Trading on Time

Simeon Djankov

Caroline Freund

Cong S. Pham*

Abstract We determine how time delays affect international trade, using newly-collected data on the days it takes to move standard cargo from the factory gate to the ship in 98 countries. We estimate a difference gravity equation that controls for remoteness, and find significant effects of time costs on trade. We find that each additional day that a product is delayed prior to being shipped reduces trade by more than one percent. Put differently, each day is equivalent to a country distancing itself from its trade partners by about 70 km on average. We control for potential endogeneity using a sample of landlocked countries and instrument for time delays with export times that occur in neighboring countries. We also find that delays have an even greater impact on exports of time-sensitive goods, such as perishable agricultural products. Our results highlight the importance of reducing trade costs (as opposed to tariff barriers) to stimulate exports.

JEL codes: F13, F14 and F15

Keywords: difference gravity equation, time costs

---

* Simeon Djankov and Caroline Freund are from the World Bank and Cong S. Pham is from the School of Accounting, Economics and Finance, Deakin University, Australia. Corresponding author: Caroline Freund, World Bank, 202-458-8250 cfreund@worldbank.org. We thank Andrew Bernard, James Harrigan, Bernard Hoekman, Amit Khandelwal, Stephen Redding, Dani Rodrik, Alan Winters, two anonymous referees, and seminar participants at Dartmouth, the Georgia Institute of Technology, the New York Federal Reserve Bank and the World Bank for comments, and Marcelo Lu and Darshini Manraj for collecting the data.

Introduction

It takes 116 days to move an export container from the factory in Bangui (Central African Republic) to the nearest port and fulfill all the customs, administrative, and port requirements to load the cargo onto a ship. It takes 71 days to do so from Ouagadougou (Burkina Faso), 93 from Almaty (Kazakhstan), and 105 from Baghdad. In contrast, it takes only 5 days from Copenhagen, 6 from Berlin, 16 from Port Louis (Mauritius), and 20 days from Shanghai, Kuala Lumpur or Santiago de Chile. Our goal is to estimate whether and how these diverse trade costs affect trade volumes. In the process, we introduce and utilize new data on trade costs. The data are collected from 345 freight forwarders, port and customs officials operating in 126 countries. We use data on the average time it takes to get a 20-foot container of an identical good from a factory in the largest business city to a ship in the most accessible port.

We use a difference gravity equation to estimate the effect of trade costs on trade. The difference gravity equation evaluates the effect of time delays on the relative exports of countries with similar endowments and geography, and facing the same tariffs in importing countries. Comparing exports from similar countries to the same importer allows us to difference out importer effects (such as remoteness and tariffs) that are important to trade. For example, we examine whether Brazilian/Argentine exports to the United States are decreasing in Brazilian/Argentine time costs of trade, after controlling for the standard determinants of trade, such as relative size, relative distance, and relative income.

An important concern is that the volume of trade may directly affect trade costs. The marginal value of investment in trade facilitation may be higher when the trade

volume is large since cost savings are passed on to a larger quantity of goods. In addition, many time-saving techniques, such as computerized container scanning, are only available in high-volume ports. Thus, while more efficient trade facilitation stimulates trade, trade is also likely to generate improved trade facilitation.[1] Alternatively, larger trade volumes could increase congestion and lessen the efficiency of trade infrastructure, leading to a positive estimated effect of time costs on trade. As an example of the latter, when trade volumes surged in China in 2003, the wait time at Shanghai's port expanded by 2 days on average. Using Chinese data from 2002 and 2003 would therefore show a positive correlation between delays and trade. In 2004, as a result of the delays, 12 loading berths were added and export times declined. These considerations make it important to distinguish correlation from causation. The difference specification reduces the problem of endogeneity to the extent that major differences in the trade facilitation process, which result from income and trade, come largely from regional variation.

Next, to identify the effect of trade costs on trade, we report the results instrumenting for the time of exporting. We use a sample of landlocked countries and use as an instrument the export time from the border and onto the ship in the neighboring country(ies), i.e. we exclude all domestic time costs. The idea is that while trade volumes may affect trade times, it is unlikely that trade volumes affect export times in foreign countries, especially since landlocked countries are small and tend to provide only a fraction of the trade going through the foreign port.

Finally, as an alternative way to eliminate the potential endogeneity problem, we estimate a "difference-in-difference" equation. The technique we use evaluates the

[1] For example, Hummels and Skiba (2004) provide evidence that trade volumes affect the timing of adopting containerized shipping and reduce shipping costs.

interactive effect of time sensitivity and time delays on trade flows, controlling for exporter and industry fixed effects. The intuition is that long delays present an even greater hurdle to exporters of time sensitive products. This follows the strategy in Romalis (2004), Levchenko (2007) and Cunat and Melitz (2007) who examine the effect of endowments, institutions, and labor flexibility, respectively, on trade. The advantage of this specification is that we can see whether lower trade costs stimulate relatively more exports in time-sensitive categories. The identification problem may still be present if enhanced trade in time-sensitive industries leads to better trade facilitation, though this is less likely since these products make up a small share of total trade.

