Transit Trade[♦]

Jerónimo Carballo
University of Maryland

Alejandro Graziano
Inter-American Development Bank

Georg Schaur
University of Tennessee

Christian Volpe Martincus[*]
Inter-American Development Bank

This version: August 2014

Abstract

In this paper, we estimate the effects of the implementation of a regional transit system that substantially streamlined administrative processing of trade flows. In so doing, we use a unique dataset that consists of the entire universe of El Salvador's export transactions over the period 2007-2013 and includes information on the transactions channeled under the new transit regime established with neighboring countries over the same period. Results suggest that this new transit system has been associated with decreased order servicing costs and variable trade costs in general and accordingly with increased firms' exports, particularly of time-sensitive goods.

Keyword: Transit Trade, Exports, El Salvador
JEL-Code: F10, F13, F14

♦ We would like to thank Victoria Valente for her excellent research assistance and Sandra Corcuera, Rodolfo Espina, Manuel Márquez, and Álvaro Sarmiento for helping us build the dataset used in this paper. We are also grateful to Jo van Biesebroeck, Joze Damijan, Catherine Fuss, Andrea Linarello, Alessia Lo Turco, Bruno Merlevede, Michael Pfaffermayr, Ferdinand Rauch, and participants at the Ljubljana Empirical Trade Conference (Izola) for helpful comments and suggestions. The views and interpretations in this paper are strictly those of the authors and should not be attributed to the Inter-American Development Bank, its executive directors, its member countries, or El Salvador's Dirección General de Aduanas. Other usual disclaimers also apply.
*Correspondence Address: Inter-American Development Bank, Stop W0610, 1300 New York Avenue, NW, Washington, DC 20577, United States of America. E-mail: christianv@iadb.org. Tel.: +1 202 623 3199. Fax: +1 202 623 2995.

Transit Trade

Customs transit is one of the cornerstones of European integration and of vital interest to European businesses. It enables goods to move more freely and makes customs clearance formalities more accessible. It does so by temporarily suspending duties and taxes that are applicable to goods at import into the Community (Community transit), or between the European Community, the European Free Trade Association and the Visegrad countries (via the Common Transit Convention) or among the States that are now contracting parties to the TIR Convention. For the countries of central and Eastern Europe, access to the common transit system plays a key role in their pre-accession strategy. Some 18 million Community and common transit documents and one million TIR carnets are issued in Europe every year, representing billions of Euro in duties and charges, and the numbers are still rising (European Communities, 2001).

1 Introduction

Countries have recently reached an important agreement to facilitate trade in Bali. From the point of view of the international trade literature, probably one of the less well documented and understood disciplines covered by this agreement is transit trade (see WTO, 2014). Transit refers to the inland transport of goods under customs control that is not cleared by customs (see Arvis et al., 2007). In particular, international transit may involve one border crossing, in which case goods are transported directly from the origin to the destination country (e.g., from El Salvador to Honduras), or several border crossings, in which case their transport takes place through one or more intermediate countries (e.g., from El Salvador to Panama through Honduras, Nicaragua, and Costa Rica).[1] Hence, this trade does not only matter for landlocked countries (see Arvis et al., 2008). It concerns all trade transiting through third countries, which is significantly larger. For example, in El Salvador, the country whose transit regime we will study in this paper, road accounts for 96% of the exports to the neighboring Central American countries Costa Rica, Guatemala, Honduras, Nicaragua, and Panama, and roughly one third of these exports are carried through a country which is not the final destination of the shipment.[2] In the absence of explicit specific procedures, this transit would require a succession of imports and exports and loading and unloading of trucks, which would create substantial congestion at the borders and lead to significant cost escalation (see Arvis et al., 2008). In short, repetitive and particularly paper-based customs procedures make it difficult to move goods across borders by unnecessarily raising transaction costs. Well-designed and well-functioning transit regimes allow for delayed customs clearance, whereby goods can be transported without having to be imported and re-exported at intermediate points, including the need to pay import duties, domestic consumption taxes, or other charges, and undergo import

[1] Transit can take place in the country of destination/origin of the goods (national transit) or in a third country where the products are carried out from an entry post to an exit post (international transit). Hence, a complete transit operation consists of a sequence of national and international transit links (see Arvis et al., 2007).

[2] Overland trade is overwhelmingly prevalent among neighboring countries. For instance, the median share of road and rail in total intra-EU trade is 95.7% (see Cristea et al., 2013).

regulations. In their most advanced versions, these regimes introduce a common electronic transit document and, if applicable, a unified border transit control, which reduces delays and trade costs including those with orders' monitoring. This paper focuses on one of such transit regimes which allowed for a significant streamlining and improvement of customs and quarantine formalities and procedures thereby facilitating border crossings for international transit operations: the Central American International Transit of Goods (TIM). More specifically, for the first to our knowledge, it provides rigorous microeconometric evidence on the impact of the establishment of a simplified transit regime on firms' exports by using data that covers the universe of export transactions and the associated transits of one of the participating countries, El Salvador, over the period 2007-2013.

Long-distance trade crossing several territories has existed for centuries (see Helpman, 2011).[3] Thus, in the Roman Empire, goods were transported between far apart regions (see Mc.Cormick, 2001). The collapse of the Empire in the fifth century C.E. left behind a pronounced political fragmentation in Western Europe. Several states were created and accordingly customs and duties and charges multiplied, thereby negatively affecting long distance trade (see, e.g., Arvis, 2004). Duties included on both trade and transit. As for the latter, for instance, in Middle Ages' Italy, *telonei* (indirect taxes) were collected at gates (*portaticum*) and landing places (*repaticum*). Even though their rates were low, their number was very high. Just to mention an example, ships going from Linz to Vienna along the Danube River were subject to 77 different customs checks and duties (see Nicali, 2002).[4] As inland transportation between cities progressed, different strategies started to be used to facilitate transit and trade. The transit system applied in the Duchy of Milan in Northern Italy is illustrative in this regard. Shipments of goods were sealed by customs officers at the main inland gateway of the duchy and carnets were issued. Upon arrival at the final destination, seals were removed and duties paid. At this stage, local officers sent all relevant data about the shipment in transit to the central office in Milan (see Favier, 1971).

