RESEARCH INSTITUTE OF INDUSTRIAL ECONOMICS

IFN Working Paper No. 848, 2010

# Completing the EU Customs Union. The Effects of Trade Procedure Harmonization

Yves Bourdet and Maria Persson

Research Institute of Industrial Economics
P.O. Box 55665
SE-102 15 Stockholm, Sweden
info@ifn.se
www.ifn.se

# Completing the EU Customs Union.
# The Effects of Trade Procedure Harmonization*

Yves Bourdet† and Maria Persson‡

August 24, 2010

*Abstract*

A main component of customs unions is a common trade policy on imports from non-member countries. Trade policy covers both tariff and non-tariff barriers like trade procedures. We argue that since trade procedures vary markedly across EU countries, the EU is not, strictly speaking, a customs union. To illustrate this, we estimate the impact of trade procedures on exports from non-EU countries and find a highly statistically significant and negative effect. Simulating what the effects would be of harmonizing trade procedures, i.e. to actually complete the EU customs union, we find that aggregated exports to the EU would increase by 20 percent for the average exporter.

*JEL classification: C23, F15, O24*
*Keywords: Customs Union, Economic Integration, European Union, Time Delays, Trade Facilitation, Trade Procedures*

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* Financial support from the Jan Wallander and Tom Hedelius Foundation, the Swedish International Development Cooperation Agency and the Marianne and Marcus Wallenberg Foundation is gratefully acknowledged.

† Department of Economics, Lund University. E-mail: yves.bourdet@nek.lu.se.

‡ Corresponding author, Department of Economics, Lund University and Research Institute of Industrial Economics (IFN), Stockholm. Address: P.O. Box 7082; SE-220 07 Lund, Sweden. E-mail: maria.persson@nek.lu.se, Phone: +46 (0)46 222 46 70; Fax: +46 (0)46 222 46 13.

# 1 Introduction

The successive rounds of multilateral trade negotiations have contributed to lowering the levels of the European Union's customs duties to historically low levels. In addition, most quantitative trade restrictions, like import quotas or voluntary export restraints, have been removed in sectors like textiles and clothing, and passenger cars, during the past two decades. The trade impeding effect of other non-tariff barriers, like technical standards, has also been reduced, partly as a result of the completion of the European single market. There remain, however, trade obstacles of a more administrative nature, commonly named trade procedures, that are under the responsibility of national authorities. The dismantlement or reduction of traditional trade barriers has given these trade procedures a prominent role in the current Doha Round negotiations.

The objective of this paper is threefold. First, we argue that since trade procedures vary markedly across EU countries, the EU is not, strictly speaking, a customs union. Second, we investigate whether these differences in trade procedures matter in practice. We estimate the quantitative effects of inefficient trade procedures on trade volumes, and use these figures to illustrate how much trade volumes would grow if the EU customs union was completed through trade procedure harmonization. Third, we discuss the policy implications of our results for the distribution of the responsibility for trade procedures between the national and community levels.

The organization of the paper is as follows. The next section illustrates the wide disparities in trade procedures among EU countries. It also discusses how these differences affect the form of regional integration and can contribute to trade deflection and the emergence of price disparities across member countries. The third section estimates the impact of trade procedures on the exports of non-member countries. Using this estimate, the fourth section simulates the gains in the form of increased exports for third countries of a harmonization of trade procedures. In a final section, the main results are summarized and some policy conclusions are drawn on how to complete the EU customs union.

# 2 Trade Procedures and Forms of Economic Integration

## 2.1 Trade Procedures in the EU

The term *trade procedures* refers to customs practices and documentary requirements that are imposed on goods and services crossing national borders. Customs practices cover routines like the use of information technology, use of computerized container scanning, risk management techniques, degree of reliance on importing and exporting firms, skill level among staff, bureaucratic structures and extent of corruption. Documentary requirements consist, for example, of certificate of origin, insurance certificate, certificate of conformity with product standards and carrier declaration.

More or less burdensome trade procedures result in more or less lengthy delays that impose varying costs on import and export activities. These costs may arise in several ways. The most straightforward reason is that, depending on the type of good, there may be depreciation costs – either in terms of physical depreciation or because products quickly lose their market value. In addition to depreciation costs, delays could cause costs for traders because companies have to keep goods in store instead of just being able to quickly ship the goods. For agricultural goods, such storage costs may not just be a matter of misallocated resources, but could lead to even higher costs for refrigeration etc. Long delays are also associated with increased uncertainty about delivery times, which means that companies will have to waste resources on having wider safety margins, and may be unable to take advantage of business opportunities.