Our estimates imply that each additional day that a product is delayed prior to being shipped reduces trade by more than one percent. Put another way, each additional day is equivalent to a country distancing itself from its trading partners by one percent, or about 70 km. For example, if Uganda reduced its factory-to-ship time from 58 days to 27 (the median for the sample), exports would be expected to increase 31 percent and Uganda would bring itself 2200 km closer to its main trading partners—two-thirds the distance from Kampala to Cairo.

The paper proceeds as follows. The next section discusses the data. Section III presents the estimation strategy. Section IV presents the results. Section V evaluates time-sensitive products, and Section VI concludes.

II. Data

Our data are based on answers to a detailed World Bank questionnaire completed by trade facilitators at freight-forwarding companies in 146 countries in 2005. Freight-forwarders are the most knowledgeable to provide information on trade costs since most

businesses use their services to move their products across borders. Globally, 43,000 freight-forwarding companies employ 11 million people and handle approximately 85% of foreign trade. Their services range from finding the most appropriate route for a shipment, preparing documentation to meet customs and insurance requirements, arranging payments of fees and duties, and advising on legislative changes and political developments that could affect the movement of freight. Overall, 345 trade facilitators participated in the survey, with at least two per country, and follow-up conference calls were conducted with *all* respondents to confirm the coding of the data.[2] As a further quality check, surveys were completed by port authorities and customs officials in a third of the sample (48 countries).

To document the procedures needed to export cargo, and the associated time, number of documents and signatures, we describe to the survey respondents a stylized transaction. The exporter is a local business (100% owned by nationals), has 201 employees, and is located in the country's most populous city. The exporter does not operate within an export-processing zone or an industrial estate with special export privileges. Each year, more than 10% of its sales go to international markets, i.e., management is familiar with all the trading rules and requirements. The purpose of defining the exporter specifically is to avoid special cases.

Assumptions are also made on the cargo to make it comparable across countries. The traded product travels in a dry-cargo, 20-foot, full container load. It is not hazardous

[2] Four main freight-forwarding companies participated in this survey. Panalpina, a Swiss company, provided their offices in 56 countries. Maersk Sealand, of Denmark, completed 28 surveys in northern Europe and East Asia. SDV International Logistics, of France, completed the questionnaire in 24 countries in west and central Africa. Manica, of South Africa, covered the 10 southern African countries. Independent freight-forwarders completed the survey in the remaining 18 countries, as well as second set of answers in other countries.

and does not require refrigeration. The product does not require any special phytosanitary or environmental safety standards other than accepted international shipping standards, in which cases export times are likely to be longer. Finally, every country in the sample exports this product category. These assumptions yield three categories of goods: textile yarn and fabrics (SITC 65), articles of apparel and clothing accessories (SITC 84), and coffee, tea cocoa, spices and manufactures thereof (SITC 07).

The questionnaire asks respondents to identify the likely port of export. For some countries, especially in Africa and the Middle East, this may not be the nearest port. For example, Cotonou, Benin's main port, is seldom used due to perception of corruption and high terminal handling fees.

The survey then goes through the exporting procedures, dividing them into four stages: pre-shipment activities such as inspections and technical clearance; inland carriage and handling; terminal (port) handling, including storage if a certain storage period is required; and finally customs and technical control. At each stage, the respondents describe what documents are required, where do they submit these documents and whose signature is necessary, what are the related fees,[3] and what is an average and a maximum time for completing each procedure. An example illustrates the data. In Burundi (Figure 1), it takes 11 documents, 17 visits to various offices, 29 signatures and 67 days on average for an exporter to have his goods moved from the factory to the ship.

[3] Non-fee payments, such as bribes or other informal payments to ease the process, are not considered. This is not because they do not happen – a separate section of the survey asks open-ended questions on the main constraints to exporting, including perceptions of corruption at the ports and customs. However, the methodology for data collection relies on double-checking with existing rules and regulations. Unless a fee can be traced to a specific written rule, it is not recorded.

Trade facilitation is not only about the physical infrastructure for trade. Indeed, only about a quarter of the delays in the sample is due to poor road or port infrastructure – in part because our exporter is located in the largest business city. Seventy-five percent is due to administrative hurdles - numerous customs procedures, tax procedures, clearances and cargo inspections - often before the containers reach the port. The problems are magnified for landlocked African countries, whose exporters need to comply with different requirements at each border.

Table 1 presents summary statistics of the necessary time to fulfill all the requirements for export by regional arrangement. Several patterns are seen in the data. Getting products from factory to ship is relatively quick in developed countries, taking on average only 10 days in Australia and New Zealand and 13 days in the EU. Countries in East Asia and the Pacific are also relatively efficient, taking 23 days on average in ASEAN, with Singapore taking only 6 days. In contrast, export times in Sub-Saharan Africa and the former Soviet Union (CIS) countries are especially long, taking on average more than 40 days. In addition, the variation across countries in Sub-Saharan Africa is large, ranging from 16 days in Mauritius to 116 days in the Central African Republic.

The trade data are from the UN Comtrade database. GDP and GDP per capita are from the World Bank's World Development indicators. We use data for 2001-2003, convert to constant values, and average them in order to avoid idiosyncracies in any given year, though results are very similar if we use only data for 2003 (the latest available). Trade data were not available for 20 of the 146 countries for which we have data on the time to move goods from factory to ship. Of these 126 countries, 98 were

identified as members of regional arrangements.[4] For the regressions with time-sensitive and time-insensitive goods, we use trade data for full sample of the 126 countries.