These transit principles developed during the Renaissance underlay the single door-to-door transit regime called International Road Transport (TIR for its name in French – *Transports Internationaux Routiers*) established in Western Europe in the early 1950s. This regime consisted of a single harmonized manifest (carnets TIR) issued in the country of origin and used at every border, authorized operators whereby only qualified operators could participate, a mutually recognized system of privately managed guarantees, an overseeing agency –the United Nations Economic Commission for Europe (UNECE)-, and a clearing house of carnets and guaranties – the International Road Transport Union (IRU) federating the national association of operators. The TIR eliminated duplication of procedures and significantly sped

[3] The so-called *Silk Road* connecting Europe and Asia is probably one of the best well-known and well-documented trading routes (see Richthofen, 1877).

[4] It should be mentioned herein that the fiscal burden was reduced through *free fairs* and *free zones* (see Nicali, 2002).

movements of goods across borders.[5] The transit regime later evolved into a common transit regime for the EU and EFTA and a single transit regime for the EU as a customs union and became fully computerized with the NCTS- New Computerized Transit System (see Arvis et al., 2008; European Communities, 2001).

In contrast, well-functioning transit regimes are virtually absent in most developing regions. The reasons include both inappropriate design due to lack of cooperation between involved public and private parties and pressure from interest groups (e.g. TRIE in Western Africa) and inability of implementation due to institutional weakness (e.g., Sub-Saharan Africa) (see Arvis et al., 2008). The picture does not differ much among partners of trade agreements. Only 36.4% of the agreements notified to the GATT/WTO by June 2013 -that typically involve neighboring countries- have provisions to facilitate transit (see Neufeld, 2014).

In this paper, we explore the trade effects of one of the few operating regional transit systems in the developing world: the Central American TIM covering borders crossing between Costa Rica, El Salvador, Honduras, Nicaragua, Panama, and Mexico. The TIM involved the gradual adoption of a common electronic document and the interconnection of all participating border agencies to make it possible a unified transit border control. This allowed for real-time control of flows and significant reductions in time required to trade across borders and generally in variable trade costs (see Sarmiento et al., 2010). We specifically address one main question: How does the establishment of such a transit regime affect firms' exports? In answering this question, we primarily carry out difference-in-differences estimations on a unique dataset that includes all export transactions originated in El Salvador over the period 2007-2013 and informs which of these transactions were processed under the regional transit system.

Our paper thereby makes a number of contributions to both the empirical international trade literature and the ongoing policy discussions on trade facilitation. First, countries around the world have invested substantial resources in their trade infrastructures and even multilateral initiatives such as Aid for Trade have been created to support these national efforts. However, how exactly this infrastructure influences trade is far from established and so are the methods that could be used to assess its costs and benefits. In this paper, by exploiting the associated exogenous variation in trade costs and probably the best data yet in this field, we provide evidence on how investments in trade infrastructure impact all trade margins and single out the most import ones in terms of generating trade and potentially welfare. Second, we specifically show how a transit regime that streamlines procedures and makes it easier to cross borders affects trade costs and firms' exports, while disentangling the channels through which these effects take place. Third, we shed completely new light on a key trade policy area in which developing countries will have to work in upcoming years to implement the commitments agreed upon in Bali.

[5] See Arvis (2004) for a detailed description of the TIR.

Our findings suggest that the adoption of the simplified transit regime has resulted in a reduction in orders' servicing costs and general trade costs in the range of 10%-16%. As a consequence, trade expanded. Exports channeled under the TIM grew faster than their counterparts subject to standard transit procedures. This growth, which has been higher for time sensitive (and differentiated) goods, can be primarily traced back to an increased number of shipments.

The remainder of this paper is organized as follows. Section 2 describes Central America's regional transit regime TIM. Section 3 introduces the dataset and presents basic statistics and preliminary evidence. Section 4 explains the empirical strategy. Section 5 discusses the estimation results, and Section 6 concludes.

2 The Central American International Transit of Goods (TIM)

Several public agencies intervene in the processing of trade flows. These include customs, migration, and sanitary and phytosanitary agencies. Figure 1 shows a typical export route from El Salvador to Panama, whereas Figure 2 illustrates in a stylized manner the border controls to which road-based shipments from El Salvador to Panama through Honduras, Nicaragua, and Costa Rica were subject and how the administrative processing of these shipments at each border office looked like until very recently. Central American exporters with shipments in transit had to clear customs at each side of the bilateral borders among these countries and sequentially present various paper documents to these different agencies, including printed copies of international transit declarations, country-specific sanitary and phytosanitary certificates, and migration arrival and departure cards that had to be filled at each border office. In particular, according to a survey conducted at El Amatillo, a border crossing between El Salvador and Honduras, 12 sets of copies of generally the same declaration and complementary documents had to be prepared and distributed among officials of intervening agencies (see Sarmiento, 2013). Transit of goods in Central America was thus hindered by lack of coordination of border agencies, cumbersome and slow customs and administrative procedures, and limited use of information technologies.

In recent years countries in the region adopted a new electronic transit system to manage and control the movement of goods in transit that is partially based on the European system. This system involves (1) stronger within and across country interagency cooperation; (2) a process reengineering, whereby previous multiple paper-based declarations were harmonized into a single and comprehensive document that gathers all data required by customs, migration, and phytosanitary agencies, and the creation of a single unified border transit control; and (3) the use of information technologies to interconnect the intranet system of all agencies participating in the project to manage and automatedly tracking of the international transit process, and to carry out risk analysis and cargo controls (see Sarmiento et al., 2010).