The more complex the procedures, the longer the associated delays, and the higher the costs for traders. Significant welfare gains are therefore expected from improvements in trade procedures that reduce the time delays occurring when crossing national borders. In fact, the net gain for society of a reduction in trade costs following a simplification and streamlining of trade procedures is actually larger than what arises if a price-equivalent tariff or import quotas is removed, because there is no tariff or import rent to be lost.

To measure empirically the trade barriers caused by trade procedures, we use the number of days it takes to comply with all necessary procedures at the border when importing to the various EU27 countries. The data comes from the World Bank's (2010a) *Doing Business Database*. In the *Trading Across Borders* section of this large survey,

local freight forwarders, shipping lines, customs brokers, port officials and banks are asked about how much time it would take for a hypothetical trading firm to comply with all the necessary procedures to import a well-defined, standardized good. All procedures from the good's arrival at the port of entry until the delivery at the warehouse are included, and if the procedures can be completed in parallel, they are assumed to have taken place simultaneously.[4] The same measure has been used by, for instance, Djankov *et al* (2010), Martínez-Zarzoso and Márquez-Ramos (2008) and Persson (2008).[5]

According to the *Doing Business Database,* the number of days needed to comply with all necessary procedures to import the same good into the countries of the European Union varies considerably. As presented in Table 1, it goes from 5 days for Cyprus, Denmark and Estonia to no less than 25 days for Greece, Poland and the Slovak Republic. The times required for the same good to cross the national border is thus five times longer in the poorest performing countries than in the best performing ones. Interestingly, there seems to be a rather clear geographical pattern with most countries that entered the EU in 2004 among the least efficient performers and older members, particularly the small Northern European countries, among the best performers. Notable exceptions to this pattern are Estonia, Greece, Portugal and Italy.

To offer an intuitive understanding of the magnitude of trade procedures as a barrier to trade, Table 1 also gives estimates of the tariff equivalents of the time to import across borders and, for comparison, the average (weighted) import tariffs for the countries of the European Union.[6] A main finding is that the tariff equivalents of the time to import are higher than the average applied import tariffs for most EU countries. This

[4] The hypothetical trading firm, that is a private limited liability company, fully domestically owned with a minimum of 60 employees, is located in the country's most populous city but does not operate within an export processing zone (EPZ) or an industrial estate with special export or import privileges. The good is assumed to be non-hazardous, not to include any military arms or equipment, not to require refrigeration or any special environment, nor any special phytosanitary or environmental safety standards, and to be shipped in a dry-cargo, 20-foot, full container load. Trade is assumed to take place by ocean transportation. For more specifics, see World Bank (2010a), or Djankov *et al*. (2010).

[5] Other empirical papers in the literature on trade procedures include Wilson *et al*. (2003; 2005), Lee and Park (2007), Nordås *et al*. (2006), Iwanow and Kirkpatrick (2007) and Sadikov (2007).

[6] These data come from Hummels (2007), to which we refer for a more detailed presentation of the method used to calculate tariff equivalents. Briefly, however, tariff equivalents are estimated in three steps: 1) the estimation of the value of time savings for each product per day, 2) the estimation of the time savings for each country per day on the basis of the country's import structure, 3) the estimation of the tariff equivalents of import waiting time with the help of the *Doing Business Database*.

suggests that trade procedures constitute a comparatively substantial trade barrier, and that it is therefore problematic for the EU not to have a uniform practice in this area.