III. Estimation

We study the extent to which the time to move goods from the factory to the ship influences the volume of exports. Long time delays present a hurdle to exporting, since the exporter must expend capital on the exporting process and storage/transport of the goods during the delay. The problem is exacerbated for high-value goods, since they are effectively depreciating during the delay. Finally, long time delays are likely to be associated with more uncertainty about delivery times, further depressing exports.[5]

We estimate a single-difference gravity equation on similar exporters:

$$Ln\left(\frac{Exp_{jk}}{Exp_{hk}}\right) = \alpha + \beta Ln\left(\frac{GDP_j}{GDP_h}\right) + \varphi Ln\left(\frac{GDPC_j}{GDPC_h}\right) + \delta Ln\left(\frac{Dist_{jk}}{Dist_{hk}}\right) + \lambda Ln\left(\frac{Export\_Time_j}{Export\_Time_h}\right) + \phi(D_{jk} - D_{hk}) + \varepsilon_{jhk}, \qquad (1)$$

The dependent variable is composed of two export values with Exp_{ik} denoting exports of country i to country k. D_{ik} is a vector of control indicator variables, such as colony,

[4] Andean Community (Colombia, Ecuador, Peru and Venezuela), ASEAN (Cambodia, Indonesia, Malaysia, Philippines, Thailand and Singapore), CACM (El Salvador, Guatemala, Honduras and Nicaragua), CEFTA (Bulgaria, Czech Republic, Poland, Romania, Hungary, Slovakia and Slovenia), CEMAC (Cameroon and Central African Republic), CER (Australia and New Zealand), COMESA (Burundi, Eritrea, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Uganda and Zambia), Commonwealth of Independent States (Armenia, Azerbaijan, Belarus, Kazakhstan, Moldova, Russia and Ukraine), EAC (Kenya, Tanzania and Uganda), ECOWAS (Benin, Burkina Faso, Ghana, Côte d'Ivoire, Guinea, Mali, Nigeria, Senegal, Sierra Leone and Togo), EFTA (Iceland, Norway, Switzerland), ELL FTA (Estonia, Latvia, and Lithuania), Euro-Med (Algeria, Egypt, Jordan, Israel, Lebanon, Morocco, Syria, Tunisia, and Turkey), European Union (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and United Kingdom), MERCOSUR (Argentina, Brazil, Paraguay and Uruguay), NAFTA (Canada, Mexico, and the United States), SADC (Botswana, Malawi, Mauritius, Mozambique, Namibia, South Africa, Tanzania and Zambia), and SAFTA (Bangladesh, India, Maldives, Nepal, Pakistan and Sri Lanka). There are 7 countries that belong to more than one regional trade agreement: Kenya, Malawi, Mauritius, Namibia, Uganda, Tanzania and Zambia.

[5] The data contain information on the maximum time for exporting. To control for uncertainty, we added maximum-time and also maximum-time-less-average-time variables to the regression equation. The coefficients on these variables were not significant when either was included along with the average time variable (which remained robust) and coefficients were very similar to those reported here when they were included without the average time variable. The correlation between maximum time and average time is 0.92. This high correlation means it is difficult to pick up the individual effect of uncertainty.

language, and landlocked, associated with the exporters.[6] The advantage of the difference specification is that it differences out variable that are hard to control for in standard gravity equation, such as remoteness, while allowing the estimation of coefficients on variables at the country level.[7] Difference gravity regressions have been used by Hanson and Xiang (2004) to study the *home-market* effect and by Anderson and Marcouiller (2002) to study the role of security in international trade.

The estimating strategy depends on choosing exporters that are similar (in location and factor endowments) and face the same trade barriers in foreign markets, for example, comparing exports from Argentina to Brazil with exports from Uruguay to Brazil. Therefore, we use 18 regional trade agreements among 98 exporter countries, and consider all cases where two countries in a trade agreement export to the same importer. As a further robustness check, we eliminate country pairs that do not fall into the same of four World Bank income classifications.[8] This ensures that we are not comparing countries at different levels of development, such as Mexico and the United States or Singapore and Cambodia, but reduces the sample.

Anderson and van Wincoop (2003) highlight the role that remoteness to the rest of the world plays in determining trade patterns and argue that this should be controlled for in gravity equations. This strategy eliminates the need to control for multilateral resistance on the importer side since we compare only imports to the same country. It

[6] Thus, D_{jk}-D_{hk} is one (negative one) if the associated dummy in the numerator country is one (zero) and the associated dummy in the denominator country is zero (one), and zero otherwise. Each country pair enters only once in the regression.

[7] As a robustness check, we also included a variable for the log of the relative land area of the country pair. In small countries, the distances to ports will be small, provided the country is not landlocked. If small size countries tend to trade more for other reasons this could bias the results. The coefficient on relative size was small and not significant and our results were not affected (not reported).