Figure 3 shows how the shipment from El Salvador to Panama is processed under the new rules. Under this new system, instead of repetitive paper-based procedures initiated at the border, firms can complete a single electronic document (DUT for its name in Spanish – *Documento Único de Transporte*) at their closest customs office and start the transit there and finish it in the final destination in the importing country. At the borders, controls are now carried out at only one of the customs offices at each side by scanning the bar code in the DUT, which shows intervening officials all the relevant information on the shipment in the system, thus no requiring the presentation of multiple documents. More specifically, shipments in transit are now processed under the logic of an electronic single window, whereby transporters interact simultaneously and in the same place with the intervening agencies –customs, migration, and quarantine, without using printed copies of documents. This new process significantly expedited border crossings, not only directly but also indirectly by allowing for a substantial reduction in congestion at these entry or exit points (see Sarmiento et al., 2010). Furthermore, the information system introduced with the TIM provides trading and transport companies with real-time data on their shipments thereby making it easier to control orders and to manage their servicing.

El Salvador was the first country to adhere to the TIM as a transit territory. Crucially for our identification purposes, the TIM entered into force gradually over the period 2011-2013 for shipments originated in El Salvador. More precisely, individual origin-customs segments –the so-called fiscal routes- were sequentially incorporated into the regime. This stepwise implementation generates variation in regime usage status both across export flows in a given point in time and over time. The TIM was first primarily applied on trade operations starting in San Bartolo, Comalapa, Santa Ana, Ajacutla, and the Free Trade Zones, going through La Hachadura or San Cristobal to Guatemala (and specific destinations therein) and Mexico and through El Poy or El Amatillo to (specific destination in) Honduras and Nicaragua in 2011. Other routes joined through 2013 (see the Salvadoran customs' administrative decisions DGA-0014-2010, DGA-0013-2011, and DGA-011-2012). Also critical in this regard, addition of new routes involving new destinations was mainly determined by the decision of other countries to take part of the new transit regime. For instance, exports to Panama could be processed under the TIM only once Costa Rica adhered to it (see Figure 1).

3 Dataset and Descriptive Evidence

Our main dataset consists of two databases. The first database includes transaction-level export data from 2007 to 2013 kindly provided by the Salvadoran customs DGA (by its name in Spanish *Dirección General de Aduanas*). Specifically, each record includes the firm's tax ID, the product code (8-digit HS), the customs through which the shipment exits El Salvador, the destination country, the foreign buyer, the transport mode, the export value in US dollars, and the quantity (weight) in kilograms.[6] The second database is also transactional and corresponds to the regional transit scheme TIM. It shares several fields with the customs database, which makes it possible to merge them, and in addition informs the time it takes to complete the transit. The TIM database therefore allows for identifying which specific transactions were processed under the regional transit scheme and when and which not.

The TIM applies to road transit trade among Central American countries -Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama-, trade with Mexico, and trade with other countries by sea transiting through their territories (e.g., exports from El Salvador to Germany via Puerto Cortez in Honduras). In this paper we consider both road-based exports to neighboring countries and primarily multimodal exports to third countries. In the analysis below we therefore impose the condition of common destinations and common transport mode across status of usage of the transit regime and hence exclude air-shipped exports.[7]

Table 1 reports El Salvador's total exports along with share accounted for by the Central American neighbors listed above in 2010 and 2013 along with key aggregate extensive margin indicators and the portion of exports along the respective dimensions processed under the TIM. Exports grew 27% over the period to reach 5.1 billion USD in 2013, 45% of which goes to the regional partners. Last year approximately 2,300 exporters made more than 400,000 shipments to sell 3,277 products to almost 9,300 buyers. Around 26% of the total export value and 28% of the export transactions were processed through the TIM.

Table 2 characterizes the average Salvadoran exporter in these years in terms of both their total foreign sales and their road-based sales to Central American partners. On average, in 2013 exporting firms sold 7.5 products to 6 buyers in 2 countries for approximately 2 million US dollars. In so doing, each of these firms made 173 annual shipments through 2 customs. Figures are similar for sales to the region, but the average total values, which was half of that when all destinations are considered – 1 million US dollars.

4 Empirical Methodology

We aim at estimating the effects of transit times on exports. Clearly, factors other than transit procedures may affect firms' foreign sales. Thus, exports may have decreased because of lower firm's

[6] In addition, we have information on the customs verification channel and the time it takes to clear customs. Approximately 93% of the export shipments are processed under the green channel and 77% among those red-channeled are released within one day as their green counterparts. We therefore do not use explicitly use these data in the estimations.

[7] The TIM may have affected the modal choice. In order to assess whether this was the case, we have regressed the share of road in exports at the firm-product-destination level on a binary indicator taking the value of one is a firm used the TIM in shipping the product to the destination in question and zero otherwise and firm-year and product-destination-year fixed effects on data at the firm-product-destination level. The estimated coefficient on the TIM indicator is non-significant, thus suggesting that the TIM does not appear to have induced changes in transport mode.

productivity or lower foreign demand for its products. Failure to properly account for these other factors would result in biased impact estimates. A possible strategy to isolate these potential confounders consists of using disaggregated export data and including appropriate sets of fixed effects in the equation estimated on these data. We adopt this approach here. In particular, our empirical model of exports is as follows:

$$lnX_{fpct} = \alpha TIM_{fpct} + \lambda_{fpc} + \delta_{ft} + \rho_{pct} + \varepsilon_{fpct} \quad (1)$$

where f denotes firm, p stands for product at the HS-8 digit-level, c indicates country, and t indexes year (i.e., transaction-level data are aggregated by year). The main variables are X and TIM. The former represents export value.[8] The latter is a binary indicator that takes the value of 1 if firm f has used the simplified transit regime in shipping product p to destination country c in year t and 0 otherwise. The coefficient on *TIM*, α, is accordingly our parameter of interest. As mentioned above, differences in the values taken by this variable across export flows are driven by the staggered implementation of transit the regime.[9] If $\alpha > 0$ $(\alpha = 0)$, then shorter administrative processing times associated with this new regime have a positive (no) impact on exports. The remaining terms of Equation (1) correspond to control variables. Thus, λ_{fpc} is a set of firm-product-destination fixed effects that captures, for instance, the firm's knowledge of the market for a given product in a given country; δ_{ft} is a set of firm-year fixed effects that accounts for time-varying firm characteristics (e.g., size), competences (e.g., delivery of goods according to the specifications agreed upon), overall performance (e.g., productivity), and firm-level public policies (e.g., export promotion) as well as the companies' changing abilities to comply with customs' and other border agencies' regulations; ρ_{pct} is a set of product-destination-year fixed effects that controls for product-destination shocks such as changes in international transport costs across products and importing countries and fluctuations in demand for goods across markets; and for time-varying trade costs associated with customs and other administrative procedures in the various destinations; and ε is the error term.