**Table 1. Trade Procedures as an Import Barrier in the European Union**

| *EU country* | *Time in days to comply with all import procedures* | *Tariff equivalent of the time to comply with import procedures* | *Average applied import tariff 2001* |
|---|---|---|---|
| Cyprus | 5 | - | - |
| Denmark | 5 | 1.4 | 2.4 |
| Estonia | 5 | 3.8 | 0.8 |
| Luxembourg | 6 | - | - |
| Netherlands | 6 | 1.9 | 2.1 |
| Sweden | 6 | 1.4 | 2.1 |
| Germany | 7 | 2.2 | 1.8 |
| Austria | 8 | 5.0 | 1.8 |
| Finland | 8 | 1.8 | 1.9 |
| United Kingdom | 8 | 4.6 | 2.7 |
| Belgium | 9 | 2.3 | 3.0 |
| Spain | 10 | 4.1 | 2.4 |
| France | 11 | 4.6 | 1.8 |
| Lithuania | 11 | 5.9 | 0.8 |
| Ireland | 12 | 5.4 | 1.5 |
| Latvia | 12 | 8.0 | 1.9 |
| Romania | 13 | 4.1 | 6.3 |
| Portugal | 15 | 4.3 | 4.2 |
| Hungary | 17 | 7.2 | 2.8 |
| Italy | 18 | 13.1 | 2.0 |
| Czech Republic | 20 | 7.8 | 3.9 |
| Bulgaria | 21 | 9.6 | 7.7 |
| Slovenia | 21 | 8.2 | 10.2 |
| Greece | 25 | 5.6 | 2.2 |
| Poland | 25 | 6.3 | 3.3 |
| Slovak Republic | 25 | 5.6 | 3.1 |
| Average | 13 | 5.2 | 3.2 |
| Minimum | 5 | 1.4 | 0.8 |
| Maximum | 25 | 13.1 | 10.2 |

*Note:* Data on the days needed to comply with all necessary import procedures come from the *Doing Business Database* (see World Bank 2010a). There is no data for Malta in the *Doing Business Database*. Data on tariff equivalents of this time and average applied (trade weighted) import tariffs are from Hummels (2007).

## 2.2 Is the EU Really a Customs Union?

The two main components of a customs union are the removal of trade barriers to internal trade and the adoption of a common trade policy on trade with non-member countries. The common trade policy concerns tariffs as well as non-tariff barriers. Hence, the significant disparities in trade procedures noted among the European countries suggest that the European Union is not a customs union in the strict economic sense of the term. In fact, it could be considered a free trade area. It is, however, an imperfect form of free trade area since it is not equipped with rules of origin to prevent trade deflection.

What are the economic implications of the EU's *de facto* failure to have a common external trade policy? It may be expected to cause both trade deflection and price differences between EU countries. Trade deflection refers to importing into an integrated area through the country (or countries) with the least restrictive trade policy for re-export to another member country (or other member countries) with a more restrictive trade policy. In the case of large disparities in trade procedures, as those illustrated in Table 1, this suggests that imports will tend to enter the European Union through the countries with the most efficient trade procedures, and in a second stage be redirected to the countries with less efficient trade procedures.[7]

Different trade procedures on imports from outside countries, associated with positive transport costs, may also result in different prices on the domestic markets of the EU countries. Higher domestic prices are expected in countries protected by more burdensome trade procedures and insulated by relatively high transport costs. This is an explanatory factor that has been bypassed in studies of price differentials in the European Union (see, for example, Engel and Rogers 2004). Price differentials also create incentives for the producers of the member countries with the most efficient trade procedures to increase their export to the countries with the least efficient trade procedures. To continue to satisfy domestic consumption, countries with more efficient trade procedures can in turn increase their imports from third countries. Disparities in the costs of trade procedures across member countries may thus also contribute to an indirect form of trade deflection and an expansion of intra-industry trade.

[7] It should be noted that a necessary condition for trade deflection to take place is that the cost of transport is lower than the cost differential ascribed to differing trade procedures.

To summarize, measuring the effectiveness of cross-border trade procedures by the time delays that they cause, we argue that the large variation in such import delays across EU countries suggests that the EU does not have a common external trade policy. This would imply that the EU does not meet the requirements of a customs union. This argument of course rests on the assertion that the border delays caused by varying trade procedures actually have a substantial effect on volumes of trade. We test this hypothesis in the next section.