[8] Classifications by per capita income are as follows: Low-income, below $825; lower-middle income, $825-$3,255; upper-middle income, $3,255-$10,065; high income, above $10,065.

also reduces the need to control for exporter remoteness because we are comparing proximate exporters that face the same trade taxes abroad. Endogeneity is also reduced because effects of trade volumes on time are likely to be much smaller between similar countries in the same geographical region—for example, we are not comparing countries in East Asia to countries in Africa. Large trade volumes have surely contributed to the development of sophisticated port facilities in Singapore and other East Asian countries. If the effect of trade on trade facilitation happens at the regional level in large discrete steps, as investing in ports tends to be lumpy, our estimation is unbiased. Indeed, we find that results from a standard gravity yield a coefficient on time of double the size, suggesting that comparing trade costs across regions is problematic. The cost of this strategy is that it reduces the variation in the time delays in exporting. This is because countries within a preferential trade agreement group are more similar in terms of tariff and procedural barriers to trade.

Endogeneity may still be a problem since relatively high export volumes within countries may lead to better or worse trade facilitation. To control for the potential effect of export volumes on export time, we also report the results using instrumental variables. We use a sample of landlocked countries and the instrument we use is the total export delay that occurs in the neighboring country(ies) as the container travels to the port. For example, this would include getting the container through customs at the border, transportation from the border to the port, and the time spent getting the container onto the ship—it does *not* include the time spent on any procedures done in the home country or transit times in the home country. In the case of Burundi, as shown in Figure 1, this is the 26 days spent on procedures 8 through 17. The intuition is that while trade volumes

may affect domestic trade times, they are less likely to affect transit times abroad, where they make up only a small share of total trade. In addition, governments in the seaside countries may be less responsive to calls from foreign producers for improved trade facilitation.

Finally, we also use a difference-in-difference specification, which takes advantage of differences in the time sensitivity of goods, as an alternate way to reduce endogeneity. After controlling for country- and industry-fixed effects, we test whether time-sensitive goods are affected to a greater extent by delays than time-insensitive goods. This approach is discussed in more detail in section V.

IV. Results

We estimate the difference gravity regression (1). The results are reported in Table 2 for the full sample of regional-trade-agreement countries and the restricted sample, which eliminates country pairs if the two are at different stages of development. Errors are adjusted for clustering on exporter pairs, since each exporter pair will be associated with numerous importers. The first column reports the results excluding the export time variable as a benchmark. In column 2 and 3, we include the variable *ratio_time*, which has a statistically significant negative impact on the volume of trade. The results imply that a 10 percent reduction in delays increases exports by about 4 percent, all else equal. The coefficients on other variables are typical in the literature and are stable with the inclusion of the time cost variable.

Next, we deal with the potential endogeneity of the variable *ratio_time* by using export time abroad for landlocked countries as an instrument. This sample includes only country pairs in the same region that are both landlocked. Because the number of

observations is limited, we use all country pairs in the same geographical region not necessarily regional agreement pairs (results are similar if we use only regional agreement members). Column 4 reports the results for the basic regression. The coefficient on relative export time is somewhat larger for the sample of landlocked countries.[9] Columns 5 and 6 report the result including export time in the neighboring country(ies) directly in the equation and also instrumenting over all time. The coefficient on time is larger, implying that delays outside the border pose an even greater burden on exports. The results imply that a one percent increase in export times in landlocked countries reduces trade by about one percent. While the effect of time costs on trade in landlocked countries is specific to the sample, the results are supportive of a significant negative effect of time costs on exports.[10]

One drawback using relative bilateral exports is that we eliminate country pairs that export to different locations. In addition, the main variable of interest is the ratio of time which varies only at the country-pair level. As a robustness test, we examine relative exports to the world, which allows us to use all country pairs and all exports within the regional groups. The disadvantage is the control group is not as carefully defined since we include exports to different partners. The results, reported in Table 3, are similar,

[9] In this specification, the coefficient on per-capita income reverses and the coefficient on income increases significantly. This is due to limited variation in per capita incomes among landlocked countries in the same region. In addition, the coefficient on contiguity increases and the coefficient on distance declines (as compared with the full sample), implying that for landlocked countries trade with neighbors is very important (relative distance is important)—but for trade outside the neighborhood, relative distance becomes less important.

[10] The relatively large coefficient on time is related to the sample—60 percent of landlocked pairs are located in Africa. We found strong evidence that the effect of delays on exports was greater in developing countries, especially in Africa (with an elasticity around -1 as in landlocked case) in estimation on bilateral data. However, different results for developing and developed countries using the aggregate data (as in Table 3) were not always significant.

implying that a 10 percent increase in the time to move goods from factory to ship reduces aggregate exports by about 3-4 percent. Results are robust to IV estimation.

Putting the results in context, the median number of days to export goods in the sample is 27, thus a one day increase in the median country is equivalent to a about a 1.3 percent increase in trade (1/27*0.35). Given that the coefficient on time is about one-fourth the coefficient on distance, we can reframe the effect in terms of distance. A one day increase in the typical export time is equivalent to about a one percent increase in distance (1/27*1/4). The median distance in the sample is 7000 km, implying that a one day increase in export time is equivalent to extending the median distance by about 70 km.

V. Time-Sensitive Exports

Time delays should have a greater effect on the export of time-sensitive goods.[11] To examine the extent to which they are hampered, we also estimate "difference-in-difference" export equation using trade data of products for which time matters the most and the least. This specification reduces the endogeneity problem coming from reverse causality because we control for country and industry fixed effects. In addition, in the case of agriculture, the products we consider account for only a tiny fraction of trade on average (less than one percent of agricultural trade) so it is unlikely they have a large effect on establishing trade facilitation processes (Table 4).