In estimating Equation (1), we use first-differencing to eliminate the firm-product-destination fixed effects. Note that, as typically the case when using this strategy to evaluate programs on more than two periods, the TIM indicator has to be differenced along all other covariates (see Wooldridge, 2002).[10] We therefore estimate the following baseline equation:

$$\Delta lnX_{fpct} = \alpha \Delta TIM_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpct} \quad (2)$$

---

[8] The presentation hereafter focuses on firms' exports, but *mutatis mutandis* also applies to other export outcomes along the extensive margin (e.g., number of shipments and number of buyers) and the intensive margin (e.g., average exports per shipment and average exports per buyer).

[9] While very limited in number, there are admittedly drops out of the TIM in our data. These might not be actual drop outs but measurement errors associated with the merger of the databases. Note, however, that results are identical if the TIM is assumed to be an absorbing state i.e., once used, it is used consistently onwards. These results are available from the authors upon request.

[10] Keeping the program indicator in levels would lead to misleading results (see Wooldridge, 2002).

where $\Delta TIM_{fpct} = TIM_{fpct} - TIM_{fpct-1}$; $\delta'_{ft} = \delta_{ft} - \delta_{ft-1}$ accounts for firm heterogeneity; $\rho'_{pct} = \rho_{pct} - \rho_{\tilde{p}ct-1}$ absorbs all product-destination shocks; and $\varepsilon'_{fpct} = \varepsilon_{fpct} - \varepsilon_{fpct-1}$.

By comparing changes over time in exports under the new transit regime and thus with shorter processing times and those for exports that have not been processed under the regime and thus with no change in their processing times, we are controlling for observed and unobserved time-invariant factors as well as time-varying ones common to both groups that might be correlated with use of the simplified transit system and exports. In addition, Equation (2) includes fixed effects that account for systematic differences across firms and product-destination shocks, thus substantially reducing the risk of omitted variable biases and particularly of heterogeneity in export dynamics.

Estimation of Equations (2) can be potentially affected by serial correlation because it relies on non-trivial time series. In our baseline estimation, we therefore allow for an unrestricted covariance structure over time within firm-product-destinations, which may differ across them (see Bertrand et al., 2004).

The baseline equation assumes that the effect of transit time on exports is symmetric across firms, products, and destinations. There are, however, reasons to believe that these effects may differ among groups of companies, goods and countries, in which case such a restriction would not hold. Thus, for instance, impacts can be larger for time-sensitive products (e.g., Volpe Martincus et al., 2014). Hence, we also generalize this equation to explore the existence of heterogeneous effects across those groups as follows:

$$\Delta lnX_{fpct} = \sum_{i=1}^{I} \alpha_i \Theta_i \Delta TIM_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpc} \quad (3)$$

where i indexes the groups of firms, products, or countries; and Θ is the corresponding group indicator.[11] These potentially asymmetric effects can inform how transit procedures impact on exports.

5 Estimation Results

5.1 Baseline Results

The first column of Table 3 presents OLS estimates of Equation (2) for the entire sample. According to this baseline specification which controls for time-varying firm and product-destination factors, use of the system has been associated with 61.6% higher export growth.[12] It is worth mentioning that this estimated impact primarily corresponds to the first use of the regime. This can be seen by estimating Equation (2) on the "First TIM" subsample. This latter subsample creates a common "before treatment" period for

[11] The non-conditional effects of the variables that form the interaction terms are already accounted for by the sets of fixed effects.
[12] Our estimations assume that there are no cross-effects, i.e., increased exports of a product to a destination by Salvadoran firms experiencing shorter transit times are not compensated by decreased exports of the same product to the same destination by other Salvadoran firms without changes in their transit times. This is consistent with what we observe when we estimate an expanded version of the baseline equation in which we include as an additional explanatory variable the median or the average use of the TIM by other firms selling the same product to the same destination. These results are available from the authors upon request.

both "treated" and "control" observations. It includes all exports that never used the TIM before ("First TIM"), that is, we are strictly comparing exports that experienced a simplification of their transit procedures in a certain year and exports with no changes in their transit procedures in the same year conditional on both having been channeled under the old procedures in the past.[13] Estimates of Equation (2) based on this sample, which are reported in the second column of Table 3, are virtually identical to that obtained from the whole sample.[14]

In making inferences we use standard errors clustered by firm-product-destination. Admittedly, exports may be potentially correlated across other dimensions, e.g., across products or destinations for given firms or across firms in given products, or destinations. Hence, we have also re-estimated Equation (2) using alternative clustered errors to account for these potential correlations. More specifically, we also consider standard errors clustered at the firm, (8 digit- and 2 digit-) product, destination, and customs levels as well as their combinations. The results are robust to these alternative clusterings.

5.2 Robustness

While we have included comprehensive sets of fixed effects that allow us to control for unobserved firm and product-destination shocks, there might potentially be space for other factors that may have influenced firms' exports. For instance, firms using the TIM may have received support from the country's competitiveness assistance program FONDEPRO to implement upgrading and marketing strategies in specific product lines or export markets that could lead to increased foreign sales in specific sectors or destinations, in which case we would be overestimating the effect of interest. Similarly, there might have occurred shocks to input provision that might have differential effects on production across goods or changes in firms' competencies across them or specifically firms may have used the TIM to import certain inputs thus favoring the production and foreign sales of specific goods. We have therefore also estimated alternative specifications of Equation (2) in which firm-destination-year or firm-product-year fixed effects are included instead of merely firm fixed-year effects. Estimates of these alternative specifications along with those not including fixed effects are reported in the first panel of Table 4.[15] These estimates essentially corroborate our initial findings.[16]

[13] Thus, for 2012 we only include exports that did not use the TIM in 2011 and for 2013 we consider exports that were not processed under the TIM in 2011 and 2012. The number of observations accordingly differs between the left panel (entire sample) and the right panel (first TIM) of Table 3.