# 3 Estimating Quantitative Effects of Trade Procedures

## 3.1 Model Specification and Estimation Method

To investigate whether cumbersome cross-border trade procedures affect trade flows into the EU, we estimate a gravity equation on bilateral imports to EU27 countries from the rest of the world. The gravity equation has been widely used to estimate the trade effects of e.g. preferential trading arrangements, currency unions and various trade costs, and its theoretical basis has been established by papers such as Anderson (1979), Bergstrand (1985; 1989), Helpman and Krugman (1985), Deardorff (1998) and Anderson and van Wincoop (2003). The estimated model is:

$$M_{ijct} = \exp(\beta_1) Time_{it}^{\beta_2} \left(GDP_{it} GDP_{jt}\right)^{\beta_3} GDPpc_{it}^{\beta_4} GDPpc_{jt}^{\beta_5} Dist_{ij}^{\beta_6} \exp\left(\beta_7 Border_{ij} + \beta_8 Language_{ij} + \beta_9 Colony_{ij} + \lambda_t + \mu_{jc}\right) \varepsilon_{ijct} \quad (1)$$

where $M_{ijct}$ is imports in chapter $c$ to the importing EU country $i$ from exporting country $j$ at time $t$.[8] The explanatory variable of main interest is $Time_{it}$. This variable measures the number of days it takes to comply with all necessary procedures at the border when importing to the various EU27 countries. This will therefore be our proxy for the costs that trade procedures cause. The other explanatory variables include the importing and exporting countries' GDP and GDP *per capita*, the distance in kilometres between the

[8] Our dependent variable is created by measuring, for all bilateral pairs and years, the volume of imports for each of the 97 *chapters* in the Harmonized System (HS). The advantage of studying trade volumes on such a detailed level is that we can control for a lot of the exporters' unobserved trade characteristics by means of fixed effects for every combination of exporter and chapter. This strongly reduces the potential problems with omitted variables.

largest cities in the importing and exporting country respectively, and dummy variables taking the value one if the trading countries share a common border, have the same official language or have been in a colonial relationship. $\lambda_t$ is a time-specific effect capturing all heterogeneity common for all trade flows in one year but differing over time (such as business cycle effects), while $\mu_{jc}$ is a specific effect for every combination of exporter and product chapter. The latter is important, because it captures all time-invariant heterogeneity based on observed and unobserved differences in product or exporter characteristics. It specifically controls for the exporter's degree of export success with a given product based on such things as geographical conditions (for instance landlockedness), natural resources or quality of institutions.[9] $\varepsilon_{ijct}$ is a disturbance term. For data sources, see Table 3 in the Appendix.

Focusing on imports to EU27 countries over the time period 2006-2008 (being the longest period for which we could find data on both trade and time delays), we include all other countries in the world as exporters. Measuring the volume of trade for each chapter in the Harmonized System, we get a large number of potential trade flows. Not surprisingly, the observed volume of trade is zero in very many of the observations.

We use a fixed effects Poisson Pseudo-Maximum-Likelihood (PPML) estimation of the equation in its original multiplicative form. This solution was first suggested by Santos Silva and Tenreyro (2006), who noted that this estimator has two advantages over the traditional approach of making the model linear by taking logarithms and then estimating it by a Least Squares (LS) estimator. First, the PPML estimator can be used on the model in its original multiplicative form, implying that the observations with zero trade flows do not have to be dropped. Given that the value of trade is zero for a lot of the observations in our dataset, this is particularly relevant. Second, the PPML estimator is consistent, even in the presence of heteroskedasticity. This is not true for the LS estimator. While Santos Silva and Tenreyro (2006) used cross-sectional data to illustrate the advantages of the PPML estimator, Westerlund and Wilhelmsson (2009) have shown

[9] Note that, due to the fact that all importing EU27 countries have the same import tariffs, these fixed effects broadly capture the level of tariff protection that different types of products from various exporters face.

that, in a panel-data setting, a fixed effects PPML estimator (with robust standard errors) strongly outperforms a corresponding log-linear fixed effects model.[10]

### 3.2 Estimation Results

The results from the PPML estimation of equation (1) are displayed in Table 4 in the Appendix (column a). We have a large number of observations; over 800 000, but more than 500 000 of these observations are actually zero. Since trade may be zero precisely because the trade costs caused by cumbersome trade procedures are so high that traders do not even begin to trade, it is of course very important not to ignore these zeroes in the estimations. There are over 11 000 combinations of exporting country and product chapter.[11]

As shown in Table 4, the estimated coefficient for the level of time delays in the importing country is highly statistically significant and has a negative sign. The coefficient may be interpreted as an elasticity, so a one-percent increase in border delays would on average lead to export volumes being diminished by 0.44 percent. In other words, the time delays caused by trade procedures do indeed have a significantly negative effect on trade volumes. It follows that a country which reforms its trade procedures so that time delays at the border are decreased could expect to see increased import volumes.