We examine the joint effect of time-sensitivity by industry and time delays by country on trade for manufacturing and agricultural goods. Time sensitivity in manufacturing is drawn from Hummels (2001), which investigates how ocean shipping

[11] In related work, Evans and Harrigan (2005) show that time-sensitive apparel products are more sensitive to distance than time-insensitive products.

times and air freight costs influence the probability that air transport is chosen. In particular, we use the estimated effect of shipping times on the probability of choosing air transport.[12] Results are reported at the SITC 2-digit level. We use estimates for 26 manufacturing industries in classifications 6, 7, and 8, as the estimating equation has the best fit for these products.

We base our selection of time-sensitive agricultural products on the information of their storage life at the HS 6-digit level (Gast, 1991). We focus on fruits and vegetables that are produced in similar areas (HS 07 and 08). We use the inverse of the median storage life to measure time sensitivity.[13] For example, the median storage life for tomatoes is 12.5 days, making them very time sensitive. In contrast, the median storage life for seed potatoes is 210 days making them relatively time insensitive.

The basic difference-in-difference regression we estimate is

$$LnExports_{ij} = \alpha_i + \alpha_j + Ln(Time\_Sensitivity_i) * Ln(Export\_Time_j) + \varepsilon_{ij}, \quad (2)$$

where *i* and *j* denote industry and exporter, respectively. The test is essentially whether exports of time-sensitive goods are more responsive to time delays than exports of time-insensitive goods. The advantage of specification is that we are controlling for exporter effects, which will pick up the overall effect of trade on time as well as other country characteristics. A negative coefficient on the interaction effect implies that an increase in the relative time to move goods from factory to ship reduces exports of time-sensitive goods by more than time-insensitive goods.

[12] There is a potential incongruity here since time-sensitive products are more likely to be shipped by air and our measure of delays is from factory gate to ship. However, much of the time delay in exporting (about 75 percent on average) is due to administrative costs, which are nearly identical for sea and air.

[13] For a list of time-sensitive and time-insensitive products see Djankov, Freund, and Pham (2006). Dried products are considered to have a storage life of 365 days.

Table 4 presents the results for time-sensitive manufacturing and agricultural goods. The first columns reports the basic regression for manufactures. The coefficient on the interaction term is always negative and significant, implying that an increase in export time reduces exports of time-sensitive goods by relatively more. Countries with longer delays are associated with relatively lower exports of time-sensitive goods. In column 2, we report the results controlling for the interactions between skill intensity and skill abundance and between capital intensity and capital abundance (as in Romalis 2004). The results are robust and the endowment variables have the expected signs. In columns 1 and 2, we report Beta coefficients which show how a standard deviation in the independent variable affects the dependent variable in standard deviations of the dependent variable. The interactive effect of time is similar in magnitude to the effect of capital abundance and capital intensity. Column 3 reports standard coefficients using a dummy for time sensitive goods and interacting it with ln(export time). To distinguish time-sensitive goods from time-insensitive goods, we create a dummy which is one if the coefficient on shipping time is positive and significant. From this specification, we can interpret the results as a ten percent increase in time reduces exports of time-sensitive manufacturing goods by more than 4 percent, all else equal.

A potential concern is that trade time is picking up general effects of the business climate that might make trade in time-sensitive goods, which may also be high value goods, less likely to be produced. To control for this issue, we also include interactions between the trade sensitivity dummy and measures of business regulation. The measures we use are on the number of procedures to start a business (Djankov et. al. 2002) and the efficiency of the labor market (Botero et al. 2004). Results are reported in column 4.

The coefficient on the interaction between trade delays and time sensitivity does not change much and remains significant. Neither of the new interactions is significant. This suggests that the effect of delays on production of time-sensitive goods is really about delay and not about other features of the climate for doing business. This is not to say that institutions do not affect trade, only that they do not affect significantly relative exports of time-sensitive to time-insensitive goods.[14]

Results for agricultural products in the difference-in-difference gravity specification are reported in columns 5-7. The coefficient on the interaction term is always negative and significant. We also report the results of using a dummy to reflect time sensitivity, where the product is time sensitive if storage life is less than four weeks. We find that a ten percent increase in time reduces exports of time sensitive agricultural products by about 3½ percent. Finally, we include interactions of measures of the business climate with time sensitivity and do not find a relationship (column 7), suggesting the effect of delays on exports of time-sensitive agricultural goods is not picking up a more general effect of an efficient business climate on composition.

Poor trade facilitation affects the composition of trade, preventing countries from exporting time-sensitive agricultural and manufacturing goods. Time-sensitive goods also tend to have higher value, implying that some of the effect of time delays on *aggregate* exports results from countries with poor trade facilitation concentrating on low-value time-insensitive goods. Taken together, our results suggest that time delays depress exports, at least part of which is due to compositional effects.

VI. Conclusions

[14] Freund and Bolaky (forthcoming) show that a restrictive business climate reduces the gains from trade because resources cannot move to their most efficient uses.

