Trading on Time

Simeon Djankov

Caroline Freund

Cong S. Pham*

Abstract: We determine how time delays affect international trade, using newly-collected World Bank 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 incorporates firm heterogeneity and 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 1 percent. Put differently, each day is equivalent to a country distancing itself from its trade partners by about 70 km on average. Delays have an even greater impact on developing country exports and exports of time-sensitive goods, such as perishable agricultural products. Our results are consistent with heterogeneous-firm models of trade, as in Melitz (2003), which imply that fixed trade costs alter the proportion of exporting firms. They also highlight the importance of reducing trade costs (as opposed to tariff barriers) to stimulate exports.

JEL codes: F13, F14 and F15

Keywords: heterogeneous-firm models, time costs

---

* The authors are from the World Bank, the International Monetary Fund, and the World Bank, respectively. Corresponding author: Caroline Freund, International Monetary Fund ph:(202) 623-7767, e-mail: cfreund@imf.org. We thank Mary Amiti, James Harrigan, Bernard Hoekman, Eric van Wincoop, Alan Winters and seminar participants at 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), 87 days from N'djamena (Chad), 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), 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 from the World Bank's Doing Business report. 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.

A standard trade model, for example Anderson and van Wincoop (2003), shows that country-specific trade costs will not affect trade patterns. The basic intuition is that if a country's shipping costs are high, it will lower the price of its goods (exclusive of the trade cost) so that all goods are sold. In contrast, in a model with firm heterogeneity, such as Melitz (2003), country-specific costs of trade will affect the fraction of firms that export, and hence the level of exports. A significant role for time costs is consistent with the latter model but not the former.

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.[1]

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.[2] 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. To

[1] We also control for adjacency, language, being landlocked, and colonial linkages. We do not need to control for preferential trading area, as our specification only compares relative exports of like countries within a preferential trading agreement.

[2] In a related paper, Hummels and Skiba (2004) provide evidence that trade volumes affect the timing of adopting containerized shipping and reduce shipping costs.

eliminate the potential endogeneity problem, we estimate a "difference-in-difference" equation and use instrumental variables to uncover the true effect of time costs on trade.

The "difference-in-difference" technique we use compares relative exports of time-sensitive goods to time-insensitive goods of similar trade partners. The intuition is that high fixed costs in the form of long delays should present an even greater hurdle to exporters. Thus, for example, we compare relative Ecuadorian/Peruvian exports of beans and other time-sensitive agricultural products to Ecuadorian/Peruvian exports of potatoes and other less time-sensitive agricultural products. The advantage of this specification is that we can see whether lower trade costs encourage relatively more exports in time-sensitive categories on the same trade route.[3] 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 very small share of total trade.

Finally, to ensure that we identify only the effect of trade costs on trade, we report the results instrumenting for the time of exporting. We use the number of signatures required to export and to import as instruments. The intuition is that administrative costs, such as the extra paperwork required when more signatures are required, are important in extending the number of days for export processing, but are less likely to be affected by the total volume of 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

[3] This assumes that overall exports, as compared to exports of time-sensitive goods, have a more important effect on trade facilitation.

(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. If the Central African Republic reduced its factory-to-ship time from 116 days to 27, exports would nearly double. The same effect could be achieved if the Central African Republic cut 6200 km from its distance to the main markets—greater than the distance from Bangui to London.

These results lend support to heterogeneous firm models as in Melitz (2003) and reject traditional models as in Anderson and van Wincoop (2003).

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.[4] Freight-forwarders are the most knowledgeable to provide information on the procedural requirements to trade since most businesses use their services to move their products in and out of the country. Globally, 43,000 freight-forwarding companies employ 11 million people and handle approximately 85% of foreign trade. Their services range from arranging the most appropriate route for a shipment, preparing documentation to meet customs and insurance requirements, arranging payments of fees and duties, and advising

[4] The World Bank's Doing Business dataset had 155 countries in 2005. However, Afghanistan, Angola, the Kyrgyz Republic, Lesotho, Marshall Islands, Micronesia, Niger, Solomon Islands, and Uzbekistan did not provide data on the time delays in exporting.

on legislative changes and political developments that could affect the movement of freight.[5]

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. And 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. Overall, 345 trade facilitators responded, with at least 2 per country. This provided an opportunity to compare the answers and, where differences arose, seek further clarification. After processing all questionnaires, we conducted follow-up conference calls with *all* respondents to confirm the coding of the data.

In addition to surveying freight-forwarders, surveys were completed by port authorities and customs officials in a third of the sample (48 countries). As ports and customs constitute a portion of the exporting procedures, they answered only the relevant sections of the questionnaire and provided information on the existing laws and regulations governing their activities. This allowed a further check on the quality of the information supplied by the main respondents, the freight-forwarders.

The data are collected as part of Doing Business, a World Bank project that investigates the scope and manner of business regulations. Doing Business collects and analyzes data in nine other areas, for example starting a business, hiring and firing workers, enforcing contracts, paying taxes. In addition to exporting procedures, the trade

[5] This information comes from the International Federation of Freight Forwarders Associations' (FIATA) website.

survey covers importing, as well as some specific aspects of trading across borders, for example recent measures to improve security and their impact on the time and cost to ship cargo.[6]

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 is to avoid special cases. In some countries, for example, Syria, foreign companies complete additional procedures or require special permits to export. In other countries, for example the Dominican Republic, much of trade takes place through export-processing zones. In larger and landlocked countries, it is necessary to specify the location of the exporter so as to identify the nearest port.