We do not have much to say about the other gravity variables. Typically, they behave as expected. The product of the trading countries' GDP has a significantly positive coefficient: the larger either economy is, the larger the traded volumes. Richer importers generally import significantly less, while richer exporters export significantly more. Distance has a significantly negative coefficient, while sharing a common border, a common language or a colonial history are all factors which significantly increase trade volumes.

[10] An alternative to the PPML estimation would be to follow Helpman *et al* (2008), who propose using a form of sample selection estimation to solve the problem of zero trade flows being dropped. While theoretically appealing due to its basis in a heterogeneous-firm type trade theory (see Melitz 2003), this method introduces the new difficulty of finding a suitable exclusion restriction for identification of the second-stage equation. This is in practice quite difficult to do.

[11] Since we include fixed effects at the exporter-chapter level, all 3363 groups where an exporter does not export anything at all from a single chapter to any importer are dropped. This restriction is not made when we use the random effects specification in the robustness section below.

### 3.3 Robustness

Since we have a very varied set of exporters in our sample, one could be concerned that the results found above only apply to certain kinds of exporters. To see whether this is the case, we estimate a less restrictive version of the baseline model, where the effects of EU import delays are allowed to differ for low-income, middle-income and high-income exporters respectively. As shown in Table 4 (column b), the differences between low-income and high-income countries are actually quite small, while middle-income countries appear to be somewhat less sensitive to delays caused by trade procedures. Nevertheless, the coefficient for time delays is significantly negative for all three types of exporters.

While we, further, believe that a fixed effects PPML estimator is a good choice for estimating the model, we also use some alternative estimators to test the robustness of the results. The results are shown in Table 4. First, we use a (fixed effects) negative binomial model, which is the most commonly used alternative to a Poisson model. We secondly replace the fixed effects in the baseline model with random effects, and thirdly remove the exporter-chapter specific effects altogether. We further use the traditional least squares fixed effects estimator (implying that the model must be log-linearized and all zero trade flows dropped) and finally the benchmark fixed effects Poisson model estimated on data where all zero trade flows have already been dropped. Very reassuringly, regardless of estimation method, which type of specific effect (if any) that is used, and whether or not the zeroes are included in the sample, the coefficient for our time delay variable is always highly significant and negative.

## 4 What Would be Gained by Harmonization?

The question that arises now is how much exports from outside countries are going to be affected by reformed trade procedures. To offer some understanding of what the data and estimation results mean in an economic sense, we use the estimate for the effect of time delays, and calculate how strongly trade volumes respond to changes in time delays. Three scenarios are presented in Table 2. First, if all EU countries reduced the time needed to comply with all import procedures by one day, aggregated exports from outside countries to the EU would increase by 4.8 percent for the average exporting country

(using our benchmark Poisson estimates). It should be noted that trade effects across EU countries are likely not evenly distributed because they start at different initial levels of time delays to trade across borders, and the volume of import from outside countries and the relative importance of time-sensitive and time-insensitive imports in countries' import differ. As a robustness measure, Table 2 also illustrates that simulation using estimates from a negative binomial model leads to aggregate volume increases of 3.5 percent. Since the negative binomial model is the alternative estimation technique yielding the lowest elasticity, this figure may be seen as a lower bound for the expected effects of trade facilitation reform.

**Table 2. Simulation Results**

| | *Baseline (Poisson)* | *Robustness (Negative Binomial)* |
|---|---|---|
| Scenario 1: One day less for all | 4.8 | 3.5 |
| Scenario 2: Down to average if above | 3.0 | 2.2 |
| Scenario 3: All achieve best practice | 19.7 | 14.5 |

*Note:* The figures illustrate how much an average exporting country's total export volume to the EU would rise following trade procedure reforms in the EU. Three scenarios are considered. In Scenario 1, delays at the border fall by one day in all EU countries. In Scenario 2, the countries having border delays above the EU average improve so that they reach the average, while the others do nothing. In Scenario 3, all EU countries reach the level of border delays that the currently most efficient countries have. The figures using Poisson estimates are considered as the benchmark, but simulation figures using negative binomial estimates are also included for comparison.