We use a new dataset on the time it takes to move containerized products from the factory gate to the ship in 126 countries. A difference gravity equation is first estimated, by regressing relative exports of similar countries—by location, endowment, and facing the same trade barriers abroad—on relative time delays, and other standard variables. Our results imply that on average each additional day of delay reduces trade by at least one percent. We find a larger effect on time-sensitive agricultural and manufacturing products, and on transit times abroad for landlocked countries.

The size of the effect suggests that a one-day reduction in delays before a cargo sails to its export destination is equivalent to reducing the distance to trading partners by about 70 km. This may explain why Mauritius has enjoyed success as an exporter. At 16 days to process cargo, the efficiency of its trade infrastructure is identical to that of the United Kingdom and better than France's.

Our results have important implications for developing countries seeking to expand exports. The recent Doha trade negotiations have focused on import barriers in the United States and European Union. However, since OECD tariffs are already quite low, estimates of increased exports by developing countries from a successful Doha Round are also relatively small—averaging about 2 percent (Amiti and Romalis 2007). For the least developed countries, which already have preferential access, the benefits from additional market access are in some cases negative.[15] In contrast, our estimates imply that reducing trade costs can have relatively large effects on exports. For example, in Sub-Saharan Africa it takes 48 days on average to get a container from the factory gate loaded on to a ship. Reducing export times by 10 days is likely to have a bigger impact on exports

[15] Amiti and Romalis (2007) find African LDCs lose from MFN tariff reduction. Even for OECD agricultural reform, the global consequences would be "relatively small and highly uneven" Rodrik (2005).

(expanding them by about 10 percent) of developing countries than any feasible liberalization in Europe or North America.[16]

[16] Similarly, Hummels (2007) uses the time data plus data on shipping times and tariffs and finds that tariff equivalents for export delays are greater than tariffs faced by developing country exporters.

References

Amiti, Mary and John Romalis, "Will The Doha Round Lead To Preference Erosion?" *IMF Staff Papers* 54:2 (2007), 338-384.

Anderson, James E. and Eric van Wincoop, "Gravity with Gravitas," *American Economic Review* 93:1 (2003), 170-192.

Anderson, James E. and Douglas Marcouiller, "Insecurity and the Pattern of Trade: an Empirical Investigation," *Review of Economics and Statistics* 84:2 (2002), 342-352.

Botero, Juan., Simeon Djankov, Raphael La Porta, Florencio Lopez-de-Silanes, and Andrei Shleifer, "The Regulation of Labor," *Quarterly Journal of Economics* 119: 4 (2004), 1339-82.

Cunat, Alejandro and Marc Melitz, "Volatility, Labor Market Flexibility, and the Pattern of Comparative Advantage," NBER Working Paper 13062 (2007).

Djankov, Simeon, Caroline Freund, and Cong S. Pham, "Trading on Time" World Bank Working Paper #3909, (2006).

Djankov, Simeon, Raphael La Porta, Florencio Lopez de Silanes, and Andrei Shleifer, 2002. "The Regulation of Entry," *Quarterly Journal of Economics*, 117:1 (2002), 1-37.

Evans, Carolyn and James Harrigan, "Distance, Time, and Specialization: Lean Retailing in General Equilibrium" *American Economic Review*. 95:1 (2005), 292-313.

Freund, Caroline and Bineswaree Bolaky, "Trade, Regulations, and Income" *Journal of Development Economics* (forthcoming).

Gast, Karen, "Postharvest Management of Commercial Horticultural Crops," Kansas State University Agricultural Experiment Station and Cooperative Extension Service, document available at http://www.oznet.ksu.edu/library/hort2/samplers/mf978.asp (1991).

Hanson, Gordon and Chong Xiang, "The Home-Market Effect and Bilateral Trade Patterns," *American Economic Review*, 94:4 (2004), 1108-1129.

Hummels, David, "Time as a Trade Barrier," Mimeo, Purdue University (2001).

Hummels, David and Alexander Skiba, "A Virtuous Circle: Regional Trade Liberalization and Scale Economies in Transport," in Antoni Estevadeordal, Dani Rodrik, Alan Taylor, and Andres Velasco (Eds.), *FTAA and Beyond: Prospects for Integration in the America* (Cambridge: Harvard University Press, 2004).

