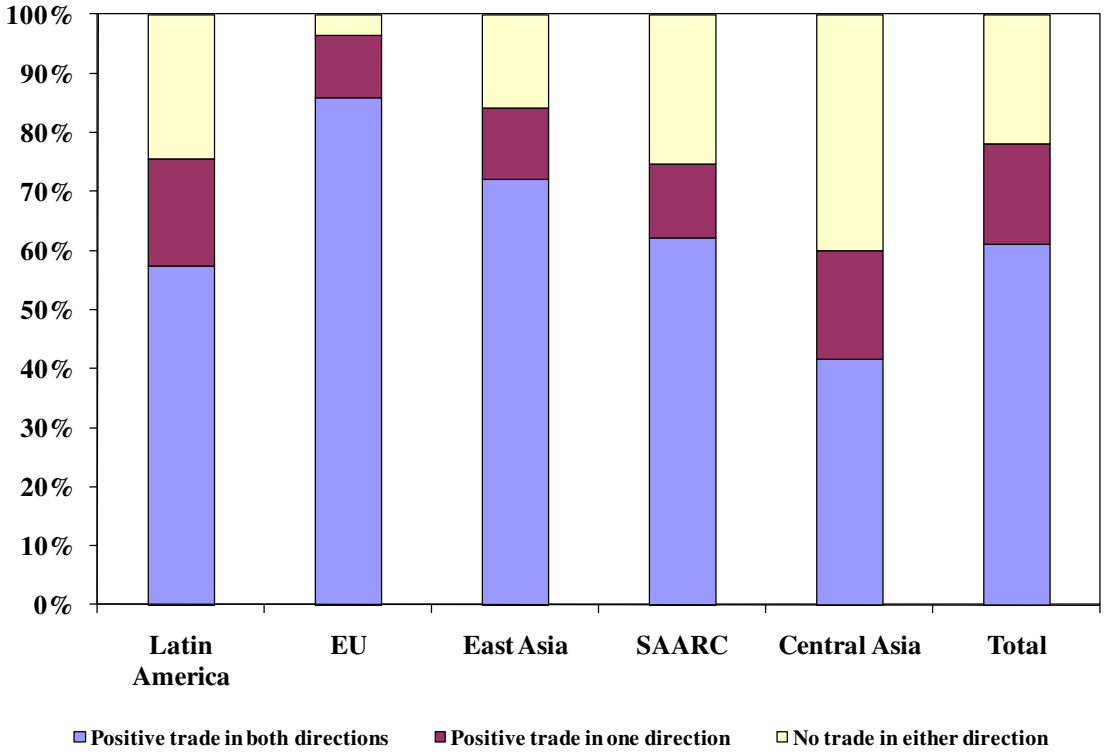
Source: World Bank (2007), authors' calculations

Figure 6: Remoteness



Source: World Bank, CEPII, authors' calculations

Figure 7: Zero trade by region



Source: BACI, authors' calculations

Table 1: Intra-regional trade in Central Asia vis-à-vis other regions

	% of total trade which is intra-regional	% of trade in manufacturing goods which is intra-regional
Central Asia	4.8	1.6
ASEAN	27.4	25.3
SAARC	5.3	4.1
EU-27	63.7	68.3
Latin America	19.4	14.7

Source: BACI, authors' calculations

Table 2: Correlation between overall LPI and its components

	Overall LPI	Customs	Infrastructure	Ease of arranging international shipments	Competence of local logistics	Ability to track and trace	Timeliness of shipments
Overall LPI	1						
Customs	0.97	1					
Infrastructure	0.97	0.96	1				
Ease of arranging international shipments	0.96	0.91	0.91	1			
Competence of local logistics	0.98	0.94	0.94	0.94	1		
Ability to track and trace	0.97	0.93	0.93	0.91	0.94	1	
Timeliness of shipments	0.93	0.88	0.87	0.86	0.88	0.89	1

Source: World Bank (2007a), authors' calculations

Table 3: Summary Statistics (Averages shown)