In view of the large disparities in the time necessary to trade across borders between the EU countries, a first step if one wants to improve the situation could be to concentrate efforts on the poorest performers. We therefore consider a second scenario where the countries with time delays above the average reduce their time delays to that average (leaving the countries under the average unchanged). In such a scenario, aggregated exports from outside countries are expected to increase by 3 percent on average, which is less than the change following a one-day improvement for all countries. Using estimates from the negative binomial model yields increases of just over 2 percent.

The third scenario is the most interesting, and is much in line with the initial ambition of the EU, namely a customs union in the economic sense of the word open to international trade and competition. This scenario corresponds to the improvement of the trade procedures to the level of the best performers (5 days to import the same good).

Completing the customs union this way boosts aggregated exports from outside countries by some 20 percent on average. Using estimates from the negative binomial model yields a somewhat lower estimate, 14.5 percent, suggesting that effects are sizeable even when we consider the most conservative estimates. It is likely that the one fifth-increase in imports from outside countries is unequally distributed among the EU countries. Contrasting the results of scenarios 1 and 3 suggests that the larger effects are likely concentrated in countries with medium-range procedures at the outset. Nevertheless, the results indicate that the aggregated exports would increase quite substantially for the average exporting country if the EU actually completed its customs union.

Simulations such as these should of course never be taken too literally, but we would like to point out that our calculation of the expected effects of reform is actually likely to err on the side of caution rather than exaggerate the effects. For one thing, the use of alternative estimates from several estimation models suggests that the results are substantial, even when we consider the lower bound of the expected effects. More importantly, however, in these simulations, only existing trade flows are allowed to be affected by the harmonization of trade procedures. However, we know from the literature that trade barriers such as these also have strong effects on the possibility of trading products internationally at all. In other words, in many cases time delays due to inefficient trade procedures may simply be too large for a product to be able to be shipped. Trade facilitation will therefore create new trade volumes, and this effect could be as important as the increase in the existing trade flows. Since we do not take these effects into account, our simulated increases should be seen as conservative. It is interesting that the effects are nevertheless sizable.

# 5 Summarizing Arguments: Should the Responsibility for Trade Procedures be Redistributed?

The European Union is formally a customs union. The choice of this form of integration was made by the six founding countries, which considered it the most suitable form of economic integration. A main reason behind this choice was that only customs unions have the potential to develop into deeper forms of integration with the complete removal of barriers to internal trade. However, focusing on the cross-border trade procedures

discussed in the literature about trade facilitation, we argue that since there is a lot of variation in trade procedures between EU countries, the EU does not meet the customs union condition of having a common external trade policy.

Measuring the effectiveness of cross-border trade procedures by the time delays that they cause, we illustrate that these delays vary considerably within the EU. In fact, they go from merely 5 days in the most efficient countries to 25 days in some others. To examine whether these variations in trade policy have the potential to affect trade volumes, we formally test in a regression analysis whether delays at the border due to cross-border trade procedures have any significant effect on import volumes to EU countries from the rest of world. Interestingly, we find a highly statistically significant and negative effect, with at an elasticity of -0.44. To put this result into an economic perspective, we show in a simulation that if the EU were to harmonize import procedures to the level of the currently most efficient EU countries, the average non-member would increase its aggregated exports to the EU by around 20 percent. In other words, the expected effects of such a completion of the EU customs union are substantial.

What are the prospects of achieving the harmonization we argue is needed if the EU seriously wants to constitute a customs union? Currently, import procedures are still under the responsibility of the member countries. A full harmonization can be difficult to achieve, at least in the short and medium term. Customs practices, skill levels and social capital elements (reliance on trading firms) are the kind of factors that take time to change. On the other hand, the use of information technology, risk management techniques and computerized container scanning can be relatively rapidly improved and harmonized across EU countries. It is hard, however, to see how this type of harmonization could occur without the explicit involvement of the European Commission. According to the subsidiarity principle, the European Commission should only handle tasks that cannot be performed effectively at the national level. Since this, we argue, is the case for trade procedure harmonization, we conclude that if the objective of the EU is the completion of a customs union, the subsidiarity principle commands a redistribution of responsibility for the design and monitoring of trade procedures from the member countries to the European Commission.

