Time and Money as Trade Barriers*

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Abstract: With the virtual disappearance of global tariffs, domestic export delays have emerged in the literature as a major obstacle to trade. Related initiatives by international organizations, including the WTO, to reduce such delays were introduced in almost forty percent of developing countries, and have been particularly successful. In this article we propose a novel theoretical mechanism by which reductions in export delays lead to increases in export fees, and test this theoretical prediction empirically. Our results provide strong support for this form of endogenous export fees. They also show that export fees are a greater obstacle to trade than delays.

Keywords: Endogenous trade costs, export delays, gravity model, developing countries

JEL classification: F1, F13, F14, F15

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Before a shipment of goods is exported to an international destination it undergoes a number of domestic channels. Aside from inland transportation, the typical shipment is subjected to a wide range of administrative hurdles: documentation requirements, custom clearance procedures, tax evaluation, cargo inspection, and so on. Exporters are liable for two types of costs that result from such processes. The first relates to the time that is required to complete them. The length of this period, or *export delays* as it is often dubbed in the literature, is important because it has the capacity to impose significant depreciation and inventory-holding losses on shippers (Aizenman 2004; Hummels and Schaur 2013).[1] The second corresponds to an assortment of charges that are levied on exporters as their shipment progresses through the various export channels. Such pecuniary *export costs* are distinct from any monetary implications of the delay itself (e.g., loss in value due to depreciation) and, for the most part, are made up of transportation dues and specific (as opposed to *ad valorem*) government fees. The latter include cargo documentation filing fees, shipment inspection fees, administrative charges for custom clearance, port and terminal handling charges, and so on.

Export delays and export costs have not received equal attention by economists. A slightly longer history of data availability has favored research on the former.[2] Consequently, a limited understanding of export costs is matched by a wealth of research findings on export delays. These findings suggest that delays have the potential to play an important role in the decision to trade. For example, Hummels (2007) calculates tariff-equivalent *ad valorem* rates of export delays in the case of 175 countries for 2007 and finds that tariff-equivalent rates exceed tariffs faced by exporters in most of the world's regions. In the Middle East and North Africa tariff-equivalent rates exceed tariffs by a factor of about 2, in Eastern Europe and Central Asia by a factor of 3, and in sub-Saharan Africa by a factor greater than 4. Similarly, Djankov, Freund, and Pham (2010) find that if developing countries, where export delays are extensive, were to reduce their delays by 10 days the impact on their exports would be more

[1] Depreciation costs correspond to literal spoilage (as in the case of fresh produce) as well as technological obsolescence, while inventory-holding costs derive from the loss of revenue that is associated with having significant capital tied up during a lengthy shipping process. Naturally, these costs are magnified in the case of high value goods (Djankov, Freund, and Pham 2010), and in the case of goods facing significant demand uncertainty (Aizenman 2004; Evans and Harrigan 2005; Hummels and Schaur 2010).

[2] For example, the study on export delays by Djankov, Freund, and Pham (2010) relies on the 2005 World Bank "Trading Across Borders" survey when this survey was not collecting export cost data.

significant (expanding them by a staggering 10%) than any feasible liberalization in Europe or North America.

The emerging prominence of export delays as a major obstacle to trade coupled with the decreasing relevance of global tariffs are likely to have contributed to the shaping of recent policies. In particular, they may help explain why the task of reducing export delays is a leading priority of trade facilitation initiatives that have been recently undertaken by a variety of regional and international organizations including APEC (2007), ASEAN (2005), WCO (2005), and UN-ESCAP (2004). The most notable such example is the August 2004 agreement of the 147 members of the World Trade Organization (WTO) to begin negotiations on a resolution that would radically expedite the domestic movement, inspection, and custom clearance procedures to which traded goods are typically subjected (WTO 2004, Annex D).[3] In terms of achieving their primary objective to reduce delays, these initiatives appear to be remarkably successful. Using survey data that was provided to us by the World Bank we constructed Table 1 that summarizes all trade facilitation reforms undertaken by a total of 122 countries during 2006-2011. According to this Table, almost 40 percent of the developing countries in the sample took steps to reduce domestic export delays. By way of comparison, only about 4 percent of such countries implemented reforms to facilitate trade by decreasing pecuniary export costs.

The neglect of export costs by researchers and policy makers is troubling for two reasons. First, while such costs vary considerably from country to country, data that has been recently made available by the World Bank suggests that they are often significant – particularly in developing countries. In the most extreme cases, such as the Republic of Chad and the Central African Republic, export costs typically correspond to about 30% of the value of containerized exports.[4] Second, there is mounting evidence that governments typically fund the innovations that make delay reductions possible *by increasing* the export fees borne by exporters. Such evidence falls in two major categories. The first category includes official communications that have been tabled in the context of ongoing WTO discussions to refine the 2004 resolution (WTO 2005a, 2005b). The second category collects reports by international organizations that examine the costs of initiatives to reduce trade delays and how such costs are typically funded. See, for example, ADB - UN ESCAP (2013, p. 9) for Asia and UNECA (2013, p. 42) for Africa.

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[3] The WTO negotiations are ongoing and have not yet led to an enforceable agreement. Still, there is considerable evidence that they have served as a catalyst for the early undertaking of the type of reforms that would be required by such an agreement (Finger 2008).

[4] See World Bank's *Doing Business* report for 2010.

Under the circumstances, by overlooking export costs previous studies failed to shed light on a trade impediment that, at least *prima facie*, is large enough to play a role that may be as significant as that of delays. More importantly, the possibility of a causal link between delays and costs suggests that researchers' and policy makers' investigation of the former in isolation of the latter is problematic. It has the capacity to introduce an important source of bias in relevant research and can lead to sub-optimal, perhaps even self defeating, trade facilitation initiatives.

The contribution of this article is twofold. First, we develop a theoretical model to investigate what mechanisms are set in motion when a country becomes a signatory to a trade facilitation agreement that compels the reduction of trade delays. This model pays particular attention to a government's decision to fund innovations that reduce export delays by increasing export fees. Second, using difference regressions we investigate the key implications of this model. Our empirical analysis is a first attempt to examine the novel causal link between export costs and export delays that we posit in this article, on the one hand, and the combined effect of both impediments on exports, on the other.

Our results are striking. First, they provide strong support for the notion that export costs are endogenous with respect to delays. Second, they suggest that export delays have no discernible impact on developing country exports. By contrast, export costs are found to be the dominant impediment to export. This is a reversal of the narrative proposed by earlier contributions that study export delays in isolation, and has important policy implications.

The remainder of this article proceeds as follows. Theoretical considerations are discussed in the next section. Section II presents our empirical methodology. Section III summarizes the data. Section IV discusses the method of estimation and our findings. Concluding remarks are reserved for section V.

I. Theoretical Foundations

It is not clear why international organizations encourage the reduction of export delays but not export costs (APEC 2007; ASEAN 2005; WCO 2005; UN-ESCAP 2004; and WTO 2004 – Annex D). This could be a tactical error, not unlike the GATT's singular preoccupation with tariffs at the exclusion of non-tariff barriers (NTBs). It is also difficult to know what drives many developing countries to acquiesce to these organizations' directives in instances where they may not be enforced. Some may do so because they recognize the welfare benefits that accrue from reducing delays. Others may simply respond to some form of Ethier's (2004) political externalities that arise when policy makers believe that their political status in their own country is sensitive to how they are perceived by prominent international organizations.

In any event, questions pertaining to the decision to encourage and implement the reduction of export delays go beyond the scope of this paper and may be addressed by a variety of political economy models such as Grossman and Helpman (1995), Maggi and Rodríguez-Clare (1998), and Bagwell and Staiger (1999). Our interest here is different. Taking the decision to reduce delays as exogenous, we investigate the following two questions: First, why would a country choose to fund the initiatives that make these reductions possible by increasing export costs rather than raising other forms of revenue, such as taxes? Second, could a welfare maximizing substitution of one impediment by another lead to a net reduction in exports?

To address these questions we develop a model for the case of a small open economy that features firm heterogeneity. This extends earlier work by Hopenhayn (1992), Melitz (2003), and Demidova and Rodríguez-Clare (2009). However, unlike earlier contributions, we introduce pecuniary export costs (in the form of government imposed export fees) as well as a government that determines endogenously how to fund initiatives that facilitate its exogenous commitments to reduce delays. We begin with the model setup. Detailed derivations appear in an Appendix that is available from the authors.

A. *Model Setup*

Consider the case of two countries (home and foreign) where home is a small open economy that is populated by a unit mass of identical households that inelastically supply labor, L, which is normalized to 1. In each country there is a continuum of monopolistically competitive firms characterized by productivity z. Let z follow a Pareto distribution with cumulative distribution function $G(z) = 1 - z^{\beta}$ where $z > 1$, $\beta > \theta - 1$, and $\theta > 1$ is the elasticity of substitution. As a matter of analytical convenience, that has no bearing on results, we normalize the minimum level of productivity to 1 (i.e., $\inf(z) = 1$). The total number of producers in the economy is also normalized to 1.

Preferences. – The utility function is given by

(1) $$Y = \left[\int y_h(z)^{\frac{\theta-1}{\theta}} dG(z) + y_f^{\frac{\theta-1}{\theta}}\right]^{\frac{\theta}{\theta-1}},$$

where $y_h(z)$ is the good produced by a home firm with productivity z, and y_f is the imported good. In an equilibrium with balanced trade, Y is also the real output (GDP) of the country. Maximizing (1) subject to prices and the expenditure constraint generates demand functions

(2) $$y_h(z) = [p_h(z)]^{-\theta} P^{\theta} Y,$$

(3) $$y_f = p_f^{-\theta} P^{\theta} Y,$$

where $p_h(z)$ is the price of the good produced by a home firm with z; p_f is the price of the imported good; and P is the home price index such that

(4) $$P = \left[\int p_h(z)^{1-\theta}\, dG(z) + p_f^{1-\theta}\right]^{\frac{1}{1-\theta}}.$$

Analogously, the quantity of the good produced by a home firm with z that is demanded by the foreign country, $y_h^*(z)$, is given by

(5) $$y_h^*(z) = [p_h^*(z)]^{-\theta} P^{*\theta} Y^*,$$

where asterisks ($*$) denote foreign variables. Hence, $p_h^*(z)$ is the price of the good produced by a home firm with productivity z that prevails in the foreign country, and P^* and Y^* represent the foreign country's price index and real output, respectively. Since the home country is assumed to be a small open economy, domestic decisions have no bearing on P^* and Y^*. For notational convenience, let D denote the constant foreign aggregate factor in the foreign demand, $D = P^{*\theta} Y^*$.