	Overall (1)	**Intra-Central Asia (2)**
Bilateral trade	US$ 333m	US$ 9.2m
Distance (bilateral)	7,353 km	2,033 km
GDP	US$ 373 bn	US$ 37.2 bn
GDP per capita	US$ 10,896	US$ 3250
LPI	2.743	2.153
Customs	2.551	2.041
Infrastructure	2.581	1.946
Logistics	2.725	2.133
Remoteness	7,920 km	6,687 km
No. landlocked countries	28	7
Number of trading pairs		
Contiguous	432	12
Common Language	1,590	2
Colonial Ties	266	0
Common Colonizer	1,546	30

Source: BACI, CEPII, World Bank, authors' calculations

Notes: 1. Common language data is from CEPII (Centre d'Etudes Prospectives et d'Informations Internationales). According to this database, Kazakhstan and the Kyrgyz Republic are the only two countries in the CAREC region that share a common official language, Russian. The database lists up to three official languages, in the cases where more than one language is spoken. If any of these official languages are shared by any other country, then the two are said to have a common language. Even if one were to use as a variable language spoken by the people, only in the case of Kazakhstan and the Kyrgyz Republic at least 20% of the population speaks a common language.

2. Data on common colonizer is from CEPII. This database defines common colonizer in fairly general terms. Two countries are said to have colonial ties if, independently of their level of development, one has governed the other over a long period of time and has contributed to the current state of its institutions. So, if two countries have had colonial ties with a common third country, they are said to have a common colonizer. In the case of the CAREC countries (except Afghanistan, provinces of the PRC, and Mongolia), because some of them were formed from the former Soviet Union, they are taken as having a common colonizer because of the common influence from the Soviet period.

Table 4: Gravity Model

	Dependent Variable: Log of Bilateral Trade flows (Manufacturing Sector)				*Total Trade*
	OLS: Truncated Sample	**OLS: log (1+trade)**	**Tobit**	**Heckman: Manufacturing Trade**	**Heckman: Total Trade**
	(1)	(2)	(3)	(4)	(5)
Log Distance	-1.53***	-1.43***	-1.78***	-1.56***	-1.50***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)
Log GDP Exporter	1.03***	1.01***	1.34***	1.07***	1.01***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Log GDP Importer	0.73***	0.74***	0.99***	0.75***	0.81***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Log GDPpc Exporter	0.03	0.13***	0.24***	0.05**	0.02
	(0.03)	(0.03)	(0.04)	(0.02)	(0.02)
Log GDPpc Importer	-0.00	0.04*	0.06*	0.002	-0.09***
	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Log LPI-Exporter	5.33***	6.30***	6.83***	5.46***	4.29***
	(0.16)	(0.15)	(0.20)	(0.15)	(0.14)
Log LPI-Importer	2.60***	3.58***	4.38***	2.77***	3.23***
	(0.15)	(0.15)	(0.20)	(0.14)	(0.14)
Common Border	0.87***	1.05***	0.83***	0.87***	0.87***
	(0.12)	(0.17)	(0.20)	(0.12)	(0.12)
Landlocked-Exporter	-0.26***	-0.44***	-0.60***	-0.29***	-0.23***
	(0.05)	(0.04)	(0.07)	(0.05)	(0.05)
Landlocked-Importer	-0.47***	-0.42***	-0.56***	-0.48***	-0.57***
	(0.05)	(0.05)	(0.07)	(0.05)	(0.05)
Log Remoteness-Exporter	0.44***	0.27***	0.23**	0.43***	1.52***
	(0.08)	(0.09)	(0.11)	(0.09)	(0.08)
Log Remoteness-Importer	1.13***	0.85***	0.98***	1.13***	0.62***
	(0.09)	(0.09)	(0.12)	(0.09)	(0.09)
Constant	-45.74***	-46.46***	-61.67***	-47.60***	-50.61***
	(1.19)	(1.23)	(1.59)	(1.25)	(1.20)
Observations	13525	19460	19460	19460	19460
Censored Observations	5935	5935	5935	5935	5009

Notes: Common language, colony, and colonial ties are used as exclusion restrictions for Heckman ML estimation. ***,**,* indicate statistical significance at 1%, 5% and 10% respectively.