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 and does not require refrigeration. The product does not require any special phytosanitary or environmental safety standards other than accepted international shipping standards. 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). Two other categories, white goods and basic electronics, were considered at

[6] The survey and data are available at www.doingbusiness.org/ExploreTopics/TradingAcrossBorders.

the pilot stage. As the prices of a container load of these goods differed substantially across countries, the two categories were later dropped.

The questionnaire was tested on a pilot sample of 19 countries, on all continents, across all World Bank income groups and all with Panalpina offices.[7] A revised questionnaire was sent to all respondents in February 2005, and they were asked to benchmark their answers to January 2005. An expanded questionnaire was sent to the 42 landlocked countries in the sample. It contained an additional section on transit transport and customs clearance at each border, as well as the associated documents, time and costs.

The questionnaire asks respondents to identify the likely port of export. For many countries, especially in Africa and the Middle East, this may not be the nearest port. Due to high port fees, inadequate inland infrastructure, or problems at border crossings, freight-forwarders avoid some ports. For example, Cotonou, Benin's main port, is seldom used due to perception of corruption and high terminal handling fees. Respondents also identify the likely destination of their cargo. This serves as another quality check of the data, to confirm that this is a viable trade destination compared with the available trade statistics.

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

[7] These are Bangladesh, Chile, Dominican Republic, Germany, Honduras, Italy, Japan, Jordan, the Republic of Korea, Latvia, Malaysia, Mexico, Netherlands, Nigeria, Singapore, South Africa, Sri Lanka, Thailand and the United States.

documents and whose signature is necessary, what are the related fees,[8] and what is an average and a maximum time for completing each procedure.

Two examples illustrate the data. In Denmark, an exporter needs three documents (exports declaration form, bill of landing and a commercial invoice) and two signatures (one by a customs official and one at the port) to complete all requirements for shipping cargo abroad. It takes on average five days from the time he starts preparing documents to the time the cargo is ready to sail. In contrast, it takes 11 documents, 17 visits to various offices (Figure 1), 29 signatures and 67 days on average for an exporter in Burundi to have his goods moved from the factory to the ship.

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 the 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

[8] 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.

ASEAN, with Singapore taking only six days. In contrast, export times in Sub-Saharan Africa and the former Soviet Union 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 time delays reported in the survey are probably at the lower end of the time it takes to move the average product from factory to ship. This is because the products are chosen so that they do not require cooling or any technical inspections based on use of hazardous materials.

Table 2 presents correlations for the full sample of bilateral trade between the time to move goods from factory to ship and other variables included in the regression analysis. Time is negatively correlated with per capita income, implying that wealthier countries tend to have better trade facilitation.

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, so our final sample for the difference estimates is the 98 countries listed in Table A1.

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.[9]

We model the effect of time delays on exports using a simplified version of the heterogeneous firm model in Helpman, Melitz, and Rubinstein (HMR 2006), though our resulting strategy for estimation is quite different. Specifically, HMR generalize Anderson and van Wincoop (2003) to allow for fixed costs and firm heterogeneity, as well as asymmetric bilateral trade volumes. They show that many standard gravity variables affect both the probability of trade as well as the volume of trade, and thus that the estimated coefficients from Anderson and van Wincoop's estimation will be biased. In contrast, using a difference specification, we focus only on the effect of trade costs on trade, given that trade occurs.

The basic intuition from Melitz (2003) and HMR (2006) is that, with heterogeneous firms, trade costs alter the fraction of firms that export, which in turn affect the value of exports. In contrast, in a standard model, such as Anderson and van Wincoop (2003) there will be no effect of country-specific trade costs on trade patterns.

[9] The Doing Business 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.

There are j countries, indexed j=1, 2, …J. Utility in country j is

$$u_j = \left[\int_{l \in B_j} x_j(l)^{\alpha} \, dl \right]^{\alpha}, \quad 0 < \alpha < 1,$$

$X_j(l)$ is consumption of product l, B_j are available products in country j, and α determines the elasticity of substitution across products in country j.

Country j's income and expenditure level is Y_j. Country j's demand for product l is

$$x_j(l) = \frac{p_j(l)^{-\varepsilon} Y_j}{P_j^{1-\varepsilon}},$$

Where $p_j(l)$ is the price of product l in country j and P_j is the country's ideal price index.

We assume that each country consumes both domestic and imported products. In each country j there are N_j domestic firms, each producing a unique product. Thus, there are $\sum_{j=1}^{J} N_j$ products in the world.

Each firm in country j produces one unit of output with a combination of inputs costing c_{ja}, where c_j is a country-specific cost, and a is a firm specific productivity parameter. There is a cumulative distribution function, identical in all countries, $G(a)$ with support $[a_L, a_H]$ that describes the distribution of a across firms ($a_H > a_L > 0$).

In the home market, the producer bares only the production cost, in a foreign market the producer bears a fixed cost of exporting (f_j) and a transport cost t_{ij}.[10] There is monopolistic competition in final products, implying a country-j producer with input coefficient a maximizes profits by charging the following markup price equation:

[10] Here we deviate from Helpman, Melitz, and Rubinstein (2006). They assume the fixed cost is dependent on the exporter and the importer, we assume it is specific to the exporter—as in our data.

$$p_j(a) = \frac{1}{\alpha} c_j a..$$

In the home market, the price of product l is $p_j(l) = c_j a / \alpha.$ If it sells in the foreign market, the price is $p_i(l) = t_{ij} c_j a / \alpha.$ Profits from selling in country *i* are

$$\pi_{ij}(a) = (1-\alpha)\left(\frac{t_{ij} c_j a}{\alpha P_i}\right)^{1-\varepsilon} Y_i - c_j f_j .$$

Since f_j is zero for the domestic market all firms sell in the home market. Sales in country *j* are profitable only if profits are positive, and $a<a_{ij}$, where a_{ij} is defined by the zero profit equation.

$$(1-\alpha)\left(\frac{t_{ij} c_j a_{ij}}{\alpha P_i}\right)^{1-\varepsilon} Y_i = c_j f_j$$

Note that although *f* is fixed for the exporter, a firm may sell to one market and not another depending on the size of the foreign market Y_i and the extent of competition in the foreign market as defined by P_i.