Production Technology. – The output, $y(z)$, of a firm with productivity z is determined by

(6) $$y(z) = zl(z)\,,$$

where $l(z)$ represents labor input. Exporting is subject to an array of marginal costs that we represent in the form of iceberg transaction costs. They include costs of shipping internationally ($\tau \geq 1$) and *ad valorem* depreciation costs that result from domestic export delays ($\delta > 1$) as well as import delays at the destination country ($\delta^* > 1$). Hence, the overall marginal trade cost is given by $\xi = \tau\delta\delta^*$ such that ξ units should have to be shipped for one unit to arrive. In addition, to be able to export, a firm must pay a fixed export fee, f_p, to the government. Given the focus of this study on the role of export delays and (fixed pecuniary) export costs, δ and f_p are of particular interest.

Let m be a binary variable of the exporting status of a producer such that $m = 1$ ($m = 0$) signifies an exporter (a non-exporter). Excluding the fixed export cost, f_p, a firm with z maximizes its operating profit

(7) $$\max \pi(z) = p_h(z)\, y_h(z) + m p_h^*(z) y_h^*(z) - wl(z)\,,$$

by choosing $p_h(z)$, $p_h^*(z)$, $l(z)$, and m subject to the demands for goods at home and foreign, (2) and (5), the production technology, (6), and the resource constraint

(8) $$y(\mathrm{z}) = y_h(z) + m\xi y_h^*(z)\,,$$

where w is the wage rate. The first order conditions give the prices that prevail in the two markets,

(9) $$p_h(z) = \left(\frac{\theta}{\theta - 1}\right)\frac{w}{z},$$

(10) $$p_h^*(z) = \left(\frac{\theta}{\theta - 1}\right)\frac{\xi w}{z}.$$

A firm chooses to become an exporter if the operating profit from exporting can cover the fixed export cost, f_p. The exporting cutoff technology, z_x, satisfies

(11) $$f_p = \left(\frac{1}{\theta}\right)\left(\frac{\theta w}{\theta - 1}\right)^{1-\theta} \xi^{1-\theta} D {n_x}^{-\frac{1}{\eta}}\,,$$

where n_x is the percentage of firms that engage in exports given by $n_x = \int_{z_x}^{\infty} dG(x) = {z_x}^{-\eta(\theta-1)}$ where $\eta = \beta/(\theta - 1) > 1$. Hence, a firm with $z \geq z_x$ $(z < z_x)$ will choose to export (not to export) its goods abroad.

The total labor input used in home production, L_p, can be written as

(12) $$L_p = \int l(z) dG(z) = \left(\frac{\theta w}{\theta - 1}\right)^{-\theta} \left(P^{\theta} Y \Psi_d + \xi^{1-\theta} D \Psi_x\right),$$

where $\Psi_d = \int_1^{\infty} z^{\theta-1}\, dG(z) = \frac{\eta}{\eta - 1}$ and $\Psi_x = \int_{z_x}^{\infty} z^{\theta-1}\, dG(z) = \left(\frac{\eta}{\eta-1}\right) n_x^{(\eta-1)/\eta}$ correspond to the elasticity-adjusted aggregate productivity of all home producers and all home exporters, respectively.

Given the foreign demand for the good produced by the home firm with productivity z, given by (5), and the price for this good that will prevail in the foreign country, given by (10), we can represent the total exports of the home country as

(13) $$EX = \int_{z_x}^{\infty} p_h^*(z) y_h^*(z) dG(z) = \left(\frac{\theta w}{\theta - 1}\right)^{1-\theta} \xi^{1-\theta} D \Psi_x.$$

Analogously with (9) and (10), the price of the imported good in the home country is given by

(14) $$p_f = \xi p_f^*,$$

where p_f^* is the price of the foreign good in the foreign country. Given (3) and (14), aggregate imports in the home country are given by

(15) $$IM = p_f y_f = \xi^{1-\theta} p_f^{*1-\theta} P^{\theta} Y.$$

Government. – The government of the home country collects export fees, f_p, from domestic exporters and lump-sum taxes, T, from domestic households. It uses revenues to hire labor, H, such that

(16) $$wH = n_x f_p + T.$$

The government relies on its H workers to process export shipments through the various customs and port channels. How much labor is required is determined according to

(17) $$H = \gamma^{-1} EX^{\alpha} \delta^{-\mu},$$

where $\gamma > 0$ measures the government efficiency in operating the export process (we assume that γ is not too high so that it is always optimal for the government to discourage unproductive firms from exporting); $\alpha > 1$ so that the labor requirement, H, is increasing and convex with respect to aggregate exports, EX; and $\mu > \alpha$ so that H is decreasing and convex with respect to the export delay, δ, and is decreasing in δ given EX/δ (exports net of delay costs). The government chooses f_p (equivalently T) to maximize national welfare, Y.

Closing the Model. – The model is closed with the balanced trade condition

(18) $$EX = IM,$$

and the labor market clearing condition,

(19) $$L = L_p + H,$$

where L that is the total labor supply at home is normalized such that $L = 1$. It is worth noting that the two approaches of closing the model with the household's budget constraint or the labor market clearing condition are equivalent.

B. f_p *Comparative Statics*

Optimal f_p. – The government chooses f_p to maximize national output, Y. The terms of trade are given by

(20) $$TOT = \frac{P_X}{p_f} = \left(\frac{\theta}{\theta-1}\right) \Psi_x^{-\left(\frac{1}{\theta-1}\right)} \left(\frac{w}{p_f^*}\right),$$

where $P_X = \left\{\int [p_h^*(z)]^{1-\theta} dG(z)\right\}^{\frac{1}{1-\theta}}$ is the export price index of the home economy and, as the reader will recall from (14), p_f is the price of the foreign good in the home economy. We can use (4), (9), (10), (12), (13), (15), (18), and (20), to determine national output

(21) $$Y = \left[\left(\frac{\eta}{\eta - 1}\right) + \xi^{1-\theta}\Psi_x TOT^{\theta-1}\right]^{\frac{1}{\theta-1}} L_p.$$

As it may be noted from this equation, a change in f_p affects Y through three channels: (i) the effective productivity gains from trade, that enter via $\xi^{1-\theta}\Psi_x$; (ii) the terms-of-trade, TOT; and (iii) the labor resource allocated in production, L_p.

In what follows we discuss the comparative statics corresponding to each of these channels.

Consider first the productivity gains that result from an increase in the fixed export fee. As we show below, these productivity gains will decrease

(22) $$\frac{\partial \ln \xi^{1-\theta}\Psi_x}{\partial \ln f_p} = -\frac{(\eta - 1)\{[(\theta - 1)(1 + \lambda) + 1]L_p + \alpha(\theta - 1)H\}}{[(\eta + \lambda)(\theta - 1) + 1]L_p + \alpha\eta(\theta - 1)H} < 0.$$

The intuition is fairly straightforward. From (11), an increase in f_p increases the cutoff productivity level z_x discouraging relatively less productive firms from exporting. This results in a reduction of the number of exporters, n_x, and hence the aggregate (elasticity adjusted) productivity of exporters, Ψ_x. Naturally, this decline in the effective productivity gains from trade results in a decline in national output.

Consider now the terms of trade. An increase in f_p will have two opposing effects that are represented by the arguments of equation (20). On the one hand, it will discourage less productive firms from exporting. This will reduce the aggregate (elasticity adjusted) productivity of exporters, Ψ_x, which will have a positive impact on the home country's export price, P_X. On the other, as we show in the Appendix, it will decrease the marginal cost of production for each exporter thereby decreasing the wage rate, w, which will have a negative impact on the home country's export price, P_X. The following result shows that the former effect, that improves the terms of trade, dominates the latter, that deteriorates these terms. The increase in TOT will, of course, have a positive effect on national income.

(23) $$\frac{\partial \ln TOT}{\partial \ln f_p} = \left(\frac{\eta - 1}{\theta - 1}\right)\frac{[(\theta - 1)\lambda + 1]L_p}{[(\eta + \lambda)(\theta - 1) + 1]L_p + \alpha\eta(\theta - 1)H} > 0.$$

Finally, we examine the issue of resource allocation. As we explained in an earlier section an increase in f_p will raise the cutoff technology, z_x, which will discourage less productive firms from exporting. This will reduce the volume of exports and, as a result, the number of workers employed by the government to process shipments via the various export channels (customs, ports, etc.) The result, which is highlighted below, is that resources will be reallocated to production.

(24) $$\frac{\partial \ln L_p}{\partial \ln f_p} = \frac{\alpha(\eta-1)[(\theta-1)\lambda+1]H}{[(\eta+\lambda)(\theta-1)+1]L_p + \alpha\eta(\theta-1)H} > 0.$$

This will have a positive impact on the country's output.

Denote f_p^o to represent the optimum f_p that maximizes national income. The government will choose f_p^o so that the marginal effects discussed in this section so far cancel out. To show further light consider that equations (21)-(24) suggest that

(25) $$\frac{\partial \ln Y}{\partial \ln f_p} = \frac{B_f}{B_y},$$

where

(26) $$B_f = (\eta-1)\left[\alpha\theta\lambda H - (1-\lambda)L_p\right],$$

(27) $$B_Y = [\eta(\theta-1) + (\theta-1)\lambda + 1]L_p + \alpha\eta(\theta-1)H > 0.$$

Here, $\lambda = \left(\frac{\theta w}{\theta-1}\right)^{1-\theta}\Psi_d P^{\theta-1}$, the expenditure share of home goods. For the existence of an interior solution (the second order condition of the maximization problem), we assume that $2-\lambda+\theta(\alpha\lambda-1) > 0$. We can rewrite this condition as $(\theta-1)H < 1-\lambda$. This condition implies that to have an interior solution, the curvature of the exporting processing cost, α, should be sufficiently high relative to the expenditure share of the home goods, λ, in the equilibrium so that the labor used in exporting processing H is not too high relative to the export share of output $1-\lambda$.

Given (25), the government will choose f_p^o so that $B_f = 0$. It follows that the equilibrium L_p and H are given by

(28) $$L_p = \frac{\alpha\theta\lambda}{\alpha\theta\lambda + 1 - \lambda},$$

(29) $$H = \frac{1-\lambda}{\alpha\theta\lambda + 1 - \lambda}.$$

Exogenous Reduction in Export Delays. – As we show in the Appendix

(30) $$\frac{\partial \ln f_p^o}{\partial \ln \delta} = -\left(\frac{1}{\eta-1}\right)\left\{2\eta(\theta-1)+1 + \left[1+\frac{\alpha\theta\lambda[\eta(\theta-1)+\theta\lambda]}{(1-\lambda)\phi}\right]\frac{(\mu-\alpha)H}{1+(\alpha-1)H}\right\} < 0,$$

where $\phi = [2-\lambda+\theta(\alpha\lambda-1)]L_p > 0$. To gain relevant insight, consider that the primary impact of a reduction in export delays, δ, is to decrease the cutoff technology, z_x, thereby increasing the number of exporters. Given (17), the greater volume of exports will cause the operating costs of processing shipments through export channels, H, to rise. To fund these operating costs, under the condition listed above, the government will increase the export fees, f_p. Given (23), this will improve its terms of trade by preventing relatively inefficient firms (relative to the additional operating costs that result from the increase in exporters) from exporting in order to maximize Y.