[14] We have also directly estimated the fixed effect model given by Equation (1) using the procedure to handle multiple large sets of fixed effects proposed by Gaure (2013). Results are also identical to those reported here. These results are available from the authors upon request.

[15] On the other hand, larger set of fixed effects impose larger restrictions on the estimation sample. However, this does not seem to drive our results. Estimates based on specifications that do not include fixed effects or only include firm or product-destination fixef effects confirm that the new transit regime has had a significant positive impact on export growth although smaller in absolute value (see Columns 1-3 in the first panel of Table 4). Alternative specifications that just include firm-year fixed effects, product-year

Unfortunately, previous estimation cannot control for potential remaining unobserved confounding factors, i.e., idiosyncratic firm-specific market developments that are correlated with TIM use. In order to minimize the risk of biased estimates due to these unobservables, we exploit our transaction-level information by estimating another variant of Equation (2) that incorporates firm-product-destination-year fixed effects on semester-frequency data and on data at the firm-product-destination-buyer level. In these cases, we also include semester and buyer-year fixed effects to account for seasonability and unobserved differences across buyers over time, respectively. Estimation results, which are shown in the second panel of Table 4, are also in line with the baseline.[17]

If shipments are ordered in advance, trade can only respond sluggishly to changes in transit conditions. In other words, simplified procedures and accordingly shorter transit times can potentially have lagged effects on export growth. We therefore also control for these effects by incorporating the change in TIM status indicator lagged up to two years in the estimating equation.[18] The results, which are shown in the third panel of Table 4, do not substantially differ from the baseline.[19]

One key assumption in our difference-in-differences-type of estimation is that exports processed under the TIM and their counterparts channeled according to the old transit procedure have had parallel trends before the establishment of the TIM, i.e., the TIM should not cause any gap in exports in previous periods. In order to assess the plausibility of this assumption, we carry out two placebo tests which imply regressing current export changes in future changes in transit procedures. First, we use data over the period 2007-2010 in which the TIM was not in force to conduct a falsification exercise whereby we assume that firm-product-destination exports using the TIM in 2011 onwards use it in 2008-2010. Estimation results are shown in the upper left panel of Table 5. Notice that, for comparison purposes, we also include estimates for the period 2010-2013 when we restrict the sample to those firm-product-destination combinations that are also present in the former sample in the respective lower panel of Table 5. Reassuringly, non-pre TIM differences in export trajectories appear to have prevailed. Second, we artificially allocate the first TIM use to the immediately previous period and re-estimate Equation (2) on the sample of firm-product-destination-year exports actually not using TIM. These placebo estimates are shown in the right panel of Table 5 with those for the respective real first TIM underneath as obtained

---

fixed effects, destination-year effects or their alternative pairwise combination at a time yield similar results. These alternative results are available from the authors upon request.

[16] While our comprehensive sets of fixed effects substantially reduce the margin for omitted variable bias, admittedly at this stage we cannot entirely rule out potential endogeneity associated with simultaneity. We are currently working in addressing this concern in additional ways.

[17] The same message is conveyed by estimates of a variant of Equation (2) expanded to include firm-product-destination fixed effects, i.e., a "double-differenced" equation which allows for individual-specific trends. These estimates are available from the authors upon request.

[18] Including these lagged TIM status indicator requires that the firm-product-destination flow be present in the data continuously over the period to enter the estimation. This causes the estimation sample to reduce.

[19] Note that the estimated effect on our baseline explanatory variable increases as we introduce additional lags of this variable. The same holds if we estimate Equation (2) on the same observations. This suggests that such a pattern of results is primarily driven by the samples on which the equation is actually estimated.

from the same firm-product-destination combinations.[20] Reassuringly, none of the former estimated coefficients are significantly different from zero, but the latter are.

5.3 *External Validity*

Estimation results consistently indicate that the TIM has had a significant positive impact on Salvadoran firms' exports. Admittedly, effects, if any at all, could have been different in other participating economies. In order to address this concern on the external validity of the findings reported so far, we look at the experience of another country with the new transit regime: Guatemala. In this country, the TIM started with a pilot project in 2008 and has also been implemented gradually over the successive years. To carry out the analysis, we use export transaction-level data comparable to those for El Salvador over the period 2007-2013, which have been kindly provided by the Guatemalan Tax Administration Agency (SAT-*Superintendencia de Administración Tributaria*)- and the respective transit data from the TIM database. We specifically replicate the basic estimations in Tables 3 and 4 using available data.[21] Results are reported in Table 6. These results are fully in line with those for El Salvador: the TIM seems to have also positively affected exports from Guatemalan firms and, notably, as testified by the point estimates, to a similar extent.

5.4 *Channels*

In this subsection we explore the channels through which observed overall export effect arises. In disentangling these channels, we estimate the effects of using the new transit system on the quantity (weight) shipped, the unit values, the number of shipments, the average value and quantity per shipment, the number of buyers, the average value and quantity per buyer, and the average number of shipments per buyer, based on Equation (2). Estimation results are presented in Table 7. These results reveal that the new transit procedures have mainly affected the number of shipments and thereby the quantity shipped as well as the number of buyers and the number of shipments per buyer, and therewith the average value and quantity of exports per buyer. Thus, these procedures have been associated with an increase in the number of shipments by 42.5% and the number of buyers and exports per buyer by 9.3% and 47.8%, respectively. Nevertheless, they have neither influenced the unit values nor the size of the shipments in terms of value or quantity.