Given that exports are greater than zero, the quantity of exports from *j* to *i* will be

$$Q_{ij} = \int_{a_L}^{a_{ij}} a^{1-\varepsilon} dG(a) .$$

The value of exports from *j* to *i* will be

$$M_{ij} = \left(\frac{c_j t_{ij}}{\alpha P_i}\right)^{1-\varepsilon} Y_i N_j V_{ij} .$$

Where Vij is the proportion fo firms from *j* that export to *i*.

Now consider the relative value of exports from two similar countries, facing identical trade barriers in market *i*.

$$\frac{M_{ij}}{M_{ik}} = \frac{\left(\frac{c_j t_{ij}}{\alpha P_i}\right)^{1-\varepsilon} Y_i N_j V_{ij}}{\left(\frac{c_k t_{ik}}{\alpha P_i}\right)^{1-\varepsilon} Y_i N_k V_{ik}} = \left(\frac{c_j t_{ij}}{c_k t_{ik}}\right)^{1-\varepsilon} \frac{N_j V_{ij}}{N_k V_{ik}}.$$

The term V_{ij}/V_{ik} reflects the proportion of exporting firms from *j* relative to *k*. It will depend on the fixed cost of exporting. In a standard model, all firms in both countries will export and the term will simply be one. Thus, relative trade will depend only on relative size, relative production costs, and relative bilateral trade costs.

We can write *x* in logs as

$$\ln \frac{M_{ij}}{M_{ik}} = (1-\varepsilon)\ln \frac{c_j}{c_k} + \ln \frac{N_j}{N_k} + (1-\varepsilon)\ln \frac{t_{ij}}{t_{ik}} + \ln \frac{V_{ij}}{V_{ik}}.$$

To estimate this equation, we proxy for relative costs with relative GDP per capita and for relative size with relative GDP; for bilateral trade costs with distance; for the share of firms that export with export times from the new World Bank data. We estimate a simple difference gravity equation on similar exporters: [11]

$$Ln\left(\frac{Exp_{jk}}{Exp_{hk}}\right) = \alpha + \beta Ln(\frac{GDP_j}{GDP_h}) + \varphi Ln(\frac{GDPC_j}{GDPC_h}) + \delta Ln(\frac{Dist_{jk}}{Dist_{hk}}) + \lambda Ln(\frac{Export\_Time_j}{Export\_Time_h}) + \phi(D_{jk} - D_{hk}) + \varepsilon_{jhk}, \quad (2)$$

where D_{ik} is a vector of control indicator variables, such as colony, language, and landlocked, associated with the exporters.[12] The dependent variable is composed of two

[11] A simple difference gravity regression and a difference-in-difference gravity regression are used by Hanson and Xiang (2004) to study the *home-market* effect. Anderson and Marcouiller (2002) use a simple difference gravity specification to study the role of security in international trade.

[12] Thus, it 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. For example, if the dependent variable is Paraguay/Uruguay exports the variable landlocked is one, if it were instead Uruguay/Paraguay exports the variable landlocked would be negative one. Similarly, if it were

export values with Exp_{lk} denoting exports of country l to country k. A model with heterogeneous firms implies that the coefficient estimate on $Export\_Time_j / Export\_Time_h$ would be negative, countries associated with higher relative time delays have lower relative exports. However, without homogeneous firms, given that all firms export to a given location, a fixed exporter cost should not matter as prices will adjust. In this case the coefficient on relative time would be zero.

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 (Table A1). As a further robustness check, we eliminate country pairs that do not fall into the same of four World Bank income classifications.[13] 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.

This strategy eliminates the need to control for multilateral resistance on the importer side since we compare only imports to the same country. It also reduces the need to control for exporter remoteness because we are comparing proximate exporters. Endogeneity is 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

---

Argentine/Uruguay exports or the reverse, the variable would be zero. Each country pair enters only once in the regression.

[13] Classification 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.

surely contributed to the development of sophisticated port facilities in Singapore and other East Asian countries. If trade facilitation influences trade in large discrete steps, as investing in ports tends to be lumpy, our estimation is robust.[14]

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 similar in terms of tariff and procedural barriers to trade.

Endogeneity may still be a problem since relatively high export volumes within regions 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. The instruments we use are the required number of signatures for exports the required number of signatures for imports. The intuition is that the number of signatures is a measure of excessive bureaucracy that slows down trade facilitation, but is not a result of shipping volumes, such as congestion or having containerized ports is likely to be.[15] For example with congestion effects, more trade may extend the waiting time for a required signature, but it would not affect the number of signatures required, as these tend to be based on historical laws.

IV. Results

We estimate the simple difference gravity regression (2). The results are reported in Table 3 for the full sample of regional-trade-agreement countries and the restricted

[14] There may, however, still be an endogeneity concern if even marginally higher trade volumes encourage relatively better trade facilitation or if higher trade volumes lead to congestion effects, extending the time to process goods.