Table 5: Benchmark specification and beta coefficients

Dependent Variable: Log of Bilateral Trade flows (Manufacturing Sector)		
	Estimated Coefficient (1)	**Beta Coefficient (2)**
Log Distance	-1.56***	-0.25
Log GDP Exporter	1.07***	0.45
Log GDP Importer	0.75***	0.32
Log GDPpc Exporter	0.05**	0.01
Log GDPpc Importer	0.002	0.0004
Log LPI-Exporter	*5.46****	*0.24*
Log LPI-Importer	*2.77****	*0.12*
Common Border	0.87***	0.03
Landlocked-Exporter	-0.29***	-0.02
Landlocked-Importer	-0.48***	-0.04
Log Remoteness-Exporter	0.43***	0.02
Log Remoteness-Importer	1.13***	0.05
Observations	19,460	
Estimated coefficients are the ones reported in Column 4 of Table 3. ***,**,* indicates statistical significance at 1%, 5% and 10%		

Table 6: Gravity Model using components of LPI and beta coefficients

Dependent Variable: Log of Bilateral Trade Flows (Manufacturing Sector)		
	Estimated Coefficient (1)	**Beta Coefficient (2)**
Log Distance	-1.55***	-0.25
	(0.028)	
Log GDP Exporter	1.06***	0.45
	(0.013)	
Log GDP Importer	0.76***	0.32
	(0.013)	
Log GDPpc Exporter	-0.02	-0.005
	(0.03)	
Log GDPpc Importer	-0.02	-0.005
	(0.02)	
Log Customs- Exporter	-0.001	-0.00003
	(0.26)	
Log Customs- Importer	1.04***	0.05
	(0.26)	
Log Infrastructure- Exporter	3.09***	0.16
	(0.28)	
Log Infrastructure- Importer	0.86***	0.04
	(0.27)	
Log Logistics- Exporter	2.19***	0.10
	(0.26)	
Log Logistics- Importer	0.75***	0.03
	(0.25)	
Common Border	0.90***	0.03
	(0.12)	
Landlocked-Exporter	-0.24***	-0.02
	(0.05)	
Landlocked-Importer	-0.45***	-0.04
	(0.05)	
Log Remoteness-Exporter	0.36***	0.02
	(0.09)	
Log Remoteness-Importer	1.11***	0.05
	(0.09)	
Observations	19,460	

Notes: Heckman ML estimation procedure is used (constant is included but not shown here). Common language, colony, and colonial ties are used as exclusion restrictions. ***,**,* indicate statistical significance at 1%, 5% and 10% respectively.

Table 7: Gains in total trade from improvement in overall LPI

	% change in total trade	Due to exports	Due to imports
	(1)	(2)	(3)
Armenia	49.2 (15.3)	25.5	23.7
Azerbaijan	28.4 (9.6)	3.2	25.2
Kazakhstan	46.8 (14.3)	16.6	30.2
Kyrgyz Republic	34.1 (16.0)	12.3	21.8
Mongolia	50.8 (23.5)	18.6	32.2
Tajikistan	62.5 (15.7)	11.2	51.3
Uzbekistan	46.6 (11.7)	20.3	26.3
Numbers in brackets are percentage point increase in total trade as share of GDP in 2005			

Table 8: Change in total exports and imports from improvement in overall LPI

	As Exporter	*As Importer*
	% Change in total exports	% Change in total imports
Armenia	72 (7.9)	37 (7.4)
Azerbaijan	54 (1.1)	27 (8.5)
Kazakhstan	76 (5.1)	39 (9.2)
Kyrgyz Republic	62 (5.8)	27 (10.2)
Mongolia	81 (8.6)	42 (14.9)
Tajikistan	105 (2.8)	57 (12.9)
Uzbekistan	73 (5.1)	37 (6.6)
Numbers in brackets are percentage point increase in exports or imports as share of GDP in 2005		