---

[20] The number of observations differs between the upper right and lower right panel of Table 5 because in the latter we restrict the sample to non-TIM observations, thus excluding the year in which the first delay was observed. Note also that the number of observations in these two columns do not coincide with that corresponding to the first TIM estimates presented in Table 3 since we impose here a common set of firm-product-destinations across estimations. Results do not change when we do not impose this condition. These alternative results are available from the authors upon request.

[21] Available Guatemalan customs data are not as detailed as those from El Salvador.

5.5 *Sources: The TIM and Trade Costs*

Is the TIM only about timeliness? As explained in Section 2, besides speeding up movement of goods across borders, this new transit regime has increased the information available to firms on their shipments' transits and thereby has facilitated their monitoring. More precisely, instead of resorting to less direct and more expensive methods to keep track of orders' servicing, firms can now easily access the TIM online platform to learn in which segment of the transit are their shipments. In other words, the TIM lowered the information management costs an exporter (or importer) incurs in each particular order.

Estimates in Table 7 can be used to quantify such reduction in order servicing costs associated with the TIM. According to a simple inventory model, $n = \left(\sqrt{aq/2r}\right)$, where n is the number of shipments per buyer, a is the per unit inventory costs, q is the quantity shipped to a buyer in a planning period (year) and r are the costs of order servicing not directly derived from transport and actual transit time themselves – basically monitoring-.[22] Log-linearizing, taking differences, assuming that $\Delta\ln(a) = 0$, and rearranging yields: $\Delta\ln(r) = \Delta\ln(q) - 2\Delta\ln(n)$. Based on the estimated effects on quantity per buyer and the number of shipments per buyer, $\Delta\ln(r) = 0.363 - 2x0.265 = -0.157$. This implies that these order servicing costs would have declined 15.7% as a consequence of the TIM.

Applying some structure from standard trade models featuring firm heterogeneity also allows us to back out the effect of TIM on variable trade costs. In the notation of Helpman et al. (2008), let ca_f be the unit cost exporter f incurs to produce a unit of output. Suppose that the importer in country c pays the ad valorem trade cost τ_c to import the product according to a standard CES demand function $x_{fc} = \left((p_f\tau_c)^{-\varepsilon}/P_c^{1-\varepsilon}\right)Y_c$ from El Salvador. The exporter then charges the optimal mill price $p_f = (1/\alpha)ca_f$ and the export value exclusive of trade costs equals $v_{fc} = \left(p_f^{1-\varepsilon}\tau_c^{-\varepsilon}/P_c^{1-\varepsilon}\right)Y_c$. Taking natural logarithm we obtain an equation similar to specification (1) where firm and country fixed effects account for unobserved firm-specific and country-specific factors and the TIM indicator captures the variable trade cost reduction for export flows processed under the TIM compared to those not processed under the TIM. More specifically, according to the export value equation, the TIM reduces the variables trade costs τ and the trade elasticity parameter ε translates these changes in trade costs to changes in trade values. Hence, knowing the elasticity parameter we can back out the effect of TIM on trade costs. Results from implementing the equation above empirically as explained in Section 4 indicate that, all else equal, TIM participation raises export values by about 62% (see Table 3). Assuming a trade elasticity of 3 (see, e.g., Broad and Weinstein, 2006; Carballo, 2014), our back of the envelope computation reveals that the TIM

[22] See, e.g., Baumol and Vinod (1970) and Clark et al. (2014).

would have reduced variable trade costs by about 15%.[23] A caveat to this baseline estimate is that it includes adjustment along both the intensive and extensive margins. If we instead focus on given exporter-importer trade relationships, the estimated effect of TIM is roughly 48%, which with a trade of elasticity of 3, implies that trade costs would have declined by approximately 12%.

5.6 *Mechanisms*

We next investigate the underlying mechanisms of the effects. In particular, we assess whether there are heterogeneous effects along various dimensions by estimating alternative specifications of Equation (3), in which we primarily allow for different impacts across groups of firms, products, and destinations.

We first distinguish between small exporters (i.e., firm with up to 50, 100, or 200 employees) and large exporters (i.e., firms whose number of employees is above these alternative thresholds).[24] Estimates are shown in the right panel of Table 8.[25] These estimates indicate that exports from larger and smaller firms benefit to similar extent from the new transit system.[26]

Second, we assess the existence of heterogeneous effects across products. In this sense, time matters for trade particularly when goods are subject to rapid depreciation. This loss of value may be driven by spoilage (e.g., fresh produce), fashion cycles (e.g., shoes and garment), and technological obsolescence (e.g., consumer electronics) (Hummels, 2007). It can therefore be expected that shorter transit times have stronger effects on these goods. In order to ascertain whether this is the case, we discriminate across goods according to their time-sensitiveness using the estimation results from Hummels and Schaur (2013), who identify the cost of lengthy delays based on firms' choices or air versus ocean shipment.[27] Products classified as time sensitive based on these results include several in those categories referred to above such as meat and meat preparations; travel goods and handbags; telecommunications and sound recording apparatuses; and professional, scientific, and controlling instruments. The respective estimates of Equation (3) are reported in the left panel of Table 9. These estimates confirm that the positive effects of

---

[23] The estimated coefficient on TIM equals 0.48. Let *v(0)* be the export value without TIM and *v(1)* be the export value with TIM. Similarly, let *t(0)* and *t(1)* denote the variable trade costs with and without TIM. This implies that *ln[v(1)/v(0)]=0.48=-sigma ln[t(1)/t(0)]* => *v(1)/v(0)=1.62=[t(1)/t(0)]^(-sigma)* => *t(1)/t(0)=0.85*. Hence, trade costs decreased by about 15 percent.

[24] Employment data come from the 2011 national economic census. The number of observations is smaller than in previous tables because information on number of employees is not available for all exporting firms. We therefore also report for reference estimates of our baseline equation on this restricted sample. These estimates are in line with those shown in Table 3.

[25] The median size of the firms using the TIM in terms of their number of employees is larger than their peers not using the TIM (i.e., 64 vs. employees). Note, however, that the potential influence of (time-varying) firm size on both selection into the new transit system and export performance is accounted for by the firm-year fixed effects.