[15] A potential problem is that political interests may lobby more extensively for more transparent export procedures if exports are large. In addition, the number of signatures may be related to the overall business climate, which may affect exports.

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 a numerous importers. The first and fourth columns report the results excluding our export time as a benchmark. In column 2 and 5, we include the ratio *time,* which has a statistically significant negative impact on the volume of trade. The result implies that a 10 percent saving of time in exporting increases exports by about 4 percent.[16]

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 1 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.

This result holds when we deal with the potential endogeneity of the variable *ratio_time* by using as instruments the number of required signatures for exports to take place and number of signatures for imports to take place.[17] We find that a 10 percent increase in the ratio of the required time for exports to take place results in about a 4 to 5 percent reduction in the ratio of exports to the same destination country. The coefficient on time increases slightly when we use instrumental variables. One explanation is that the simple difference specification virtually eliminates the positive effect of trade on trade facilitation, as this effect works largely across regions. In addition, using signatures as

[16] In a standard gravity the coefficient is about double the size, reflecting the missing variables problem of the gravity equation and that comparing trade costs across regions is problematic.
[17] Coefficient estimates are very similar when we use each instrument independently.

instruments picks up the administrative costs associated with export times, and the elasticities with respect to these may be greater than with respect to overall time.

Table 4 reports results allowing developing countries to have different coefficients on export time. The coefficient on time delays in developing countries is significantly different from that for developed countries. This remains true even when we instrument. The results imply that a 10 percent increase in export time reduces developing country exports by 8-12 percent.

One drawback using relative bilateral exports is that we eliminate country pairs which 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 an additional 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 5 are similar, 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.

V. Time-Sensitive Exports

Time delays should have a greater effect on the export of time-sensitive goods.[18] To examine the extent to which they are hampered, we also estimate "difference-in-difference" gravity regressions using trade data of products for which time matters the most and the least. This specification reduces the endogeneity problem coming from

[18] Evans and Harrigan (2005) show that time-sensitive apparel products are more sensitive to distance than time-insensitive products.

reverse causality because the products account for only a small fraction of trade on average (5-6% and 0.3-0.4% for manufacturing and agricultural trade, respectively) so it is unlikely they have a large effect on establishing trade facilitation processes (Table 6).

We examine a set of time-sensitive manufacturing and agricultural goods. The three time-sensitive manufacturing industries (SITC 2-digit) are office equipment (75), electric power machinery (77), and photographic equipment (88) (Table 7). These are drawn from Hummels (2001), which investigates how ocean shipping times and air freight times influences the probability that air transport is chosen. Those industries are associated with highest positive and statistically significant estimates of the days/rate ratio in Hummels (2001). This ratio measures the combined effect of ocean shipping times and air freights on the probability of choosing air transport. Similarly, three two-digit SITC 2 industries – textile yarns (65), cement (66), plumbing fixtures (82) – are chosen as time-insensitive as they are associated with the lowest negative and statistically significant estimates of the days/rate ratio.[19]

We base our selection of time-sensitive agricultural products on the information of their storage life (Gast, 1991). We focus on fruits and vegetables (HS 07 and 08). We classify products with a minimum storage life of 3 weeks or less, for example apricots, beans, currants, and mushrooms, as time-sensitive agricultural products. Time-insensitive agricultural goods are those with a minimum storage life of 4 weeks or longer, for example apples, cranberries and potatoes (Table 8). Since the data are at a very disaggregate level, we only use export data of those agricultural products of the most important exporters (Table A2).

[19] Time-sensitive products are more likely to be shipped by air, while our measure of time delays is from factory 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.

The difference-in-difference gravity regression we estimate is

$$Ln\left(\frac{Exp_{mjk}/Exp_{ojk}}{Exp_{mhk}/Exp_{ohk}}\right) = \alpha + \beta Ln(\frac{GDP_j}{GDP_h}) + \varphi Ln(\frac{GDPC_j}{GDPC_h}) + \delta Ln(\frac{Dist_{jk}}{Dist_{hk}}) + \phi(D_{jk} - D_{hk})$$
$$+ \lambda Ln(\frac{Export\_Time_j}{Export\_Time_h}) + \varepsilon_{mojhk}\,, \tag{3}$$

where *m* and *o* denote time-sensitive and time-insensitive industries respectively. We estimate gravity regression (3) using disaggregate data of products of time-sensitive and time-insensitive industries, and do so separately for manufacturing and agricultural trade. The test is essentially whether Ecuadorian/Peruvian relative exports of time-sensitive goods are different from Ecuadorian/Peruvian relative exports of time-insensitive goods. The advantage of the double relative is that we are capturing both relative exports of time sensitive to time insensitive goods and making sure that the control group is to the same importer. A negative coefficient on relative time 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.

Table 9 presents the results for time-sensitive manufacturing and agricultural goods. The first three columns report the results for manufactures. The coefficient on exporter time is always negative and significant. Countries having longer required time for exports to take place are associated with a lower ratio of exports in time-sensitive goods to exports in time-insensitive goods to the same destination. In particular, a 10 percent increase in the ratio of time is associated with a 2.4 percent reduction in country j's ratio of exports of time-sensitive goods to the exports of time-insensitive goods in relation to country *h*'s ratio.