Table 9: Gains in intra-Central Asia trade from improvement in overall LPI

	% change in total trade	Due to exports	Due to imports
	(1)	(2)	(3)
Armenia	108.8	52.6	56.3
Azerbaijan	95.3	26.7	68.6
Kazakhstan	100.8	49.0	51.8
Kyrgyz Republic	88.0	51.7	36.3
Mongolia	115.2	4.0	111.2
Tajikistan	115.8	3.7	112.1
Uzbekistan	103.5	70.2	33.3

Table 10: Change in intra-Central Asia exports and imports from improvement in overall LPI

	As Exporter	*As Importer*
	% Change in exports to Central Asian countries	% Change in imports from Central Asian countries
Armenia	109	109
Azerbaijan	88	98
Kazakhstan	107	95
Kyrgyz Republic	84	95
Mongolia	111	115
Tajikistan	137	115
Uzbekistan	104	103

Table 11: Gains in total trade from improvement in different components of LPI

	% change in total trade		
	Infrastructure (1)	**Customs (2)**	**Logistics (3)**
Armenia	33.6	6.9	17.2
Azerbaijan	14.1	6.9	7.8
Kazakhstan	24.4	12.8	14.7
Kyrgyz Republic	19.7	7.8	10.4
Mongolia	22.4	10.4	15.3
Tajikistan	18.1	14.5	20.6
Uzbekistan	21.3	11.5	16.7
Each cell shows the percent increase in total trade (exports + imports) from improvement in different components of LPI			

Table 12: Estimates of gravity model using sector level trade

	Dependent variable: log of bilateral trade flows (overall or sectoral as specified)							
	All manufacturing goods	Primary products	Textiles & garments	Metals	Chemicals	Machinery	Transport	Medical appartus & optical instruments
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Distance	-1.56***	-1.39***	-1.59***	-1.81***	-1.72***	-1.53***	-1.65***	-1.17***
	(0.03)	(0.03)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.03)
Log GDP Exporter	1.07***	0.78***	1.08***	1.22***	1.00***	1.00***	1.17***	0.97***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Log GDP Importer	0.75***	0.76***	0.67***	0.68***	0.82***	0.75***	0.65***	0.78***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Log GDPpc Exporter	0.05**	-0.16***	-0.70***	-0.01	0.21***	-0.05	-0.20***	0.02
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Log GDPpc Importer	0.00	-0.13***	0.22***	0.10***	-0.03	0.13***	0.08**	0.18***
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)
Log LPI-Exporter	5.46***	3.46***	5.46***	3.45***	4.52***	8.60***	7.21***	7.85***
	(0.15)	(0.17)	(0.20)	(0.19)	(0.18)	(0.18)	(0.25)	(0.20)
Log LPI-Importer	2.77***	2.54***	2.64***	1.84***	1.28***	2.05***	2.26***	2.29***
	(0.14)	(0.16)	(0.19)	(0.18)	(0.17)	(0.17)	(0.22)	(0.17)
Commom Border	0.87***	1.09***	0.73***	1.05***	0.83***	0.90***	0.90***	0.85***
	(0.12)	(0.12)	(0.14)	(0.13)	(0.12)	(0.13)	(0.15)	(0.12)
Landlocked-Exporter	-0.29***	-0.30***	-0.29***	0.05	-0.33***	-0.03	0.21**	0.19***
	(0.05)	(0.06)	(0.07)	(0.07)	(0.06)	(0.06)	(0.08)	(0.07)
Landlocked-Importer	-0.48***	-0.66***	-0.43***	-0.68***	-0.43***	-0.20***	-0.56***	0.02
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.06)
Log Remoteness-Exporter	0.43***	2.60***	1.07***	0.28***	0.47***	0.48***	0.61***	0.51***
	(0.09)	(0.10)	(0.11)	(0.11)	(0.10)	(0.10)	(0.13)	(0.10)
Log Remoteness-Importer	1.13***	-0.12	0.90***	1.64***	2.14***	1.25***	0.97***	0.99***
	(0.09)	(0.10)	(0.11)	(0.11)	(0.10)	(0.10)	(0.14)	(0.11)
Constant	-47.61***	-45.65***	-47.21***	-50.51***	-56.20***	-52.26***	-50.23***	-56.66***
	(1.25)	(1.37)	(1.65)	(1.61)	(1.47)	(1.45)	(1.94)	(1.51)
Observations	19460	19460	19460	19460	19460	19460	19460	19460
Censored Observations	5935	7329	9537	9856	9749	8471	11308	11405