[26] Results do not change if we impose the condition that small and large firms export in the same product-destination combinations. These results are available from the authors upon request.

[27] We use the estimated effect of shipping times on the share of air relative to ocean shipments. In particular, goods are identified as time-sensitive if the estimated coefficient on shipping time (i.e., days/rate ratio) of the respective 2 digit HSs positive and significant.

reduced transit times are stronger on sales of time-sensitive goods.[28] In particular, these effects are the largest for food products (see right panel of Table 9).[29] Applying the formula of the number of shipments introduced in Subsection 5.4 on these sectoral estimates reveals that order servicing costs declined by 28.6% for this sector. Transport equipment and other consumer goods also experienced important reductions in such costs.

When we additionally allow for different effects by firm size categories, estimation results reveal that the impact is largest on small firms' exports of time-sensitive products. The second largest effect is observed on large firms' exports of the same type of goods.[30]

In addition, we allow for different effects on differentiated and non-differentiated products based on the classification proposed by Rauch (1999) and on heavy and light products (i.e., products with weight-to-value ratios above and up to the median according to worldwide data from COMTRADE).[31] Estimates are shown in Table 10. Estimates reveal that simplification of transit procedures has particularly favored exports of differentiated products (see left panel of Table 10). Interestingly, they also indicate that these new procedures do not seem to have affected differently exports of heavy products and light products (see right panel of Table 10). While such a difference would be expected if the policy shock would have consisted for instance of improved road infrastructure (hardware), this is not necessarily here as the policy innovation primarily assumed the form of a change in processes (software).

Heterogeneous effects can also arise across destinations. In Table 11 we examine whether this holds in our data by distinguishing across groups of countries through interaction terms. Evidence presented in this table suggests that the positive response of foreign sales to shorter transit processing times does not depend on the final destination, either within the region or outside of the region (see Columns 1 and 2 of Table 11). Note that, since regional sales are mostly road-based while extra-regional sales are mostly multimodal –road and maritime transportation-, these results could also be seen as informing impacts according to transport modes.[32] Within Central America, effects tend to be stronger for closer destinations. A possible explanation could be that time savings associated with the new transit regime are larger relative to the respective total time spent in reaching the market for these destinations.

---

[28] Alternatively, we use the frequency at which goods were shipped abroad over the period 2007-2009 to distinguish between time-sensitive goods (i.e., goods whose frequency of shipment was above the median) and time-insensitive goods (i.e., goods whose frequency of shipment was below or at the median) and re-estimate Equation (3), this time permitting different effects for these so-defined groups of goods (see Evan and Harrigan, 2005; and Volpe Martincus and Blyde, 2013). According to the estimation results, only time sensitive products seem to experience foreign sales loses as a consequence of longer customs delays. These results are available from the authors upon request.

[29] Estimates for more finely defined product categories are available from the authors upon request.

[30] These results are available from the authors upon request.

[31] Results presented in Table 8 are based on the liberal version of the classification. Estimates obtained when using the conservative alternative are similar and are available from the authors upon request.

[32] This is confirmed by estimating a variant of Equation (3) on data at the firm-product-destination-transport mode-year level that allows for different effects depending on the transport mode. These results are available from the authors upon request.

So far the analysis has focused in the effects of improved transit procedures on the export intensive margin (i.e., continuing flows). In addition, shorter transit times may have caused firms to expand foreign sales along the extensive margin. Here, we examine the impact of these changes in transit times on the destination margin for firms' exports of given products. More specifically, we estimate a variant of Equation (2) where the dependent variable is the change of a binary indicator that takes the value of one if a firm-product-destination flow is present in a given year and zero otherwise and the main explanatory variable is the change in the TIM status indicator between two consecutive years, on the sample of al firm-product-destination triples that did not register exports in 2010 conditional on the firms exporting the products in question to at least one destination (i.e., on the respective firm-product pair being positive).[33] According to the estimates of this equation, reduced transit times associated with the TIM has had a significant positive effect on the destination extensive margin.[34] In other worlds, TIM appears to have helped firm reach new export markets.[35]

6 Concluding Remarks

In a meaningful portion of trade transactions, time associated with transit is a key component of the total time needed to move goods from the origins to the destinations. Streamlined transit procedures can therefore play an important role in expediting these movements and thereby allowing for increased trade. The same specifically holds for the real-time information that electronically processed transits provides to firms on their shipments as this improved information enables more effective monitoring and management of order servicing. While available anecdotal evidence seems to indicate that this is the case, our understanding of transit in general and how it affects trade in particular has been so far limited due to absence of data. In this paper we fill this gap in the empirical literature by exploiting the gradual adoption of a new simplified transit regime in Central America -the International Transit of Goods (TIM)- to identify the effects of improvements in transit conditions on firms' exports. In so doing, we use highly detailed export transaction-level data that inform the regime under which shipments were processed. Our results indicate that the TIM has reduced trade costs and has consequently facilitated trade: exports processed under this new transit system grew faster than their counterparts subject to regular transit procedures, primarily along the shipment dimension. Furthermore, the TIM seems to have influenced export specialization: its impact has been larger on foreign sales of time-sensitive and differentiated goods.

---

[33] Given the logic of the transit system and to be parsimonious and consistent with estimations aimed at uncovering potential heterogeneous effects across countries, singled out destinations are the individual Central American countries and the rest of the word as such.

[34] Results are identical if we instead directly estimate the respective variant of Equation (1) such that the dependent variable is a binary indicator of export status in the year in question. These results are available from the authors upon request.

[35] These estimation results are available from the authors upon request.

References

Arvis, J., 2005. Transit and the special case of landlocked countries, mimeo.

Arvis, J.; Raballand, G.; and Marteau, J., 2007. The costs of being landlocked: Logistics costs and supply chain reliability. World Bank Policy Research Working Paper 4258.

Arvis, J.; Carruthers, R.; and Willoughby C., 2008. Improving transit and transport for landlocked developing countries. World Bank.

Baumol, W. and Vinod, H., 1970. An inventory theoretic model of freight transport demand. Management Science, 16, 7.