Results for agricultural products in the difference-in-difference gravity specification are reported in columns 4-6. Because agriculture production depends on climate and land area, we also include the ratio of distance from the equator and the ratio of log land area. As expected, the coefficient on time is always negative and exhibit robustness across specifications. In particular, a 10 percent increase in the relative time of moving goods from factory to ship reduces relative exports of time sensitive goods by 5 percent. The coefficient estimate on distance is not significant—indicating that domestic restrictions are a bigger constraint to trade in time-sensitive agricultural goods than distance.

Poor trade facilitation affects the composition of trade, preventing countries from exporting time-sensitive 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

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, remoteness and other standard variables. Our estimates imply that on average each additional day that a product is delayed prior to being shipped reduces trade by at least 1 percent. We find a larger effect on time-sensitive agricultural and manufacturing products

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 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 eliminating them are also relatively small—around 2-10 percent.[20] For the least developed countries, which already have preferential access, the benefits from additional market access are in some cases negative.[21] 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 (expanding them by about 10 percent) than any feasible liberalization in Europe or North America.

[20] Amiti and Romalis (2006) use detailed data on tariffs and trade volumes, incorporating preference schemes, and show that average tariffs on non-LDC developing country products in the U.S. and the EU are below 3 percent. Tariffs on comparative advantage goods are also below 3 percent. They estimate market access gains of 2.28 percent following a 40 percent reduction in tariffs in the EU and US, with no exclusions. Anderson, Martin and van der Mensbrugghe (2005) estimate that *world* exports would increase by about 10 percent if there was complete global trade liberalization.

[21] Francois, Hoekman, and Manchin (2005) estimate an export expansion of 6 percent on average, ranging from -8 to 20 percent in poor countries, from full elimination of OECD tariffs. Rodrik (2005) notes that, even for OECD agricultural reform, the global consequences would be "relatively small and highly uneven".

References

Amiti, Mary and John Romalis. (2006). "Will The Doha Round Lead To Preference Erosion?" IMF Working Paper.

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

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

Anderson, Kym, Will Martin, and D. van der Mensbrugghe. (2005). "Market and Welfare Implications of Doha Reform Scenarios" in Eds. K. Anderson and W. Martin *Agricultural Trade Reform and The Doha Development Agenda* The World Bank.

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

Francois, Joseph, Bernard Hoekman, and M. Manchin. (2005). "Preference Erosion and Multilateral Trade Liberalization," CEPR discussion paper # 5153, London.

Gast, Karen (1991) "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.

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

Helpman, Elhanan, Marc Melitz and Yona Rubinstein (2006). "Trading Partners and Trading Volume." Mimeo. Harvard University.

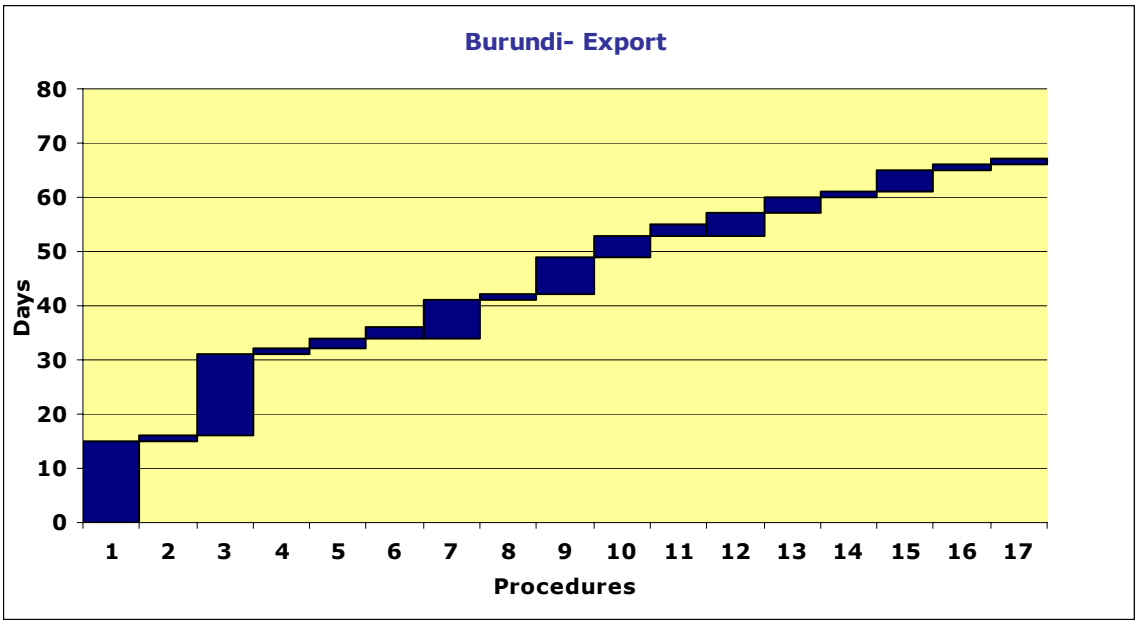
Hummels, David. (2001). "Time as a Trade Barrier." Mimeo, Purdue University.

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

Melitz, Marc (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity" *Econometrica* 71, 1695-1725.

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

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 port of departure
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					
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					
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					
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	12.00	6.00	6	18	3
European Union	13.00	8.35	5	29	14
Western Hemishere					
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	30.13	19.20	5	116	98

See Table A1 for definitions of the regional agreements. 7 countries belong to more than one regional agreement.