Efficiency Improvement. – Recall that γ measures the government efficiency in processing shipments via export channels. We have

$$\frac{\partial \ln f_p^o}{\partial \ln \gamma} = -\left(\frac{1}{\eta - 1}\right)\left\{1 + \frac{\alpha\theta\lambda[\eta(\theta - 1) + \theta\lambda]}{(1 - \lambda)\phi}\right\}\frac{\mu H}{1 + (\alpha - 1)H} < 0. \tag{31}$$

A rise in γ reduces the overall cost of processing exports, H creating a government incentive to reduce the fee to the exporters, f_p.

B. *Exports Comparative Statics*

The log change in exports, $d \ln EX$, is given as

$$d \ln EX = \frac{1}{\eta(\theta - 1) + \theta\lambda}[\eta(\theta - 1)d \ln Y - (\eta - 1)\theta\lambda d \ln f_p - \eta(\theta - 1)(2\theta\lambda - 1)d \ln \delta]. \tag{32}$$

It is clear from this expression that exports are increasing in national income, but decreasing in export fees, f_p, and export delays, δ, if $\lambda > 1/(2\theta)$.

Exogenous Reduction in Export Delays. – When f_p is chosen optimally, such that $f_p = f_p^o$, then

$$\left.\frac{\partial \ln EX}{\partial \ln \delta}\right|_{f_p = f_p^o} = 1 + \left[1 + \frac{\alpha\theta^2\lambda^2}{(1 - \lambda)\phi}\right]\frac{(\mu - \alpha)H}{1 + (\alpha - 1)H} > 0. \tag{33}$$

A reduction in export delays, δ, will have two effects. First, given that a reduction in export delays constitutes a fall in the marginal cost of exports this will have the direct effect of increasing exports, i.e., $\frac{\partial \ln EX}{\partial \ln \delta} < 0$ given f_p. Both a reduction of δ and an increase in EX raise the labor required to process export shipments, H, as shown in (17). This reallocation of labor from production to export processing is too costly for the country. Thus, the government increases the fixed export fees, f_p^o, to reduce the cost of processing exports by discouraging less productive firms from exporting as shown by (30). This second indirect effect of increasing pecuniary export fees f_p^o decreases exports. As shown by (33) the latter effect will always outweigh the former resulting in a fall in aggregate exports.

Efficiency Improvement. – When f_p is chosen optimally, such that $f_p = f_p^o$, then

$$(34) \qquad \left.\frac{\partial \ln EX}{\partial \ln \gamma}\right|_{f_p=f_p^o} = \left[1 + \frac{\alpha\theta^2\lambda^2}{(1-\lambda)\phi}\right]\frac{H}{1+(\alpha-1)H} > 0.$$

A rise in γ reduces the overall cost of processing exports, H, creating a government incentive to reduce the fee to the exporters, f_p, which will in turn increase aggregate exports.

The basic setup and comparative statics of this section inform both the design of our regression equations as well as the interpretation of our empirical results.

II. Empirical Methodology

Over the last decade policy initiatives reduced export delays to stimulate trade. Yet, the logic of endogenous funding of equation (30) points to delay reductions as a driver of higher export costs that, in turn, hinder trade. In the simplest case, the nexus of these relationships can be summarized by the following system of equations:

$$(35) \qquad ln\left(\frac{Exp.Costs_{it}}{Exp.Costs_{jt}}\right) = \alpha + \beta_1 ln\left(\frac{Exp.Delays_{it}}{Exp.Delays_{jt}}\right) + \beta_2 ln\left(\frac{Agg.Exports_{it}}{Agg.Exports_{jt}}\right)$$
$$+\beta_3 ln\left(\frac{Corruption_{it}}{Corruption_{jt}}\right) + \beta_4 ln\left(\frac{Political\ Stability_{it}}{Political\ Stability_{jt}}\right)$$
$$+\beta_4 ln\left(\frac{Voice\ and\ Accoutability_{it}}{Voice\ and\ Accoutability_{jt}}\right) + \varepsilon_{ijt}$$

$$(36) \qquad ln\left(\frac{Exports_{ikt}}{Exports_{jkt}}\right) = \alpha + \gamma_1 ln\left(\frac{GDP_{it}}{GDP_{jt}}\right) + \gamma_2 ln\left(\frac{GDPC_{it}}{GDPC_{jt}}\right)$$
$$+\gamma_3 ln\left(\frac{Distance_{ik}}{Distance_{jk}}\right) + \gamma_4 ln\left(\frac{Exp.Delays_{it}}{Exp.Delays_{jt}}\right)$$
$$+\gamma_5 ln\left(\frac{Exp.Costs_i}{Exp.Costs_j}\right)$$
$$+\gamma_6\left(Landlocked_i - Landlocked_j\right)$$
$$+\gamma_7\left(Contiguity_{ik} - Contiguity_{jk}\right) + \gamma_8\left(Colony_{ik} - Colony_{jk}\right)$$
$$+\gamma_9\left(Language_{ik} - Language_{jk}\right) + \vartheta_{ijkt}$$

Equation (35) investigates the link between export costs and export delays. The direction of endogeneity is not ambiguous. Self declarations by reforming nations, summarized in Table

1, suggest that their primary target is to reduce export delays not export costs. Why countries commit to decrease delays, often in line with anticipated forthcoming WTO requirements, is beyond the object of this paper. Instead, we investigate the extent to which these commitments, which translate into actual reductions in delays, result in higher export costs.

Equation (36) explores the combined effect of both such impediments on exports. In both instances we estimate first-difference equations. This approach entails pairing *similar* exporters and regressing ratios of corresponding variables across each pair. Exporters are deemed to be similar if they belong to the same geographical region and generally face the same trade barriers in countries to which they export.[5]

Let $m \in (i, j)\ \forall\ i \neq j$. Beginning with equation (35), let $Exp.Costs_{mt}$ and $Exp.Delays_{mt}$ denote the domestic export costs and domestic export delays of country m at time t, respectively. The sign and significance of the coefficient of relative export delays is of particular importance to this study as it measures the extent to which innovations that target delay reductions are funded by increases in export fees. As highlighted by equations (16) and (17), two other factors are likely to play an important role in the determination of export costs. The first is the aggregate volume of exports of any given country to the rest of the world. This is represented by $Agg.Exports_{mt}$ in equation (35). An increase in aggregate exports will increase the demand for resources that are used intensively in the various export channels which may, in turn, increase the government fees that are charged for the use of these channels. The second is the efficiency with which any given government is likely to operate the export process. This is what we represent by γ in equation (17) of our theoretical model. Efficient governments are those with an established and well operating transportation infrastructure and customs framework which are likely to keep export costs at relatively low levels. This is an easy consequence of equation (31) of our theoretical model. We use three variables to proxy government efficiency. These are indexes of corruption ($Corruption_{mt}$), political stability and absence of political violence ($Political\ Stability_{mt}$), and the prevalence of political voice and institutional accountability ($Voice\ and\ Accountability_{mt}$). Certainly in the case of developing countries, which are the focus of this study, absence of corruption and political violence and presence of political stability, political voice, and institutional accountability represent important pillars of government efficiency. We avoid the use of other indexes, such as the World Bank's index of government effectiveness, that are constructed using measures of the incidence of distortive

[5] Each match of a pair of exporters with a particular importer enters our regressions once.

fees such as export costs. Such indexes are endogenous with respect to the dependent variable of equation (35) and are therefore unsuitable.

The results of equation (36) have the potential to reverse the narrative advocated by earlier studies regarding the importance of export delays. To impart credibility to these results we follow Rose (2004) and purposefully avoid introducing novelty to the specification, data, or estimation of this equation. Its formulation follows that of a typical gravity equation in difference form. In particular, the dependent variable represents the relative exports of two *similar* countries i and j to the same destination. Letting $m \in (i, j)$, it is constructed using $Exports_{mkt}$ that denotes the value of exported goods from country m to country k at time t. Formulating the regressors follows a similar approach. With the exception of export delays ($Exp.Delays_{mt}$) and export costs ($Exp.Costs_{mt}$), the remaining explanatory variables are standard in gravity equations.[6] Let $Distance_{mk}$ denote the distance from exporter m to importer k, and let GDP_{mt} ($GDPC_{mt}$) represent exporter m's gross domestic product (gross domestic product per capita) at time t. In addition, let $Landlocked_m$ denote a dummy that is equal to unity when country m is landlocked, and let $Contiguity_{mk}$, $Colony_{mk}$, and $Language_{mk}$ denote dummy variables that are equal to unity when exporter m and importer k have a common border, colonial history, and language, respectively. Finally, ε_{ijkt} and ϑ_{ijkt} are the disturbance terms.

Difference gravity models have a number of advantages over competing characterizations and have been used extensively in the literature (e.g., Anderson and Marcouiller 2002; Hanson and Xiang 2004; Djankov, Freund, and Pham 2010; and Hummels and Schaur 2013). Some of these advantages rely on how similarity between countries is defined, whereas others are inherent to the differencing process. We discuss them in this order, while paying particular attention to how the specific criteria that we use to define similarity (i.e., geography and trade barriers) give rise to the benefits of this approach. We begin with the criterion of a common geographical region. This criterion is important for three reasons. First, its use in the context of a difference equation facilitates controlling for importers' and exporters' remoteness which, as highlighted by the work of Anderson and van Wincoop (2003), play an important role in trade. Of course, remoteness can also be controlled in level gravity equations using an index of multilateral resistance. However, the calculation of such indexes can be a complicated proposition and their accuracy has been a subject of considerable debate (Behrens, Ertur, and Koch 2012). Second, reliance on

[6] For a recent review of the literature see Anderson (2010).

geography to define similarity disentangles the dual role of distance in gravity equations. The original and principal role of this variable is, of course, to account for transportation costs between exporters and importers. However, in a recent important contribution Melitz (2007) shows that latitudinal distance has a profound effect on climatological and natural conditions which, in turn, impact on optimal production techniques, the productivity of different factors and – assuming comparable levels of development – relative factor endowments. These differences increase opportunities for profitable trade. Hence, an increase in latitudinal distance has a dual effect. It increases transportation costs hindering trade, but also increases production differences that promote trade. By pairing countries that belong to the same geographical region (while controlling for their level of development) and examining their relative distance to a common importer our model controls for the extent to which distance may capture production differences that may promote comparative advantage. Third, combining common geographical region, while controlling for the level of development, reduces the prevalence of endogeneity bias. Not only are export delays and export costs expected to impact on exports but the reverse is also possible. Djankov, Freund, and Pham (2010) argue that by pairing similar countries that are likely to have similar exporting infrastructures, and therefore similar capacities to respond to changes in the demand for resources used in export channels, the difference approach partly neutralizes the impact that comparable perturbations on exports have on export delays. Of course, the same logic that applies to the case of delays must apply to export costs. Still, the difference approach may not eliminate endogeneity bias in either case. For this reason our estimations also include an instrumental variables approach which we discuss in some detail in a forthcoming section.