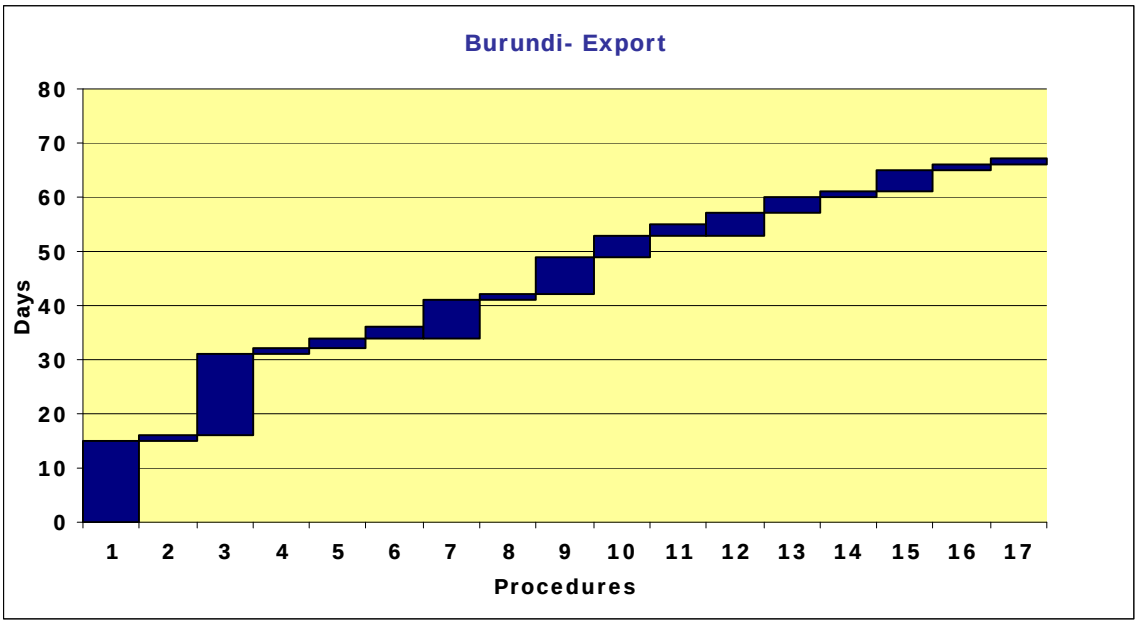
Hummels, David, "Calculating Tariff Equivalents for Time in Trade," USAID Report, March (2007).

Levchenko, Andrei, "Institutional Quality and International Trade" *Review of Economic Studies*, 74:3 (2007), 791-819.

Rodrik, Dani, (2005). "Failure at Trade Talks Would Be No Disaster" Mimeo, Harvard University (2005).

Romalis, John, "Factor Proportions and the Structure of Commodity Trade," *American Economic Review*, 94:1 (2004), 67-97.

Figure 1: Export Procedures in Burundi



List of Procedures

1 Secure letter of credit
2 Obtain and load containers
3 Assemble and process export documents
4 Pre-shipment inspection and clearance
5 Prepare transit clearance
6 Inland transportation to border
7 Arrange transport; waiting for pickup and loading on local carriage
8 Wait at border crossing
9 Transportation from border to port
10 Terminal handling activities
11 Pay of export duties, taxes or tariffs
12 Waiting for loading container on vessel
13 Customs inspection and clearance
14 Technical control, health, quarantine
15 Pass customs inspection and clearance
16 Pass technical control, health, quarantine
17 Pass terminal clearance

Table 1: Descriptive Statistics by Geographic Region

Required Time for Exports

	Mean	Standard Deviation	Minimum	Maximum	No of Obs.
Africa and Middle East	41.83	20.41	10	116	35
COMESA	50.10	16.89	16	69	10
CEMAC	77.50	54.45	39	116	2
EAC	44.33	14.01	30	58	3
ECOWAS	41.90	16.43	21	71	10
Euro-Med	26.78	10.44	10	49	9
SADC	36.00	12.56	16	60	8
Asia	25.21	11.94	6	44	14
ASEAN 4	22.67	11.98	6	43	6
CER	10.00	2.83	8	12	2
SAFTA	32.83	7.47	24	44	6
Europe	22.29	17.95	5	93	34
CEFTA	22.14	3.24	19	27	7
CIS	46.43	24.67	29	93	7
EFTA	14.33	7.02	7	21	3
ELL FTA	14.33	9.71	6	25	3
European Union	13.00	8.35	5	29	14
Western Hemisphere	26.93	10.33	9	43	15
Andean Community	28.00	7.12	20	34	4
CACM	33.75	9.88	20	43	4
MERCOSUR	29.50	8.35	22	39	4
NAFTA	13.00	4.58	9	18	3
Total Sample	30.40	19.13	5	116	98

Note: 7 countries belong to more than one regional agreement.

Table 2: The Effect of Time Costs on Export Volumes

Aggregate Bilateral Data – Sample 98 Exporters						
Independent Variables	*Regional Agreement Sample*		*Regional Agreement and Income Group*	*Landlocked Country Sample*		
	(1)	(2)	(3)	(4)	(5)	(6)
Ratio_time		-0.484 ***	-0.412 ***	-0.559		-1.034 **
		(-7.17)	(-5.34)	(-1.43)		(-1.96)
Ratio_export time in neighbors					-1.869 **	
					(-2.32)	
Ratio_GDP	1.146 ***	1.170 ***	1.134 ***	1.818 ***	2.001 ***	1.847 ***
	(41.38)	(43.09)	(33.92)	(8.17)	(8.56)	(7.75)
Ratio_GDPC	0.315 ***	0.116 *	0.446 ***	-0.891 ***	-1.001 ***	-0.878 ***
	(5.82)	(1.81)	(2.93)	(-3.84)	(-4.02)	(-3.66)
Distance	-1.272 ***	-1.255 ***	-1.296 ***	-0.833 ***	-0.763 ***	-0.731 **
	(-23.05)	(-22.06)	(-20.53)	(-2.95)	(-2.61)	(-2.48)
Contiguity	0.533 ***	0.533 ***	0.471 ***	1.598 ***	1.643 ***	1.986 ***
	(6.41)	(6.40)	(4.59)	(3.12)	(3.22)	(3.61)
Language	0.720 ***	0.758 ***	0.670 ***	0.414	0.526 **	0.573 **
	(8.84)	(9.13)	(8.42)	(1.14)	(2.12)	(2.22)
Colony	0.503 ***	0.566 ***	0.528 ***	0.469 *	0.398	0.460
	(5.49)	(6.38)	(6.03)	(1.70)	(1.11)	(1.27)
Landlocked	-0.387 ***	-0.340 ***	-0.341 ***			
	(-4.14)	(-3.82)	(-2.83)			
Instrument: Transit time In neighbors	No	No	No	No	No	Yes
R^2	0.49	0.50	0.47	0.34	0.35	0.34
No of Obs.	44207	44207	29717	2010	2010	2010

Notes: (1) T-statistics computed based on the robust standard errors adjusted for clustering on pairs of exporters are in the parentheses. *, ** and ** denote 10, 5 and 1 percent level of significance respectively.