Table 2: Correlation of Explanatory Variables

	Export_Time	GDP	GDPC	Export_Sign	Import_Sign	Import_Time	Contiguity	Language	Colony
GDP	-0.225	1							
GDPC	-0.611	0.460	1						
Export_Sign	0.796	-0.150	-0.486	1					
Import_Sign	0.753	-0.160	-0.482	0.938	1				
Import_Time	0.938	-0.236	-0.630	0.786	0.778	1			
Contiguity	0.066	-0.012	-0.046	0.057	0.057	0.063	1		
Language	0.052	0.020	-0.020	0.049	0.051	0.075	0.120	1	
Colony	-0.038	0.061	0.074	-0.032	-0.032	-0.044	0.098	0.171	1
Landlocked	0.393	-0.112	-0.124	0.288	0.241	0.327	0.033	-0.032	-0.025

Table 3: Simple Difference Gravity Regressions

Aggregate Bilateral Data – Sample 98 Exporters

Independent Variables	*Unrestricted Sample*			*Restricted Sample*		
	(1)	(2)	(3)	(1)	(2)	(3)
Ratio_time		**-0.435 ****	**-0.537 ****		**-0.353 ****	**-0.397 ****
		(-6.73)	**(-5.63)**		**(-4.94)**	**(-3.94)**
Ratio_GDP	1.152 **	1.176 **	1.181 **	1.114 **	1.141 **	1.144 **
	(42.83)	(44.05)	(43.53)	(33.88)	(34.81)	(34.45)
Ratio_GDPC	0.340 **	0.161 **	0.120	0.790 **	0.516 **	0.482 **
	(6.40)	(2.60)	(1.78)	(6.11)	(3.52)	(3.06)
Distance	-1.438 **	-1.425 **	-1.422 **	-1.458 **	-1.461 **	-1.462 **
	(-27.39)	(-26.28)	(-25.90)	(-26.65)	(-26.04)	(-25.99)
Contiguity	-0.009	-0.009	-0.008	-0.007	-0.008	-0.008
	(-0.95)	(-0.87)	(-0.85)	(-0.62)	(-0.71)	(-0.73)
Language	0.017 *	0.02 **	0.021 **	0.019 *	0.022 *	0.023 *
	(2.23)	(2.66)	(2.73)	(2.05)	(2.40)	(2.43)
Colony	0.101 **	0.104 **	0.105 **	0.110 **	0.112 **	0.113 **
	(9.01)	(8.45)	(8.26)	(9.50)	(9.01)	(8.89)
Landlocked	-0.428 **	-0.368 **	-0.354 **	-0.395 **	-0.351**	-0.346 **
	(-4.44)	(-3.96)	(-3.74)	(-3.09)	(-2.80)	(-2.72)
Instruments						
No of Required Signatures for Exports and Imports to Take Place	No	No	Yes	No	No	Yes
Overidentification Test			*1.074*			*0.182*
P-Value			*0.300*			*0.670*
Shea-Partial R^2 in the First Stage			0.52			0.58
R^2	0.49	0.49	0.48	0.47	0.47	0.47
No of Obs.	44207	44207	44207	29717	29717	29717

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

(2) In the restricted 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.

(3) 44027 is the number of exporter pair-importer combinations for which trade data are *positive*. It is noteworthy that we pair only exporters that belong to the same regional trade agreement.

(4) Exporter pairs are configured randomly. The results are essentially the same when exporter pairs are configured in such a way that the exporter that has longer required time for exports to take place is always in the nominator.

Table 4: Simple Difference Gravity Regressions

Aggregate Bilateral Data – Sample 98 Exporters

Independent Variables	(1)	(2)	(3)
Ratio_Time	**-0.353 ****	**-0.272 ****	**-0.288 ****
	(-4.94)	**(-3.99)**	**(-3.77)**
Ratio_Time_Developing Countries		**-0.463 ***	**-0.949 ****
		(-2.19)	**(-2.54)**
Ratio_GDP	1.141 **	1.130 **	1.125 **
	(34.81)	(34.65)	(33.73)
Ratio_GDPC	0.516 **	0.495 **	0.394 *
	(3.52)	(3.33)	(2.36)
Ratio_Distance	-1.461 **	-1.453 **	-1.445 **
	(-26.04)	(-25.42)	(-23.81)
Contiguity	-0.008	-0.007	-0.006
	(-0.71)	(-0.65)	(-0.60)
Language	0.022 *	0.022 *	0.023 *
	(2.40)	(2.39)	(2.43)
Colony	0.112 **	0.111 **	0.110 **
	(9.01)	(9.90)	(8.95)
Landlocked	-0.351 **	-0.280 *	-0.192
	(-2.80)	(-2.16)	(-1.37)
Instruments			
No of Required Signatures for Exports and Imports to Take Place and the Interactions of those two Variables With Dummy Variables for Developed and Developing Countries	*No*	*No*	*Yes*
Overidentification Test			*4.450*
P-Value			*0.108*
Shea R^2 in the First Stage: Ratio_Time			*0.741*
Shea R^2 in the First Stage: Ratio_Time_ Developing Countries			*0.366*
R^2	0.47	0.47	0.47
No of Obs.	29717	29717	29717

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

(2) Developed exporters are those that have annual GDP greater than $10065 while developing exporters are those that have annual GDP less than $10065.

(3) Exporter pairs are configured randomly. The results are essentially the same when exporter pairs are configured in such a way that the exporter that has longer required time for exports to take place is always in the nominator.