Notes: Heckman ML estimation procedure is used (constant is included but not shown here). Common language, colony, and colonial ties are used as exclusion restrictions. ***,**,* indicate statistical significance at 1%, 5% and 10% respectively.

Table 13: Estimates of gravity model using different product classifications

	Dependent variable: log of bilateral trade flows of goods grouped according to various classifications						
	PRODY Classification		OECD (2008) Classification		Rauch (1999) Classification		
	Above 75th percentile PRODY	Below 25th percentile PRODY	High technology	Low technology	Differentiated goods	Reference price goods	Goods traded on commodity exchanges
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Log Distance	-1.62***	-1.52***	-1.35***	-1.52***	-1.54***	-1.63***	-1.50***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Log GDP Exporter	0.99***	1.13***	1.00***	1.01***	0.99***	1.03***	0.84***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Log GDP Importer	0.79***	0.68***	0.79***	0.81***	0.71***	0.77***	0.84***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)
Log GDPpc Exporter	0.26***	-0.34***	-0.03	0.01	-0.14***	0.14***	0.04
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Log GDPpc Importer	0.10***	-0.04	0.15***	-0.09***	0.05**	0.02	-0.27***
	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Log LPI-Exporter	7.55***	2.96***	8.37***	4.11***	6.77***	3.11***	0.84***
	(0.17)	(0.18)	(0.20)	(0.14)	(0.14)	(0.16)	(0.20)
Log LPI-Importer	1.87***	3.11***	2.19***	3.18***	2.75***	2.20***	3.44***
	(0.16)	(0.17)	(0.18)	(0.14)	(0.14)	(0.16)	(0.20)
Commom Border	0.78***	0.96***	0.79***	0.85***	0.89***	1.05***	0.95***
	(0.12)	(0.13)	(0.13)	(0.12)	(0.12)	(0.12)	(0.14)
Landlocked-Exporter	0.15***	-0.42***	0.19***	-0.25***	-0.34***	-0.55***	-0.20***
	(0.06)	(0.06)	(0.07)	(0.05)	(0.05)	(0.06)	(0.07)
Landlocked-Importer	-0.25***	-0.58***	-0.07	-0.60***	-0.48***	-0.67***	-0.55***
	(0.05)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.07)
Log Remoteness-Exporter	0.58***	0.54***	0.57***	1.58***	0.88***	1.24***	2.96***
	(0.09)	(0.10)	(0.10)	(0.09)	(0.08)	(0.09)	(0.12)
Log Remoteness-Importer	1.54***	0.98***	1.11***	0.64***	0.91***	1.26***	0.39***
	(0.10)	(0.10)	(0.11)	(0.09)	(0.09)	(0.10)	(0.12)
Constant	-57.28***	-42.57***	-55.83***	-51.05***	-47.21***	-53.74***	-54.69***
	(1.37)	(1.48)	(1.57)	(1.21)	(1.21)	(1.35)	(1.71)
Observations	19460	19460	19460	19460	19460	19460	19460
Censored Observations	9047	7949	10099	5082	5936	8000	8870

Notes: Heckman ML estimation procedure is used (constant is included but not shown here). Common language, colony, and colonial ties are used as exclusion restrictions. ***,**,* indicate statistical significance at 1%, 5% and 10% respectively.