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# Appendix

**Table 3. Variables and Data Sources**

| *Variable* | *Definition and Data Source* |
|---|---|
| Imports | Import volume at the Harmonized System (HS) chapter level. Data from Eurostat (2010). |
| Time for imports | Number of days it takes to comply with all necessary procedures at the border when importing to the various EU27 countries. Data from World Bank (2010a). |
| GDP | Data from World Bank (2010b). |
| GDP per capita | Data from World Bank (2010b). |
| Distance | Distance in kilometres between the largest cities in the importing and exporting country respectively. Data from CEPII (2010). |
| Common border | Takes the value one if the importer and exporter shares a common border. Data from CEPII (2010). |
| Common language | Takes the value one if the importer and exporter shares a common language. Data from CEPII (2010). |
| Colonial history | Takes the value one if the importer and exporter shares a common colonial history. Data from CEPII (2010). |

**Table 4. Estimation Results**

| | *Baseline* | *Robustness* | | | | | |
|---|---|---|---|---|---|---|---|
| | Fixed effects Poisson | Fixed effects Poisson, time effect varying by income level | Fixed effects negative binomial | Random effects Poisson | Pooled Poisson | Log-linear least squares fixed effects | Fixed effects Poisson, no zeroes |
| | (a) | (b) | (c) | (d) | (e) | (f) | (g) |
| Time for imports | -0.438*** | | -0.323*** | -0.438*** | -0.476*** | -0.332*** | -0.432*** |
| | (0.000) | | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Low income countries | | -0.528*** | | | | | |
| | | (0.000) | | | | | |
| Middle income countries | | -0.338*** | | | | | |
| | | (0.000) | | | | | |
| High income countries | | -0.585*** | | | | | |
| | | (0.000) | | | | | |
| GDP importer*GDP exporter | 0.852*** | 0.850*** | 0.495*** | 0.852*** | 0.848*** | 1.189*** | 0.804*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| GDP per capita importer | -0.270*** | -0.263*** | -0.221*** | -0.270*** | -0.256*** | -0.422*** | -0.265*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| GDP per capita exporter | 0.682*** | 0.831*** | -0.00393** | 0.682*** | -0.245*** | -0.541*** | 0.677*** |
| | (0.000) | (0.000) | (0.020) | (0.000) | (0.000) | (0.002) | (0.000) |
| Distance | -1.245*** | -1.199*** | -0.284*** | -1.245*** | -0.784*** | -1.855*** | -1.143*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Common border | 0.183*** | 0.188*** | 1.013*** | 0.183*** | 0.691*** | 0.701*** | 0.218*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |

*Table continued overleaf.*

**Table 4. Continued**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Common language | 0.485*** | 0.474*** | 0.498*** | 0.485*** | 0.0108 | 0.615*** | 0.488*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.909) | (0.000) | (0.000) |
| Colonial history | 0.0778*** | 0.0943*** | 0.311*** | 0.0778*** | 0.0225 | 0.563*** | 0.0479*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.811) | (0.000) | (0.000) |
| Time effects | *yes* | *yes* | *yes* | *yes* | *yes* | *yes* | *yes* |
| Exporter-product effects | *yes* | *yes* | *yes* | *yes* | *no* | *yes* | *yes* |
| No of observations | 803,560 | 803,560 | 803,560 | 1,045,272 | 1,045,272 | 255,657 | 254,309 |
| No of exporter-product groups | 11,090 | 11,090 | 11,090 | 14,453 | - | 11,090 | 9,742 |

*Note:* Column (a) contains the baseline estimation of equation (1) with a fixed effects Poisson model. In column (b), the same estimator is used, but separate effects of time delays are allowed for low-income, middle-income and high-income exporters respectively. The remaining columns estimate equation (1) with different estimation techniques and/or samples. The estimated models are: (c) a negative binomial model with fixed effects at the exporter-product level; (d) a Poisson model with random effects at the exporter-product level; (e) a Poisson model without specific effects at the exporter-product level, i.e. a pooled Poisson model; (f) a log-linear least squares model with fixed effects at the exporter-product level (N.B. since the dependent variable is logged in this case, all observations with zero trade volumes are dropped), and (g) a Poisson model with fixed effects at the exporter-product level where all zero trade flows are dropped. *P*-values in brackets (these are based on robust standards errors, estimated using Stata's *oim* choice, except for the pooled Poisson and least squares estimations where the "robust" alternative has been chosen). Asterisks denote significance at the 1% (***), 5% (**) and 10% (*) levels.