(2) In Regional Agreement sample we keep only countries that are in the same geographical region and members of a trade agreement. In Regional Agreement and Income Group sample we only keep pairs of countries that belong to the same group of income. The four groups of income are defined as follows: low income group: less than $825; lower middle income group: $825 - $3255; upper middle income group: $3255 - $10065; and high income group: greater than $10065. The landlocked sample includes only countries in the same region that are both landlocked.

Table 3: The Effect of Time Costs on Aggregate Exports

	Aggregate Trade Data to the World					
	Regional Agreement Sample		*Regional Agreement & Income Group*	*Landlocked Countries*		
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
Ratio_Time		-0.307 ***	-0.362 ***	-0.749 **		-0.825 *
		(-3.26)	(-2.97)	(-2.06)		(-1.79)
Ratio_export time in neighbors					-0.588* (-1.84)	
Ratio_GDP	0.933 ***	0.943 ***	0.955 ***	1.124 ***	1.057 ***	1.136 **
	(26.20)	(26.51)	(16.40)	(5.24)	(3.06)	(5.41)
Ratio_GDPC	0.363 ***	0.257***	0.365	0.121	0.132	0.115
	(7.54)	(4.30)	(1.46)	(0.55)	(0.63)	(0.54)
Landlocked	0.024	0.070	0.089			
	(0.16)	(0.50)	(0.53)			
Instrument: Transit time in neighbors	No	No	No	No	No	Yes
R^2	0.82	0.83	0.79	0.70	0.70	0.70
No of Obs	333	333	220	23	23	23

Notes: (1) T-statistics computed based on the robust standard errors are in the parentheses. . *, ** and ** denote 10, 5 and 1 percent level of significance respectively.

(2) In Regional Agreement sample we keep only countries that are in the same geographical region and members of a trade agreement. In Regional Agreement and Income Group sample we only keep pairs of countries that belong to the same group of income. The four groups of income are defined as follows: low income group: less than $825; lower middle income group: $825 - $3255; upper middle income group: $3255 - $10065; and high income group: greater than $10065. The landlocked sample includes only countries in the same region that are both landlocked.

(3) The number of observations is also the number of pairs of exporters that belong to the same regional trade agreement. Specifically, they are: EU: 91; EFTA: 3; NAFTA: 3; ASEAN: 15; CEFTA: 21; ELL FTA: 3; Andian Community: 6; CIS: 21; MERCOSUR: 6; CACM: 6; COMESA: 45; SADC: 22 (there are only 22 pairs – not 28 pairs – because Malawi, Mauritius, Namibia, and Zambia belong to both COMESA and SADC); EAC: 2 (there are only 2 pairs of exporters for this three-country trade agreement because Kenya and Uganda are members of both COMESA and EAC); ECOWAS: 36; CEMAC: 1; Euro-Med: 36; Australia and New Zealand: 1; and SAFTA: 15.

Table 4: The Effect of Time Costs on Time Sensitive Products

Dependent Variable: Aggregate Exports by Industry							
	Manufacturing Products SITC 2-digit				*Agricultural Products* HS 6-digit		
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Ln(Time) *ln(Time Sensitivity)	-0.260***	-0.148***			-0.273***		
	(-8.12)	(-3.20)			(-5.25)		
Ln(Time)*(TimeSensitivityDummy)			-0.430***	-0.366***		-0.341***	-0.403***
			(-4.94)	(-3.42)		(-3.61)	(-3.41)
Ln(Skill Intensity) *Ln(Skill Abundance)		0.557***	0.371***	0.342***			
		(6.76)	(7.25)	(6.51)			
Ln(Capital Intensity) *Ln(Capital Abundance)		0.152**	2.124	2.002			
		(2.02)	(1.20)	(1.06)			
Ln(Business_Entry)*Ln(TimeSensitivityDummy)				-0.028			-0.219
				(-0.21)			(-1.29)
Ln(Labor_Regulation)*Ln(Time_SensitivityDummy)				-0.065			0.148
				(-0.81)			(1.20)
R^2	0.87	0.88	0.88	0.87	0.53	0.53	0.52
Number of Obs.	3276	2366	2366	2288	5025	5025	4828

Notes: Exporter and industry fixed effects in all regressions, coefficients not reported. Columns (1), (2), and (5) report Beta coefficients. In columns 1-4 T-statistics reported with bootstrapped robust standard errors (500 reps). In columns 5-7 robust T-statistics reported. *, ** and ** denote 10, 5 and 1 percent level of significance respectively.