Consider now the criterion of common trade barriers that exporters face by importing nations. We implement this criterion by requiring any two countries to belong to the same regional agreement before they are deemed to be similar. Using this criterion to define similarity and expressing the dependent variables in terms of relative exports to a common importer accounts for the fact that trade bloc members are often treated symmetrically by third parties. In this light, this approach nets out importers' tariffs and NTBs which are notoriously difficult to measure. In addition, this approach nets out trade factors that are specific to the importer and can have an important impact on trade. These include the importer's population, GDP, and so on.

Proceeding to benefits that are independent of how similarity is defined we note that the difference approach is particularly well suited to this study given our emphasis on export costs. This is due to the fact that there is no available information regarding the specific rate of inflation in such costs. In this light, the use of level equations in conjunction with a price deflator that may only partly account for true inflation in export costs would generate results suggesting a negative causal relationship between costs and delays even in the absence of such a link. Difference equations eliminate the need to deflate export costs and ensure that what we measure is fluctuations in the relative rate of *real* export costs between any given country pair.

III. Data

The econometric analysis requires data on trade flows, trade blocs, export transaction costs and related customs data, the quality of governance and institutional performance, national income accounts, and various geographic and historical country characteristics.

Trade data, in nominal US dollars, was collected from the United Nation's *Comtrade Database.* Trade bloc membership and custom inspections of imports data (used as an instrument and only available for 2005) were kindly provided by Djankov, Freund, and Pham (2010). Export transaction costs, in the form of time delays and pecuniary costs, were collected from the World Bank's "Trading Across Borders" survey. This survey has been administered annually since 2005 to freight forwarders, shipping lines, custom brokers, and banks in over 140 countries. The survey includes questions on export delays from its inception, whereas questions on export costs were introduced in the 2007 report. To make the data comparable across economies, survey questions concentrate on goods with common characteristics. In particular, they pertain to goods that may travel in a dry-cargo, 20-foot container that weighs 10 tons, and are valued at $20,000. Such goods exclude military items, are not hazardous, do not require refrigeration or special phytosanitary or environmental safety standards, and represent one of the economy's leading export products. In addition, such goods must be produced by a business that employs at least 60 employees, is located in the economy's largest business city, is a private limited liability company, does not operate in an export processing zone or an industrial estate with special export or import privileges, is entirely domestically owned, and exports more than 10% of its sales.

The survey collects information regarding four distinct types of export delays and pecuniary export costs. They correspond to the time required and the monetary expense that are incurred in: (i) preparing and submitting the requisite export documents to the appropriate government authorities; (ii) subjecting a shipment to custom inspections and fulfilling the various requirements for customs clearance; (iii) arranging inland transportation, loading shipment on mode of transportation, and transporting it from warehouse to seaport (or, in the case of landlocked countries, to border); and (iv) handling a shipment within the port. This last item entails waiting delays before the designated vessel for any given shipment departs and the time required to load containers onto the vessel in conjunction with a variety of associated terminal charges. Costs do not include destination tariffs, charges associated with international transportation, or bribes.

The endogenous relationship between delays and costs that is discussed in earlier sections is not likely to be equally prevalent across these categories. Consider for example the case of export documents. Typically, the submission of each such document must be accompanied by a prescribed government fee. Cutting down on bureaucracy by, say, eliminating some of these documents can decrease associated time delays and is not likely to represent a costly exercise.[7] This is supported by official testimonies of nations undertaking trade facilitation reforms collected by the WTO (2006, p.52). Of course, this does not also imply the elimination of associated submission fees. In most instances we would expect governments to choose revenue-neutral policies by requiring the total revenue generated from document submission fees to remain unchanged.

Unlike the case of export documents, reducing delays associated with domestic transportation from factory to port, which could be accomplished by building better road networks, is likely to be exceptionally costly. Furthermore, such costs may very well be passed on to all users of such networks, including exporters. However, to the extent that such infrastructure projects are taking place around the world, their completion is likely to take a long time and we do not expect their results to be fully captured by the short time span that we examine.

Of particular interest to our study are delays and costs associated with clearing goods through customs and ports – categories (ii) and (iv) above. According to the experience of a number of developing countries around the world, reducing time delays associated with these channels can be achieved with relative ease by hiring more custom inspectors, establishing custom inspection priority channels (that can issue advance ruling and release of express shipments), forming "enquiry points" that disseminate customs information, streamlining terminal procedures, expanding terminal holding areas, introducing automation in processing shipments at national ports, increasing the number of dockside gantry cranes that are used to load containers on ships, and so on (United Nations 2006). The preponderance of such

[7] For example, a number of countries have recently eliminated the requirement of a packing list, certificate of origin, export license, inspection report, and technical and health certificates. Collecting such information is either entirely unnecessary or replicated in the customs export declaration that most nations require (*Doing Business*, 2010).

innovations can be introduced within a very short time span but they come at significant establishment costs and – perhaps more importantly –ongoing operational costs (United Nations 2006; Yasui and Engman 2009; WTO 2005a; WTO 2005b). For reasons advocated in earlier sections, and highlighted by our theoretical model, such costs are likely to be passed on to exporters rather than any given government's general ledger and we expect the ensuing relationship between delays and costs to manifest in our results. In light of these considerations, and to simplify the analysis, we merge categories (ii) and (iv) pertaining to custom and terminal channels, on the one hand, and categories (i) and (iii) corresponding to documentation and transportation procedures on the other.

Our econometric analysis relies on data from 2006 to 2011 that was collected by the World Bank's "Trading Across Borders" surveys conducted from 2007 to 2012. Given the significant extent to which this data is typically revised in the first 2 years after it is published, we avoid using more recent surveys. Table 2 provides descriptive statistics of aggregate export delays and export costs by custom union.

We measure the quality of governance and institutional performance using indexes of political stability, voice and accountability, and corruption. Indexes of political stability and voice and accountability were collected from the World Bank's *Worldwide Governance Indicators*. The former measures perceptions of the likelihood of political stability and absence of politically motivated violence. The latter captures perceptions of the extent to which a country's citizens have a voice in selecting their government, consider their media to be free, and have freedom of expression and association. These indexes increase monotonically with positive perceptions and, as it may be noted from Table 3, in our sample of countries they range from -2.81 to 1.67. The third measure of institutional performance that we employ is an index of corruption which was collected from the database of *Transparency International.* The index is normalized to assume values between 0 and 10 and is *inversely* related with the prevalence and intensity of corruption.

GDP and GDP per capita were collected from the World Bank's *World Development Indicators*. The remaining data corresponds to trade friction indicators that are fairly standard in gravity equations. Our measure of the distance between trade partners corresponds to the geodesic distance calculated using the great circle formula which uses latitudes and longitudes of the most important cities and population agglomerations. This measure of distance and the information needed to construct dummies corresponding to common border, language, and colonial history between trade partners were all collected from the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII).

Our panel includes data for 114-119 countries for 2006-2011. The small differences in the number of countries that appear in our panel from year to year are the result of data availability constraints. On average, about 65% (35%) of these countries are classified as developing (high-income). Table 3 provides descriptive statistics of all variables used in this study.

IV. Estimation and Results

To impart credibility to our results we avoid the introduction of novelty in our estimation approach and follow the convention of estimating the gravity equation – in our case, equation (36) – independently of other equations that may determine its regressors. Following this approach will help establish the precise source of any differences between our findings and those of related studies that rely on similar gravity formulations. In any event, (35) and (36) are not a complete system of equations and are therefore not eligible for simultaneous estimation. In the current context, this is not necessarily a disadvantage. Independent estimation of (35) and (36) guards the latter against transmission of specification bias that may derive from our, inescapably *ad hoc*, choices for proxies of government efficiency in equation (35).[8]

Consider now equation (35). Following the discussion of a previous section, this equation can be used to investigate whether there is empirical support for the hypothesis that innovations implemented by developing countries for the purpose of introducing reductions in certain types of time delays are typically funded by increases in corresponding export fees. A number of nations are on record for expressing a preference for this funding approach (WTO 2005a; WTO 2005b), and our theoretical model provides a plausible explanation for such a preference (see equation 30). Interestingly, while funding decisions *within* developing countries can explain a negative link between certain delays and their corresponding pecuniary export costs over time, physical and institutional factors predict the opposite relationship between such variables *across* countries. As recently explained by Clark, Dollar, and Micco (2004) port inefficiencies and the general condition of countries' trade infrastructure are historically responsible for introducing a concomitance of significant trade delays and large pecuniary shipment handling costs. This is consistent with our theoretical model given the structure of equations (16) and (17) and the result of (31). Using 1998 figures Clark, Dollar, and Micco (2004) provide tentative evidence along these lines by

[8] It may be instructive to recall that 3SLS and 2SLS are asymptotically equivalent and that the former is more efficient only under the null of no misspecification (Hausman, 1978).

comparing the efficient, fast, and low fee ports of East Asia with their inefficient, slow, and high cost counterparts of Latin America. However, due to significant data deficiencies the authors are not able to extend their analysis to the majority of developing countries (including African countries) which, as we show in Table 2, are an important part of the story.

To set the scene for an investigation of the dynamic relationship between costs and delays within countries, that is at the heart of this study, we first consider the composite of cross-country and time-series correlations between these variables. Using data for all countries during 2006-2011 and the aggregations discussed in a previous section, we calculate the logarithms of real document and transportation costs $(logDTCosts)$, real customs and terminal costs $(logCTCosts)$, document and transportation delays $(logDTDelays)$, and custom and terminal delays $(logCTDelays)$. We compute the correlation coefficient between $logDTDelays$ $(logCTDelays)$ and $logDTCosts$ $(logCTCosts)$ as well as regress the former on the latter. The results of these naïve panel estimations are reported in Table 4. As it may be noted, the correlation between costs and delays across all categories is positive. This result provides support for the explanations of Clark, Dollar, and Micco (2004). Yet, it is not incongruous with a possible negative causal relationship between costs and delays within individual countries. If such a negative relationship does in fact manifest in the data, it is overshadowed in Table 4 by the positive cross-country correlations.

Estimating (35) with fixed effects for individual pairs of exporting countries disentangles the within-country, dynamic, relationship from the cross-country link between costs and delays. In addition, unlike the naïve regressions of Table 4, estimation of (35) realizes the benefits of the differencing approach discussed in an earlier section and accounts for determinants of export costs other than delays. Following the aggregations discussed earlier, we estimate two different interpretations of (35). The first links document and transportation delays and costs and the second custom and terminal delays and costs.

The ratio of aggregate exports $\left(Agg.Exports_{it}/Agg.Exports_{jt}\right)$ in equation (35) is of particular interest. Not only do we expect changes in exports to impact on export costs in any given country, but the reverse must also be true. For reasons discussed in an earlier section, the endogeneity bias that may derive from such reverse causation is, at least in part, ameliorated by the differencing approach. To further address the possible prevalence of such bias we also instrument the ratio of aggregate exports using three key determinants of this variable that flow from the theory underlying gravity equations: the ratio of exporting countries' GDP, GDP per capita, and aggregate distance to all respective trade partners.