Table 5: Simple Difference Gravity Regression

Aggregate Trade Data to the World

Independent Variables	(1)	(2)	(3)	(4)
Ratio_Time		**-0.370 ****	**-0.417 ****	**-0.515 ****
		(-5.19)	**(-4.76)**	**(-3.83)**
Ratio_GDP	0.963 **	0.976 **	0.990 **	0.981 **
	(34.46)	(35.11)	(23.31)	(34.96)
Ratio_GDPC	0.380 **	0.253 **	0.427 **	0.203 **
	(8.18)	(5.13)	(2.74)**	(3.22)
Landlocked	0.082	0.154	0.217	0.182
	(0.81)	(1.51)	(1.60)	(1.75)
Instruments				
Signatures for Exports and Signatures for Imports to Take Place	No	No	No	Yes
Overidentification Test				*1.556*
P-Value				*0.212*
Shea R^2 in the First Stage				0.442
R^2	0.81	0.82	0.77	0.82
No of Obs	333	333	220	333

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

(2) Column (3) reports the regression result when we apply the following restriction: 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.

(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.

(4) Exporter pairs are configured randomly. The results are essentially the same when exporter pairs are configured in such a way that the exporter that has longer required time for exports to take place is always in the nominator.

Table 6: Summary Statistics
Shares of Manufacturing and Agricultural Products in Total Exports

	Manufacturing		**Agriculture**	
	Treatment	Control	Treatment	Control
Mean	0.0664	0.0519	0.0038	0.0026
Standard Deviation	0.107	0.066	0.007	0.005
Minimum	0.00023	0.00058	4.96e-06	2.75e-06
Maximum	0.6293	0.4812	0.0436	0.0332

Table 7: Time Sensitivity of Products

List of *Time-Insensitive* and *Time-Sensitive* Industries

SITC	*Time-Insensitive* Industries	SITC	*Time-Sensitive* Industries
651	Textile yarn	751	Office machines
652	Cotton fabrics, woven (not including narrow or special fabrics)	752	Automatic data processing machines and units thereof
653	Fabrics, woven, of man-made fiber (not narrow or special fabrics)	759	Parts, nes of and accessories for machines of headings 751 or 752
654	Textile fabrics, woven, other than cotton or man-made fibers	771	Electric power machinery, and parts thereof, nes
655	Knitted or crocheted fabrics	772	Electrical apparatus for making and and breaking electrical circuits
656	Tulle, lace, embroidery, ribbons, trimmings and other small wares	773	Equipment for distribution of electricity
657	Special textile fabrics and related Products	774	Electro-medical and radiological equipment
658	Made-up articles, wholly or chiefly of textile materials, nes	775	Household type equipment, nes
659	Floor covering, etc	776	Thermionic, microcircuits, transistors, valves, etc
661	Lime, cement, and fabricated construction materials	778	Electrical machinery and apparatus, nes
662	Clay and refractory construction materials	881	Photographic apparatus and equipment, nes
663	Mineral manufactures, nes	882	Photographic and cinematographic supplies
664	Glass	883	Cinematograph film, exposed and developed
665	Glassware	884	Optical goods, nes
666	Pottery	885	Watches and clocks
821	Sanitary, plumbing, heating, lighting fixtures and fitting, nes		

Source: Hummels (2001).

Table 8: Time Sensitivity of Agricultural Products

Time-Sensitive Agricultural Products

Code	Description	Storage Life
070200	Tomatoes, fresh or chilled	4-21 days
070410	Cauliflowers & headed broccoli, fresh or chilled	21-28 days
070420	Brussels sprouts, fresh or chilled	21-35 days
070511	Cabbage lettuce (head lettuce), fresh or chilled	14-21 days
070519	Lettuce, except cabbage lettuce, fresh or chilled	14-21 days
070521	Witloof chicory, fresh or chilled	14-28 days
070700	Cucumbers & gherkins, fresh or chilled	10-14 days
070810	Peas (pisum sativum), shelled or unshelled, fresh or chilled	6-14 days
070820	Beans (vigna spp., Phaseolus spp.) fresh or chilled	5-10 days
070920	Asparagus, fresh or chilled	14-21 days
070930	Aubergines (egg-plants) fresh or chilled	7 days
070951	Mushrooms of the genus Agaricus, fresh or chilled	3-4 days
070970	Spinach, New Zealand spinach & orache spinach (garden spinach) fresh or chilled	10-14 days
080610	Grapes, fresh	14-56 days
080711	Watermelons, fresh	14-21 days
080719	Melons (excluding watermelons), fresh	14-21 days
080910	Apricots, fresh	7-21 days
080920	Cherries, fresh	2-21 days
080930	Peaches, including nectarines, fresh	14-28 days
080940	Plums & sloes, fresh	14-35 days
081010	Strawberries, fresh	3-7 days
081020	Raspberries, blackberries, mulberries, loganberries, Fresh	2-3 days
081030	Black, white, red currants & gooseberries, fresh	2-28 days
081050	Kiwifruit, fresh	14-21 days

Note: We classify those agricultural products as time-sensitive ones based on their minimum storage life.