The logic of the mechanism that we examine in this study links changes in delays that may be compelled by international agreements *over time* to changes in costs *over time*. In this light, we estimate (35) not only in levels (of ratios) but also in time differences (of ratios) that may better capture the relevant dynamics. In each case we use data for all countries as well as, independently, for high-income and developing countries. In all instances we report errors that are robust in the presence of arbitrary heteroskedasticity. The results appear in Table 5.

Consider first the results corresponding to the determination of customs and terminal costs in the case of developing countries. They are found in the rows of Panel B, columns (3) and (4). Beginning with the measures of governance quality, we note that two of the three relevant indexes (*Political Stability* and *Voice and Accountability*) switch signs across level and time difference regressions. In addition, only one of the four relevant coefficients of these two variables (in columns 3 and 4) is statistically significant. By contrast the corruption index is negative and statistically significant in both columns. This suggests that, in accordance with *a priori* expectations, higher levels of corruption are consistent with greater export costs.[9] Also consistent with expectations is the coefficient of aggregate exports which is positive and statistically significant. An increase in exports increases the demand for resources that are required to process them through customs channels and export terminals driving export costs to higher levels. Finally, the coefficient of delays is negative and significant at the 1 and 5 percent levels in the time differences and levels regressions, respectively. This provides strong support for the mechanism envisaged in this study and has important implications. As expected, this negative relationship does not manifest in the case of corresponding regressions that examine the determination of documents and transportation costs where, as we explained in an earlier section, the prospect of such a link is tentative. In addition, such a relationship also fails to manifest in the case of high-income countries where, as we show in Table 1, export delays have remained virtually unchanged over the period under examination. We will not discuss the remaining results that are reported in this table. They are consistent with expectations and are provided here only in the interest of completeness.

The key objective of estimating equation (36) is to investigate the relative role of export costs and delays in export decisions. This entails a small number of specific deviations from

[9] It is important to recall that *Transparency International*'s index of corruption increases *inversely* with the level of corruption and that our definition of pecuniary export costs excludes bribes.

the estimation approach of earlier studies in this area. In addition to omitting export costs from the analysis altogether, such studies typically abstract from a detailed discussion of different types of delays, and rely exclusively on cross-country data (see for example Djankov, Freund, and Pham 2010). How such estimation frameworks must be modified in this study is guided by our findings so far. There are three key lessons that may be drawn from such findings. First, in any given country different types of export delays may have different dynamic relationships with their corresponding export costs. Second, the nature of such links is likely to be different across developing and high-income countries. Third, at least in the case of developing countries, the relationship between particular export costs and their corresponding export delays *within countries* over time can be orthogonal to the analogous link *across countries* for any given year.

To clarify the relevance of each of these considerations and to bridge the gap between important earlier contributions, on the one hand, and this study, on the other, our estimation strategy unfolds in a series of steps. For presentational convenience we denote these steps Models 1, 2, and 3. Each successive model adds a specific layer of complexity to the analysis and sheds progressive light on the precise role of export costs and delays in export decisions.

We begin with Model 1 that is a cross-country interpretation of equation (36) using data for 2009, which is at the midpoint of our time series. We estimate this model for all countries as well as independently for high-income and developing countries. In each case, we estimate two specifications. The first is in line with earlier formulations that include aggregate delays but exclude aggregate export costs. The second adds aggregate export costs to the regression. All regressions cluster observations by pairs of exporters, and all reported standard errors are robust to the presence of arbitrary heteroskedasticity. In addition, export delays and export costs are instrumented with their first lags, the number of customs inspections, and our indexes of corruption, political stability, and voice and accountability. The results are given in Table 6.

We first consider the coefficients of variables that are standard in comparable formulations that may be found in the literature. *Distance* is, of course, ubiquitous in such formulations given that it is a central concept in the development of the gravity approach. The coefficient of this variable for the subset of our regressions that rely on data for all countries (columns 1 and 2) is about –1.3 and statistically significant at the 1 percent level. This is in line with the overwhelming majority of relevant studies that, according to the recent survey of Disdier and Head (2008), find this coefficient to assume values under 1.55. Also in accordance with similar studies, we find the coefficient of *Distance* to be generally higher in the case of developing exporters than their high-income counterparts. As predicted by theory, and as supported empirically by the relevant literature (see Carerre 2006 for key references), our coefficient of *GDP* is around unity for all specifications. Also in accordance with expectations, and similarly to other studies that use comparable data (e.g., Rose 2004), the coefficients of *GDPC*, *Language*, and *Colony* are positive in the case of all specifications and, in most cases, statistically significant at the 1 percent level. By contrast coefficients for *Landlocked* and *Contiguity* exhibit sign reversals across developing and high-income countries. At least in the case of *Landlocked* none of the estimated coefficients corresponding to the various specifications are significant. However, in the case of *Contiguity* it is surprising that the relevant coefficient is negative and significant in the case of the specifications for high-income countries (columns 5 and 6). This appears to be driven by significant trade between high-income countries that belong to the European Union (EU) and are in close proximity but do not share a land border (think France and the U.K., Italy and Spain, etc.).[10]

Finally, we turn our attention to the key variables of export delays and export costs. Consider first the specification of column (1) which relies on data for all countries and excludes export costs from the analysis. It is intended to replicate the results of earlier studies, such as Djankov, Freund, and Pham (2010), that also exclude export costs and only consider the role of delays using 2005 data. Our estimated coefficient for this variable using 2009 data is –0.633 which is comparable to these authors' 2005 figure of –0.484.[11] Also in accordance with the findings of these authors, this coefficient is statistically significant at the 1 percent level. The specifications of columns (3) and (5) estimate this coefficient independently for developing countries and high-income countries As it may be noted, the former is –1.628 and the latter −0.320 and they are significant at the 5 and 10 percent levels, respectively. We set aside an interpretation of the difference in these coefficients which, in any event, is broadly consistent with those of similar contributions.[12]

Having effectively replicated the results of earlier studies that only consider delays, we proceed to the results of regressions that also include export costs. These are given in columns 2, 4, and 6 of Table 6 for all countries, developing countries, and high-income countries, respectively. Central to our analysis is how the coefficient of export delays changes when export costs are added to our regressions. We can, of course, infer the likely direction

[10] Dropping EU countries that are contiguous from the dataset changes the coefficient of *Contiguity* to positive (and statistically insignificant) while leaving the remaining coefficients virtually unchanged.
[11] See Table 2 of Djankov, Freund, and Pham (2010).
[12] See for example the various specifications estimated by Djankov, Freund, and Pham's (2010) outlined in their Tables 2 and 3. Note in particular their estimates for the coefficient of delays in the case of landlocked countries – which are primarily developing nations (Faye *et al.* 2004) – with their estimates of this coefficient in the case of all countries.

of such change. Given the positive cross sectional correlation between delays and costs, which may be inferred from the results of Tables 4 and 5, we expect the absolute value of the coefficient of delays to decrease with the addition of costs. However, we have no *a priori* expectation regarding the extent of such a decrease. Consider first the case of developing countries. As it may be noted from Table 6, the coefficient of export delays declines (in absolute value) from a figure of –1.628 that is statistically significant at the 5 percent level, to a statistically insignificant figure of –0.654. At the same time the coefficient of export cost is –1.64 and statistically significant at the 5 percent level. These findings are staggering. They suggest that earlier studies inflate the role of export delays and highlight the important, yet previously neglected, role of export costs in the developing world's export decisions. To place these coefficients in perspective, consider the average size of export costs and bilateral exports for developing countries in 2009. These were $1,416 and $333.4 million, respectively. Given these figures our findings suggest that, other things equal, a 10 percent reduction in export costs from $1,416 to $1,274 can increase bilateral trade by an average figure of almost $55 million. Delays, of course, remain an important impediment to trade. Other things equal, a 10 percent reduction in time delays would generate on average an additional $21 million of bilateral trade. However, this is only about 40 percent of the impact identified by earlier studies. In this light, the developing world's monolithic approach to trade liberalization that, as may be seen from Table 1, has so far concentrated almost exclusively on delays is unjustified.

Contrary to the case of developing countries, adding export costs to the regressions of high-income exporters appears to have virtually no impact on the coefficient of delays. From a value of –0.320, that is statistically significant only at the 10% level, this coefficient decreases (in absolute value) to a value of –0.269 that is statistically insignificant. It is also important to note that the coefficient of export costs, that assumes a value of –0.141 and is statistically insignificant, is only about one tenth as large as the corresponding coefficient in the case of developing countries.

The important difference in the relative role of export delays to export costs in the trade decisions of developing and high-income countries merits further examination. Why is it that a 1 percent reduction in export costs matters more than a 1 percent reduction in export delays in developing countries than it does in high-income countries? One possible explanation may relate to the fact that export costs are, for the most part, a *fixed* expenditure on any given shipment. By contrast, the financial implications of time delays – that are largely due to depreciation – represent an *ad valorem* cost to exporters. Consider now that in 2009 the average export costs (delays) in high-income countries were $1,027 (12 days) and in developing countries $1,416 (23 days). Given these figures, a sufficiently large difference in the value of the average shipment originating from high-income countries and developing countries could explain our estimates. By way of an illustration assume that the value of the former is, say, $10,000 and the latter $5,000 and that the daily depreciation that results from export delays of a shipment is in the order of 1 percent. Given these figures, a 10% reduction in the export costs (export delays) of high-income countries corresponds to $103 (a monetary cost of $120). By contrast, a 10% reduction in the export costs (export delays) of developing countries corresponds to $US142 (a monetary cost of $110). Dividing export costs by the monetary cost of export delays corresponds to 0.86 and 1.2 for high-income and developing countries, respectively. Hence, reductions in export delays (export costs) matter relatively more than comparable reductions in export costs (export delays) to high-income (developing) countries if the value of the average shipment of high-income countries is sufficiently larger than the value of the average shipment of developing countries. In this example we relied on hypothetical shipment value figures because data on the value of goods that are exported in standard 20-foot containers by different countries is not readily available. Still, in an effort to shed some relevant light, we were able to collect data from the U.S. Department of Commerce on the average value per kilogram of all 2 digit level Harmonized commodity categories of containerized exports from various countries to the United States during 2009. Using this data we calculated the value of the average shipment of one kilogram of goods exported by each country. We then disaggregated the 119 countries in our sample into high-income and developing groups and generated corresponding averages. These figures are reported in Table 7. As it may be noted from this table, the value of the average kilogram of containerized exports of high-income countries to the U.S. is significantly larger – almost twice – that of developing countries. If we assume that the average kilogram of any given origin is likely to require the same physical space within a standard 20-foot container, then containerized exports from developing countries are likely to be worth half as much as those from high-income countries. This is very much in line with the figures used in our earlier example.

To investigate the extent to which our findings for 2009 are representative of cross-country regressions for other years we ran independent cross-country regressions for all years in the 2006-2011 period. We also ran a series of pooled regressions for the same country subsamples considered in Table 6. We refer to these collectively as Model 2. In the interest of brevity we only report the estimated coefficients of our pooled regressions that, crudely speaking, represent a form of a weighted average of the cross-country coefficients for individual years.[13] The estimation approach is similar to what was used in the case of the regressions of Model 1. The results are given in Table 8. As it may be noted, the estimated coefficients are, for all practical purposes, virtually identical to those of Table 6.[14,15]

The objective of our final set of regressions, which we denote Model 3, is twofold: First, and principally, to examine the extent to which document and transportation impediments, on the one hand, and customs and handling impediments, on the other, play different roles in export decisions.[16] Second, to investigate such roles in a setting that accounts for the dynamic, within-country, endogeneity of export costs.

As our earlier discussion suggests, the interplay between export costs and export delays is particularly important in the case of developing exporters. There are three reasons for this. First, the developing world is the foremost driver of reductions in export delays during the years under examination (Table 1). Second, both on the basis of statements made by developing countries (e.g., WTO 2005a, 2005b) as well as statistical evidence (Table 5) it appears that the innovations that make delay reductions possible are funded by increases in export cost. Third, when export costs are added to gravity equations that were previously used to study delays in isolation, they have a significant impact on the role of delays in developing countries but not in high-income countries (Tables 6 and 8). For these reasons Model 3 concentrates on panel data for developing exporters. We estimate this model both without and with fixed effects – with the former serving as a bridge with earlier estimations. In each case, we estimate two specifications. As in the case of Models 1 and 2, the first includes export delays but excludes corresponding export costs. The second adds export costs to the regression. All four specifications are estimated using 2SLS where the various types of export delays and costs are instrumented with their second lags (to avoid the complication of first order serial correlation), the number of custom inspections of imports (available only for 2005), as well as the indexes of corruption, political stability, and voice and accountability discussed earlier. In addition, all regressions cluster observations by pairs of exporters, and

[13] This statement should be interpreted with care. It can be shown that under certain conditions pooled sample coefficients are not bounded by the values of the cross-sectional subsample coefficients.

[14] As in the case of cross-sectional regressions, dropping EU countries that are contiguous from the analysis changes the coefficient of *Contiguity* from negative to positive.

[15] The similarity between the results of Table 6 and 8 provides support to the notion that our cross-country results for 2009 are not the artifact of a particular pathology and in particular the significant trade decline linked with the Global Financial Crisis (GFC) of 2008-2009. The view that the GFC has not introduced a bias in our results is further supported by Levchenko, Lewis and Tesar (2010) who find that the fall of trade following the GFC was largely consistent across regions.

[16] One source of such a difference may result from the distinct timing that costs associated with such impediments are incurred. For example, a one dollar filing fee of an export license, incurred at the beginning of the exportation process, is likely to be viewed as more valuable than a one dollar invested in the handling of goods at the port, say, a month later.

all calculated standard errors are robust to the presence of arbitrary heteroskedasticity. The results are reported in Table 9.

Consider first specification (1). The coefficients of both custom and terminal handling (CT) delays as well as documents and transportation (DT) delays are negative – with the former being statistically significant at the 1 percent level. Consistent with our earlier findings, adding the corresponding export costs in specification (2) causes a significant drop in the absolute value of the coefficients of both types of delays. In addition, it renders both statistically insignificant. We forgo a discussion of possible sources of differences in the coefficients of CT delays (costs) and DT delays (costs) which are, for the most part, statistically insignificant.

Consider now the fixed effects regressions of specifications (3) and (4) of Table 9. From Table 5 we know that CT (DT) delays relate negatively (positively) with CT (DT) costs *in a representative developing country over time*. This implies that the coefficients of delays will change in a more or less predictable manner as we progress from specification (3), that does not include export costs, to specification (4), that does. In particular, the addition of export costs in (4) is expected to increase (decrease) the absolute value of the coefficient of CT (DT) delays estimated in (3) and hence render CT (DT) delays to matter more (less) in export decisions. Of course, directional predictions do not shed light on the precise quantitative impact on the coefficients of CT and DT delays. At least in the case of the CT delays, this impact is particularly important because it has the potential to reverse the main finding of this paper so far: that when export costs are taken into account the estimated role of delays in the export decisions of developing countries is *significantly* smaller. In other words, given the results of Table 5, specification (4) of Table 9 provides the best possible setting for the coefficient of CT delays to assume a large negative value. It does not. This coefficient remains virtually the same as in specification (3) (–0.683 versus –0.625) and is statistically insignificant in both specifications. At the same time, the coefficient of DT delays decreases substantially from –2.043, and significant at the 10 percent level, to 0.626 and insignificant. Similarly to delays, DT costs appear to have a very small effect on exports, with a coefficient of –0.131 that is statistically insignificant. By contrast, and similarly to what we found in the case of pooled regressions, CT costs – with a coefficient of –1.67 that is significant at the 5 percent level – are found to play an important role in export decisions.

A natural question deriving from the preceding analysis is whether an exogenous reduction in export delays has the capacity to generate a net decrease in exports. The possibility of such an outcome is in fact supported by equation (33) of our theoretical model.

Given that we estimate (35) and (36) independently, subject to other things being equal, our results cannot be used to answer this question directly. Still, examination of Tables 5 and 9 can shed some relevant light. Beginning with Table 5 we note that while the coefficient of DT delays is consistently positive in all specifications, that of CT delays in the case of the level estimations for developing countries is negative and statistically significant at the 5 percent level. Using this coefficient we know that a 10 percent reduction in CT delays will increase costs by 1.64 percent. From Table 9, we infer that this increase will generate a decrease in exports by 2.74 $(= 1.64 * 1.67)$ percent that is significant at the 5 percent level. This corresponds to over $6.5 million in bilateral exports. Of course, this does not account for the direct benefit of reducing delays in the first place. However, the coefficient of CT delays in the fixed effects regression of Table 9 is statistically insignificant and does not therefore lend itself to reliable inference. These results are not definitive. However, they do hint at the possibility that a reduction in CT delays, that ignores their indirect impact of CT costs, have the capacity to be self defeating potentially leading to an overall reduction in trade.

Before concluding, a few remarks on robustness are in order. In an important recent contribution Pham, Mitra, and Lovely (2014) show that the decision to include a constant in regressions of difference equations can have a non-trivial impact on the results. While our equations are in difference form this concern does not apply throughout our estimations. Consider first equation (35). Because it was estimated using fixed effects the inclusion of a constant in the original specification becomes irrelevant. In the case of equation (36) we re-ran all regressions which do not rely on a fixed effects approach (i.e., specifications 3 and 4 of Table 9) while excluding the constant as a robustness check. The estimated coefficients, which can be made available on request, remained virtually identical. This was not surprising given that when the constant is included in the regressions it is consistently found to be statistically indistinguishable from zero.

Naturally, the key findings that we discuss in this section are valid only insofar as our instruments are valid. To examine the quality of these instruments we performed overidentification tests in the case of all estimations. The relevant *Sargan-Hansen* statistic, that is reported in the various tables, suggests that these instruments satisfy the exclusion restrictions in all instances. To shed further light on the correction of the endogeneity bias made possible by our 2SLS regressions of the gravity regressions of Tables 6 and 8 we also undertake the corresponding OLS estimations.[17] The results can be found in Table A1 of the

[17] We do not do the same in the case of the regressions of Table 9 where the degree of disaggregation is such that complicates *a priori* predictions on the direction of endogeneity bias.

Appendix. The object of the regressions of Tables 6 and 8 is, of course, to examine the relative impact of export costs and delays on exports. Instrumenting the trade impediments of costs and delays is intended to correct for the possible effects of reverse causation running from exports to impediments. Such reverse causation may manifest in different ways. For example, an increase in exports may lead to bottlenecks which, in turn, can increase both export delays and export costs introducing a positive bias in the coefficient of these impediments. Of course, prevalence of bottlenecks may motivate governments to modernize export channels in a manner that decreases export delays and costs below pre-bottleneck levels. Hence, left uncorrected reverse causation can either understate or overstate the size of the coefficients of trade impediments. Comparing the 2SLS coefficients of Tables 6 and 8 with the corresponding OLS coefficients of Table A1 suggests that in the case of developing countries the bias is positive whereas in high-income countries it is negative. This is intuitive given that unlike their high-income counterparts developing nations are unlikely to have the resources at hand to consistently alleviate export bottlenecks that may arise from time to time.

V. Concluding Remarks

In a series of articles published in the early 1980s Edward Ray explains how the GATT inadvertently encouraged the proliferation of non-tariff barriers (NTBs) during the 1960s and 1970s (Ray 1989, p. 24-25). Of course, throughout its history the GATT consistently condemned all trade restrictions. However, it also encouraged negotiations on quantifiable tariff rates rather than obscure NTBs – with poorly understood trade flow implications. As a result, nations would typically acquiesce to demands that they implement tariff reductions, and often compensate industries that lost protection using NTBs with unclear net effects on overall trade. At least in one respect, though for very different reasons, the topic of this article is a case of history repeating. Over the last decade, or so, the WTO and other trade organizations have been pursuing an agenda of decreasing export delays while neglecting export costs (for which, until relatively recently, there was no comparable data across countries). It is widely acknowledged that developing countries responded positively to this agenda by undertaking initiatives that made delay reductions possible (Table 1). What has not been previously recognized in the literature is that to fund these initiatives the developing world typically relied on increasing export fees. Building on limited and anecdotal evidence that provide support for such a link (e.g., WTO 2005a, 2005b; ADB-UN ESCAP 2013, p. 9; and UNECA 2013, p. 42), the objective of this contribution is threefold: first, to study the theoretical plausibility of this particular form of endogenous export costs; second, to examine the empirical regularity and economic significance of such an endogenous relationship; and third, to investigate the joint role of endogenous export costs and export delays in the flow of international trade.

As we show, despite the seeming incongruity of making the reduction of one trade impediment possible by increasing another, this relationship is an easy consequence of a rather conventional theoretical setup. In fact, as our model illustrates, such an endogeneity may prevail even when the net effect on exports is negative. Our empirical results provide strong support for our theoretical prediction of an endogenous relationship between export costs and export delays. Perhaps more importantly, when export costs are combined with export delays in the case of developing countries, the impact of delays all but disappears. This result stands in stark contrast with those of earlier studies that find export delays to be the last remaining significant impediment to international trade.

The key policy consequence of our analysis requires that international organizations advancing trade facilitation in developing countries recognize and find ways to disrupt the causal link between export delays and export costs, that they prioritize costs over delays, and that they encourage the simultaneous reduction of both. Anything less may well translate into the GATT quagmire of the 1960s and 1970s.

Our theoretical model and identification strategy may be used to study a host of related questions. For example, our analysis can be extended to consider the role of import costs and import delays in import decisions (our differencing approach combined with a model of common importers neutralizes the effect of these variables). In addition, while our theory takes into account the well documented positive relationship between export delays and export costs *across* countries (Clark, Dollar, and Micco 2004), our focus is the novel negative causal relationship between these variables *within* countries over time. Using our approach, much can be done to extend the important work of Clark, Dollar, and Micco (2004) in order to gain further insight into how institutional and structural differences across countries are often responsible for significant delays coexisting with significant export costs. Reconciling this paper’s findings pertaining to within-country dynamics with an understanding of how such dynamics may vary across counties will shed further useful light on the path leading to a more globalized world.