Time-Insensitive Agricultural Products

Code	Description	Storage Life
070110	Seed potatoes, fresh or chilled	120-300 days
070190	Potatoes other than seed potatoes, fresh or chilled	120-300 days
070310	Onions, Shallots, fresh or chilled	28-180 days
070320	Garlic, fresh or chilled	180-210 days
070910	Globe artichokes, fresh or chilled	120-150 days
070490	Cabbages, kohlrabi	60-90 days
071010	Potatoes, uncooked/cooked by steaming/boiling in water, frozen *	120-300 days
071220	Onions, dried (powder etc), not further prepared	Dried
071310	Peas, dried shelled, including seed	Dried
071320	Chickpeas (garbanzos), dried shelled, include seed	Dried
071331	Beans (Vigna mungo or Hepper…etc), dried shelled	Dried
071332	Small red (Adzuki) beans, dried shelled, including seeds	Dried
071333	Kidney beans, including white pea beans, dried shelled including seeds	Dried
071340	Lentils, dried shelled, including seeds	Dried
071350	Broad beans & horse beans, dried shelled including seeds	Dried
071420	Sweet potatoes, fresh or dried	
080111	Coconuts, desiccated	
080119	Coconuts, other than desiccated	
080121	Brazil nuts, fresh or dried, in shell	Dried
080131	Cashew nuts, fresh or dried, in shell	Dried
080211	Almonds, fresh or dried, in shell	Nuts
080221	Hazelnuts or filberts, fresh or dried, in shell	Nuts
080231	Walnuts, fresh or dried, in shell	Nuts
080240	Chestnuts, fresh or dried	Nuts
080250	Pistachios, shelled or not, fresh or dried	Nuts
080620	Grapes, dried	Dried
080810	Apples, fresh	28-336 days
080820	Pears & quinces, fresh	60-210 days
081310	Apricots, dried	Dried
081320	Prunes, dried	Dried
081330	Apples, dried	Dried

Note: The list of time-sensitive and time-insensitive agricultural products is chosen based on Gast (1991) and the availability of trade data from UN Comtrade Database. Specifically, we eliminate classifications to which we can not attribute a precise storage life based on Gast (1991). Examples are HS 070610 – Carrots and turnips, fresh or chilled and HS 080420 – Figs, fresh or dried.

Table 9: Difference-in-Difference Gravity Regressions

Independent Variables	*Manufacturing Products*		*Agricultural Products*	
	(1)	(2)	(1)	(2)
Ratio_Time		**-0.284 ** **		**-0.455 * **
		(-2.61)		**(-2.30)**
Ratio_GDP	-0.010	0.031	-0.174	-0.142
	(-0.19)	(0.59)	(-1.12)	(-0.92)
Ratio_GDPC	1.457 **	1.287 **	0.924 **	0.950 **
	(12.53)	(9.56)	(3.64)	(3.93)
Ratio_Distance	-0.176 **	-0.169 **	0.149	0.143
	(-3.05)	(-2.97)	(1.06)	(1.01)
Ratio_Distance from the Equator			-5.196 **	-6.208 **
			(-5.51)	(-4.66)
Ratio_Land			-0.138	-0.071
			(-1.23)	(-0.63)
Contiguity	-0.554 **	-0.566 **	0.568 **	0.506 **
	(-8.17)	(-8.62)	(3.77)	(3.60)
Language	0.277 **	0.306 **	-0.149	-0.158
	(3.22)	(3.52)	(-0.92)	(-0.98)
Colony	0.041	0.07	-0.606 **	-0.446 **
	-0.47	-0.83	(-2.97)	(-2.68)
Landlocked	-0.022	-0.002	-1.003 **	-1.091 **
	(-0.14)	(-0.01)	(-3.88)	(-4.19)
R^2	0.09	0.10	0.05	0.06
Number of Obs.	1383520	1383520	138631	138631

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

(2) Exporter pairs are configured randomly. The results are essentially the same when exporter pairs are configured in such a way that the exporter that has longer required time for exports to take place is always in the nominator.

Table A1: List of 98 Members of Regional Trade Agreements[22]

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 (CIS) 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

SAFTA Bangladesh, India, Maldives, Nepal, Pakistan and Sri Lanka

[22] There are 7 countries that belong to more than one regional trade agreement: Kenya, Malawi, Mauritius, Namibia, Uganda, Tanzania and Zambia.

Table A2: List of Members of Regional Trade Agreements for Time-Sensitive Trade

Manufacturing Trade Data

Andean Community Colombia, Ecuador, Peru, and Venezuela
ASEAN Cambodia, Indonesia, Malaysia, Philippines, Singapore and Thailand
CACM El Salvador, Guatemala, Honduras and Nicaragua
CEAMAC Cameroon and Central African Republic
CEFTA Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia
CER Australia and New Zealand
COMESA Burundi, Eritrea, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Uganda, and Zambia
Commonwealth of Independent States (CIS) Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Republic of Moldova and Russian Federation
ECOWAS Burkina Faso, Ghana, Nigeria, Senegal and Togo
EFTA Iceland, Norway, and Switzerland
ELL FTA Estonia, Latvia and Lithuania
European Union Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, and the United Kingdom
MERCOSUR Argentina, Brazil, Paraguay and Uruguay
NAFTA Canada, Mexico and the United States
SADC Malawi, Mauritius, Namibia and South Africa
SAFTA Bangladesh, India, Nepal, Pakistan and Sri Lanka

Agricultural Trade Data

Andean Community Colombia, Ecuador, and Peru
ASEAN Malaysia and Thailand
CACM El Salvador, Guatemala, Honduras and Nicaragua
CEFTA Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia and Slovenia
CER Australia and New Zealand
COMESA Kenya, Madagascar, Malawi, Mauritius, Namibia, Uganda, and Zambia
Commonwealth of Independent States (CIS) Belarus, Kazakhstan, Kyrgyzstan and Russian Federation
EFTA Iceland, Norway, and Switzerland
ELL FTA Estonia, Latvia and Lithuania
European Union Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, Turkey and the United Kingdom
MERCOSUR Argentina, Brazil and Uruguay
NAFTA Canada, Mexico and the United States
SAFTA Bangladesh, India, Maldives, Nepal, Pakistan and Sri Lanka