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TABLE 1 – SUMMARY OF TRADE REFORM TARGETS DURING 2006-2011

	Countries in sample	Counties that undertook reforms	Area of reform				Objective of reform	
			Document preparation	Customs	Transportation	Terminal handling	Delays reduction	Cost reduction
Developing	93	51	22	43	4	18	37	4
High-income	29	8	3	6	1	1	3	0
Total	122	59	25	49	5	19	40	4

Notes: The table was constructed using data from the *Doing Business* reports of the World Bank and the International Finance Corporation. A selection of countries undertook simultaneous reforms in a number of areas and not all countries that undertook reforms stated their objective. Hence, the figures in column "Countries that undertook reforms" need not correspond to either the sum of the columns under "Area of reform" or those under "Objective of reform".

TABLE 2 – DESCRIPTIVE STATISTICS OF TRADE DELAYS AND TRADE COSTS BY GEOGRAPHIC REGION (2006-2011)

	Aggregate Export Delays				Aggregate Export Costs				
	Mean	SD	Min	Max	Mean	SD	Min	Max	Countries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Africa and the Middle East	23.9	11.5	7	60	1,218.6	729.9	436.6	5,051.2	42*
COMESA	32.1	12.2	10	60	1,775.2	727.8	657.0	3,725.5	9
CEMAC	33.6	13.8	23	57	2,159.1	1,665.1	975.3	5,051.2	2
EAC	28.3	5.0	18	38	1,808.5	646.9	1,018.7	2,934.5	3
ECOWAS	25.5	8.2	12	45	1,230.9	477.4	605.4	2,192.3	9
EUROMED	15.7	4.3	10	26	768.4	224.5	450.8	1,558.1	9
SADC	28.3	11.0	10	53	1,430.5	530.6	657.0	2,625.2	8
Other	22.3	14.4	7	53	961.5	670.4	436.6	3,017.3	9
Asia and the Pacific	16.5	7.9	6	49	677.1	254.4	368.6	1,781.5	21
ASEAN	16.0	6.4	6	37	555.9	119.5	393.2	822.7	6
CER	9.5	0.5	9	10	860.0	121.1	685.2	1,112.4	2
SAFTA	23.5	6.8	16	41	801.0	352.0	486.7	1,781.5	6
Other	14.3	7.9	6	49	637.4	223.0	368.6	1,753.1	7
Europe	15.6	11.5	6	89	1,086.3	459.5	444.2	3,258.4	39
CEFTA	17.9	3.0	13	25	1,038.3	218.2	632.9	1,484.1	7
CIS	33.9	20.2	15	89	1,931.5	584.1	1,167.2	3,258.4	7
EFTA	9.0	2.0	8	14	1,139.7	255.2	631.3	1,424.8	3
ELL FTA	9.3	2.6	6	13	671.7	103.7	472.6	806.5	3
EU	10.8	4.3	6	20	903.1	220.4	444.2	1,229.2	14
Other	17.6	4.3	10	26	1,085.0	182.0	659.0	1,321.0	5
Western Hemisphere	17.1	8.8	6	49	1,127.2	398.5	425.3	2,400.9	20
Andean Community	23.7	11.4	12	49	1,375.3	584.4	509.3	2,400.9	4
CACM	20.3	6.1	14	36	996.2	242.4	510.4	1,729.8	4
MERCOSUR	19.2	7.9	12	36	1,178.2	300.6	611.2	1,974.4	4
NAFTA	8.8	2.8	6	13	1,232.8	233.6	907.3	1,585.2	3
Other	15.1	5.3	8	35	849.1	271.7	425.3	1,368.0	5
Total Sample	18.3	11.1	6	89	1,054.6	546.9	368.6	5,051.2	122

Source: The table was constructed using data from the *Doing Business* reports of the World Bank and the International Finance Corporation.

Notes: Costs are expressed in constant 2005 dollars. *Seven African countries belong to more than one regional trade agreement: Kenya in COMESA and EAC, Malawi, Mauritius, Namibia, and Zambia in COMESA and SADC, Uganda in COMESA and CEMAC, and Tanzania in EAC and SADC. Africa and the Middle East include COMESA (Burundi, Kenya, Madagascar, Malawi, Mauritius, Namibia, Rwanda, Uganda, and Zambia), CEMAC (Cameroon and Central African Republic), EAC (Kenya, Tanzania, and Uganda), ECOWAS (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Guinea, Mali, Nigeria, Senegal, and Togo), EUROMED (Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Syria, Tunisia, and Turkey), SADC (Botswana, Malawi, Mauritius, Mozambique, Namibia, South Africa, Tanzania, and Zambia), and other (Guyana, Iran, Kuwait, Oman, Saudi Arabia, Sudan, United Arab Emirates, Yemen, and Zimbabwe). Asia and the Pacific include ASEAN (Cambodia, Indonesia, Malaysia, Philippines, Singapore and Thailand), CER (Australia and New Zealand), SAFTA (Bangladesh, India, Maldives, Nepal, Pakistan, and Sri Lanka), and other (China, Fiji, Hong Kong, Japan, Korea, Mongolia, and Samoa). Europe includes CEFTA (Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia), CIS (Armenia, Azerbaijan, Belarus, Kazakhstan, Moldova, Russia, and Ukraine), EFTA (Iceland, Norway, and Switzerland), ELL FTA (Estonia, Latvia, and Lithuania), EU (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom), and other (Albania, Bosnia and Herzegovina, Croatia, Georgia, and Macedonia). The Western Hemisphere includes the Andean Community (Colombia, Ecuador, Peru, and Venezuela), CACM (El Salvador, Guatemala, Honduras, and Nicaragua), MERCOSUR (Argentina, Brazil, Paraguay, and Uruguay), NAFTA (Canada, Mexico, and the United States), and other (Chile, Costa Rica, Dominican Republic, Jamaica, and Panama).

TABLE 3 – SUMMARY STATISTICS (2006-2011)

Variables	Unit	Mean	SD	Min	Max
	(1)	(2)	(3)	(4)	(5)
All countries (122)					
Exports (bilateral)	US$	531,443,369.40	1,062,755,205.00	0.89[a]	327,951,374,882.50
Aggregate exports	US$	99,903,975,012.65	211,017,210,213.50	3,448,320.23	1,659,352,994,184.00
Export delays	Days	20.84	12.19	6	89
Custom and terminal delays	Days	5.63	2.80	2	19
Documents and transportation delays	Days	15.21	10.26	3	70
Export costs	US$	1,134.92	638.92	368.59	5,051.20
Custom and terminal costs	US$	365.58	164.43	53.77	991.87
Documents and transportation costs	US$	769.35	555.27	120.03	4,067.82
Distance	KM	7,088.71	1,895.15	59.62	19,812.04
GDP	US$	446,715,245,479.60	1,414,132,905,283.43	131,150,139.24	13,846,778,428,638.92
GDPC	US$	12,678.67	16,406.48	153.58	88,329.48
Political Stability	index	-0.11	0.91	-2.81	1.50
Voice and Accountability	index	0.07	0.90	-1.75	1.67
Corruption	index	4.32	2.18	1.60	9.60
Developing countries (86)					
Exports (bilateral)	US$	244,369,495.83	729,166,877.66	0.89	289,713,729,510.11
Aggregate exports	US$	42,898,751,861.98	142,439,412,665.70	3,448,320.23	1,659,352,994,184.00
Export delays	Days	24.69	12.08	8	89
Custom and terminal delays	Days	6.51	2.74	2	19
Documents and transportation delays	Days	18.17	10.48	5	70
Export costs	US$	1,216.44	716.64	368.59	5,051.20
Custom and terminal costs	US$	386.17	175.97	53.77	991.87
Documents and transportation costs	US$	830.27	632.93	120.03	4,067.82
Distance	KM	7,082.64	1880.41	85.94	19,812.04
GDP	US$	174,375,266,135.51	533,071,529,481.96	131,150,139.24	6,526,710,500,583.00
GDPC	US$	3,377.68	2,653.09	153.58	9,222.91
Political Stability	index	-0.45	0.80	-2.81	1.19
Voice and Accountability	index	-0.28	0.68	-1.75	1.23
Corruption	index	3.19	1.02	1.60	7.30
High-income countries (48)					
Exports (bilateral)	US$	1,037,331,251.24	1,267,589,695.63	0.91	327,951,374,882.50
Aggregate exports	US$	197,693,581,778.30	254,047,782,537.60	2,181,544,893.51	1,346,081,240,593.00
Export delays	Days	14.38	11.53	6	76
Custom and terminal delays	Days	4.23	2.43	2	14
Documents and transportation delays	Days	10.15	9.42	3	62
Export costs	US$	1,001.43	467.07	393.16	2,790.07
Custom and terminal costs	US$	334.39	148.69	115.88	872.55
Documents and transportation costs	US$	667.04	374.81	193.74	2,388.94
Distance	KM	7,194.97	2003.03	59.62	19,747.40
GDP	US$	948,908,748,895.86	2,102,965,923,594.63	11,145,055,550.68	13,846,778,428,638.92
GDPC	US$	28,876.79	16,405.23	9,212.41	88,329.48
Political Stability	index	0.54	0.69	-1.62	1.50
Voice and Accountability	index	0.69	0.92	-1.70	1.67
Corruption	index	6.24	2.22	1.90	9.60

Notes: The number of trade partners varies by exporter and for some exporters data is not available for all years in the data. To avoid unbalanced weights in the calculation of statistics, each variable is first averaged to one value per exporter before computing the overall means and standard deviations reported in the table. Developing and high-income countries are defined as countries with a GDP per capita below and above $10,065, respectively. Some countries change categories between 2006 and 2011. Hence, the sum of the number of countries corresponding to high-income and developing countries is not equal to the total number of countries. Monetary variables are in constant 2005 values. [a]Between 2006 and 2011 the *United Nations Comtrade Database* reports 42 export values equal to US$1.

TABLE 4 – NAÏVE PANEL CORRELATIONS BETWEEN EXPORT COSTS AND EXPORT DELAYS (2006-2011)

	Correlation coefficient (1)	OLS (2)	
Panel A. Dependent variable: Documents & transportation costs			
Documents & transportation delays	0.454	0.453***	(0.04)
Constant		5.310***	(0.09)
Panel B. Dependent variable: Customs & terminals costs			
Customs & terminal delays	0.372	0.350***	(0.04)
Constant		5.227***	(0.06)
Observations	697	697	

Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

TABLE 5 – ENDOGENOUS EXPORT COSTS (2006-2011)

	All countries		Developing countries		High-income countries	
	Time Differences	Levels	Time Differences	Levels	Time Differences	Levels
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Dependent variable: Documents & transportation costs						
Documents & transportation delays	0.130***	0.099**	0.155**[a]	0.095[a]	0.086[a]	0.044
	(0.05)	(0.04)	(0.08)	(0.07)	(0.09)	(0.07)
Aggregate Exports	0.165	-0.297**	0.124	-0.391**	0.451	0.906**
	(0.11)	(0.13)	(0.12)	(0.16)	(0.31)	(0.39)
Political Stability	-0.013	-0.016	-0.001	-0.014	-0.064***	-0.138***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.05)
Corruption	-0.025	-0.034	-0.106	0.022	0.502***	-0.472*
	(0.08)	(0.07)	(0.11)	(0.12)	(0.08)	(0.25)
Voice and Accountability	-0.002	0.033**	-0.007	0.031*	-0.110*	0.587**
	(0.01)	(0.02)	(0.01)	(0.02)	(0.06)	(0.25)
Overidentification test (*P-value*)	0.6490	0.4930		0.7168	0.5644	0.4723
Observations	710	952	191	313	444	535
Panel B. Dependent variable: Customs & terminals costs						
Customs & Terminals delays	-0.140***	0.004[a]	-0.351***	-0.164**	0.022[a]	0.011
	(0.05)	(0.05)	(0.10)	(0.08)	(0.06)	(0.08)
Aggregate Exports	0.360***	0.769***	0.516***	0.406**	0.119	3.189***
	(0.13)	(0.21)	(0.19)	(0.20)	(0.24)	(0.69)
Political Stability	-0.024	0.062***	-0.088***	0.017	0.033	-0.097*
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.06)
Corruption	-0.356**	-0.178	-0.550*	-0.227	0.233*	-0.622***
	(0.18)	(0.15)	(0.29)	(0.20)	(0.12)	(0.21)
Voice and Accountability	0.084	0.012	0.087	-0.019	0.088	1.364***
	(0.06)	0.03	(0.05)	(0.03)	(0.12)	(0.25)
Overidentification statistic (*P-value*)	0.6149	0.4726	0.5345	0.6192		0.7333
Observations	710	952	191	313	444	535

Notes: All regressions are estimated using fixed effects in the context of an IV2SLS approach where Agg. Exports are instrumented using the ratio of exporting countries' GDP, GDP per capita, and aggregate distance to all respective trade partners. Reported statistics are robust to the presence of arbitrary heteroskedasticity. [a] The estimated covariance matrix of moment conditions is not of full rank. This does not affect the estimated coefficients or the standard errors, but it does not allow the estimation of the Overidentification test. Partialling out Political Stability, Corruption and Voice and Accountability successfully addresses the problem and allows calculation of the overidentification test in Panel (P) A Column (C) 4, PAC5, and PBC2 but not in PAC3 and PBC5. Consequently, in the latter cases the overidentification statistic is not reported. The panel used in all regressions is balanced. Standard errors in parentheses *** p<0.01, ** p<0.05, *p<0.1.

TABLE 6 – MODEL 1: EFFECT OF EXPORT TIME DELAYS AND PECUNIARY EXPORT COSTS ON EXPORT VOLUMES – A CROSS-COUNTRY PERSPECTIVE (2009)

Dependent Variable: Ratio of Exports from Similar Country Pairs to the Same Market						
	All countries		Developing countries		High-income countries	
	(1)	(2)	(3)	(4)	(5)	(6)
Exp. Delays	-0.633***	-0.565***	-1.628**	-0.654	-0.320*	-0.269
	(0.22)	(0.21)	(0.67)	(0.88)	(0.18)	(0.20)
Exp. Costs		-0.275		-1.640**		-0.141
		(0.20)		(0.82)		(0.22)
Distance	-1.287***	-1.306***	-1.778***	-1.854***	-1.186***	-1.188***
	(0.09)	(0.09)	(0.26)	(0.28)	(0.06)	(0.06)
GDP	1.096***	1.116***	0.962***	1.103***	1.119***	1.135***
	(0.04)	(0.04)	(0.09)	(0.14)	(0.05)	(0.06)
GDPC	0.485***	0.479***	0.832***	0.741***	0.675***	0.738***
	(0.18)	(0.17)	(0.17)	(0.16)	(0.25)	(0.27)
Contiguity	0.121	0.095	0.523**	0.573***	-0.165*	-0.178**
	(0.10)	(0.10)	(0.21)	(0.21)	(0.09)	(0.088)
Colony	0.820***	0.807***	0.526***	0.581***	0.712***	0.700***
	(0.11)	(0.11)	(0.19)	(0.17)	(0.10)	(0.10)
Language	0.568***	0.624***	0.294	0.378	0.770***	0.805***
	(0.11)	(0.10)	(0.27)	(0.23)	(0.10)	(0.08)
Landlocked	-0.141	-0.0920	0.263	0.819	-0.073	-0.037
	(0.13)	(0.13)	(0.50)	(0.50)	(0.15)	(0.16)
Constant	0.073	0.090	0.073	0.110	0.019	0.022
	(0.07)	(0.07)	(0.17)	(0.16)	(0.08)	(0.08)
Observations	21,429	21,429	4,306	4,306	15,323	15,323
R^2	0.490	0.491	0.473	0.485	0.562	0.562
Overidentification statistic (*P-value*)	0.1284	0.1682	0.1265	0.1693	0.0000	0.0000

Notes: All regressions cluster observations by pairs of exporters, and all reported standard errors are robust to the presence of arbitrary heteroskedasticity. In addition, export delays and export costs are instrumented with their second lags as well as the number of custom inspections of imports and our indexes of corruption, political stability, and voice and accountability. Developing and high-income countries are defined as countries with a GDP per capita below and above $10,065 respectively. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.

TABLE 7 – VALUE OF A STANDARDIZED KILOGRAM OF CONTAINERIZED EXPORTS

	Countries in sample	Average value (US$)
Developing	88	14.48
High-income	33	27.30

Notes: Data from the U.S. Department of Commerce.

TABLE 8 – MODEL 2: POOLED EFFECT OF EXPORT TIME DELAYS AND PECUNIARY EXPORT COSTS ON EXPORT VOLUMES (2006 – 2011)

Dependent Variable: Ratio of Exports from Similar Country Pairs to the Same Market

	All countries		Developing countries		High-income countries	
	(1)	(2)	(3)	(4)	(5)	(6)
Exp. Delays	-0.639***	-0.633***	-1.435**	-0.379	-0.388**	-0.431**
	(0.17)	(0.18)	(0.60)	(0.84)	(0.18)	(0.20)
Exp. Costs		-0.0291		-2.039**		0.115
		(0.18)		(0.88)		(0.22)
Distance	-1.312***	-1.314***	-1.769***	-1.952***	-1.174***	-1.172***
	(0.08)	(0.08)	(0.26)	(0.30)	(0.05)	(0.05)
GDP	1.085***	1.088***	0.909***	1.023***	1.119***	1.105***
	(0.04)	(0.04)	(0.12)	(0.15)	(0.05)	(0.05)
GDPC	0.388***	0.386***	0.762***	0.789***	0.678***	0.643***
	(0.14)	(0.14)	(0.18)	(0.17)	(0.23)	(0.24)
Contiguity	0.159*	0.156*	0.837***	0.823***	-0.0827	-0.0714
	(0.09)	(0.09)	(0.22)	(0.21)	(0.08)	(0.08)
Colony	0.720***	0.719***	0.608***	0.560***	0.647***	0.658***
	(0.10)	(0.10)	(0.17)	(0.17)	(0.10)	(0.09)
Language	0.527***	0.533***	0.120	0.242	0.727***	0.697***
	(0.11)	(0.10)	(0.27)	(0.23)	(0.11)	(0.08)
Landlocked	-0.176	-0.170	-0.142	0.712	-0.107	-0.139
	(0.12)	(0.12)	(0.40)	(0.46)	(0.15)	(0.16)
Constant	0.0639	0.0660	-0.0903	0.111	0.0419	0.0394
	(0.07)	(0.07)	(0.21)	(0.17)	(0.07)	(0.07)
Observations	88,966	88,966	14,192	14,192	65,361	65,361
R^2	0.485	0.486	0.415	0.434	0.552	0.552
Overidentification statistic (P-value)	0.3188	0.3164	0.2017	0.3478	0.0000	0.0000

Notes: All regressions cluster observations by pairs of exporters, and all reported standard errors are robust to the presence of arbitrary heteroskedasticity. In addition, export delays and export costs are instrumented with their second lags as well as the number of custom inspections of imports and our indexes of corruption, political stability, and voice and accountability. Developing and high-income countries are defined as countries with a GDP per capita below and above $10,065, respectively. In the interest of brevity, time dummy variables are not reported. The panel used is unbalanced. Standard errors in parentheses *** p<0.01, **p<0.05, * p<0.1.

TABLE 9 – MODEL 3: EFFECT OF EXPORT TIME DELAYS AND PECUNIARY EXPORT COSTS ON THE EXPORT VOLUMES OF DEVELOPING COUNTRIES– DISAGGREGATED CATEGORIES (2006 – 2011)

Dependent Variable: Ratio of Exports from Similar Country Pairs to the Same Market

	Pooled – 2SLS		Fixed effects – 2SLS	
	(1)	(2)	(3)	(4)
Custom and terminal delays	-0.793***	-0.361	-0.683	-0.625
	(0.28)	(0.55)	(0.54)	(0.44)
Documents and transportation delays	-0.562	0.048	-2.043*	0.626
	(0.56)	(0.58)	(1.14)	(1.25)
Custom and terminal costs		-1.474***		-1.670**
		(0.45)		(0.84)
Documents and transportation costs		-0.218		-0.131
		(0.71)		(0.32)
Distance	-1.886***	-1.735***		
	(0.28)	(0.29)		
GDP	0.910***	1.098***	-1.860	-0.131
	(0.11)	(0.14)	(4.42)	(4.51)
GDPC	0.791***	0.399**	1.758	0.675
	(0.17)	(0.17)	(4.40)	(4.45)
Contiguity	0.791***	0.867***		
	(0.22)	(0.23)		
Colony	0.602***	0.693***		
	(0.17)	(0.17)		
Language	0.168	0.297*		
	(0.24)	(0.17)		
Landlocked	-0.354	-0.836		
	(0.39)	(0.69)		
Constant	-0.123	0.101		
	(0.20)	(0.18)		
Observations	14,192	14,192	11,578	11,578
R^2	0.424	0.442	-0.026	-0.008
Number of panels			3,533	3,533
Overidentification statistic (P-value)	0.1902	0.0113	0.1562	0.4547

Notes: All regressions cluster observations by pairs of exporters, and all reported standard errors are robust to the presence of arbitrary heteroskedasticity. In addition, export delays and export costs are instrumented with their second lags as well as the number of custom inspections of imports and our indexes of corruption, political stability, and voice and accountability. Developing countries are defined as countries with a GDP per capita below $10,065. In the interest of brevity, time dummy variables are not reported. The panel is unbalanced. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1.