Bertrand, M.; Duflo, E.; and Mullainathan, S., 2004. How much should we trust difference-in-differences estimates? Quarterly Journal of Economics, 119, 1.

Carballo, J.; Graziano, A.; Schaur, G.; and Volpe Martincus, C., 2014. The heterogeneous costs of port-of-entry delays. IDB Discussion Paper 351.

Clark, D.; Schaur, G.; and Kozlova, V., 2014. Supply chain uncertainty as a trade barrier. University of Tennessee, mimeo.

Cristea, A.; Hummels, D.; Puzzello, L.; and Avetisyan, M., 2013. Trade and the greenhouse gas emission from international freight transport. Journal of Environmental Economics and Management, 65, 1.

European Communities, 2001. New customs transit systems for Europe.

Evans, C. and Harrigan, J., 2005. Distance, time, and specialization: Lean retailing in general equilibrium. American Economic Review, 95, 1.

Favier, J., 1971. Finances et fiscalité au Bas Moyen Age. SEDES, Paris.

Gaure, S., 2013. Ife: Linear group fixed effects. The R Journal, 5, 2.

Helpman, E., 2011. Understanding global trade. Harvard University Press, Boston.

Helpman, E.; Melitz, M.; and Rubinstein, Y., 2008. Estimating trade flows: Trading partners and trading volumes. Quarterly Journal of Economics, 123, 2.

Hummels, D. 2007. Calculating tariff equivalents for time in trade. USAID.

Hummels, D. and Schaur, G., 2013. Time as a trade barrier. American Economic Review, 103, 7.

McCormick, M., 2001. Origins of the European Economy: Communications and Commerce, AD 300-900. Cambridge University Press, New York.

Neufeld, N., 2014. Trade facilitation provisions in regional trade agreements: Traits and trends. WTO Staff Papers ERSD-2014-01.

Nicali., A., 2002. A historical outlook on the Italian customs policy. Version edited and updated by G. Favale.

Rauch, J., 1999. Networks versus markets in international trade. Journal of International Economics, 48, 3.

von Richthofen, F., 1877. Über die zentralasiatischen Seidenstrassen bis zum 2. Jh. N. Chr. Verhandlungen der Gesellschaftfür Erdkunde zu Berlin.

Sarmiento, A., 2013. El TIM como herramienta para mejorar el control del tránsito internacional de mercancías en Mesoamérica. Módulo 1, Introducción al TIM: Objetivos, componentes y beneficios. Edición 2. IDB, Integration and Trade Sector.

Sarmiento, A.; Lucenti, K.; and García, A., 2010. Automating the control of goods in international transit: Implementing the TIM in Central America. Smart Lessons, real experiences, real development. International Financial Corporation, May.

Volpe Martincus, C.; Carballo, J.; and Graziano, A., 2014. Customs. IDB, mimeo.

Wooldridge, J., 2002. Econometric analysis of cross section and panel data. The MIT Press, Cambridge, Massachusetts.

WTO (World Trade Organization), 2014. WTO Agreement on Trade Facilitation: Self-Assessment Guide. WTO, Geneva.

Table 1

Aggregate Export Indicators				
Indicators	**All Sample**		**Central America**	
	2010	**2013**	**2010**	**2013**
Export Value	4,024	5,100	0.433	0.450
Number of Shipments	321,155	403,249	0.801	0.814
Number of Exporters	2,272	2,333	0.826	0.826
Number of Products	3,133	3,277	0.939	0.937
Number of Destinations	111	113	0.045	0.044
Number of Buyers	9,273	9,340	0.727	0.711
Number of Customs	25	29	0.840	0.759
Share of TIM on Exports	0.000	0.260	0.000	0.365
Share of TIM on Shipments	0.000	0.278	0.000	0.300
Share of TIM on Exporters	0.000	0.365	0.000	0.418
Share of TIM on Products	0.000	0.577	0.000	0.589
Share of TIM on Destinations	0.000	0.372	0.000	1.000
Share of TIM on Buyers	0.000	0.268	0.000	0.334
Share of TIM on Customs	0.000	0.172	0.000	0.227

Source: Authors' calculations based on data from DGA and TIM.
Export values are expressed in millions of US dollars. The columns corresponding to "Central America" report the respective share of the totals for all destinations for export value, number of shipments, number of exporters, number of products, number of destinations, number of buyers, and number of customs. Destinations in Central America include: Costa Rica, Guatemala, Honduras, Nicaragua, and Panama. The lower panel of the table presents the share of the respective aggregate export figures under the TIM in both exports to all destinations and exports to Central America. Air-shipped exports are excluded.

Table 2

Average Exporter				
Indicators	**All Destinations**		**Central America**	
	2010	**2013**	**2010**	**2013**
Export Value	1,771.0	2,186.1	928.5	1,190.5
Number of Shipments	141.4	172.8	137.1	170.3
Exports per Shipment	14.2	19.6	8.5	9.6
Number of Products	7.2	7.5	7.1	7.5
Exports per Product	218.9	264.0	137.4	148.4
Number of Destinations	2.3	2.3	1.9	1.9
Exports per Destination	350.2	415.3	272.8	352.5
Number of Buyers	5.9	5.8	5.4	5.2
Exports per Buyer	151.0	194.8	104.8	147.6
Number of Customs	2.1	2.1	2.0	1.9
Exports per Customs	398.3	523.6	242.1	344.1
Exports per Product and Destination	102.3	117.4	75.4	80.5
Number of Shipments per Product and Destination	7.1	7.6	7.9	8.2
Number of Buyers per Product and Destination	1.4	1.4	1.5	1.4
Number of Customs per Product and Destination	1.1	1.1	1.1	1.1

Source: Authors' calculations based on data from DGA and TIM.
Export values are expressed in thousands of US dollars. Destinations in Central America include: Costa Rica, Guatemala, Honduras, Nicaragua, and Panama. Air-shipped exports are excluded.

Table 3

The Impact of TIM on Firms' Export Growth Baseline Specification and First TIM		
	Baseline	**First TIM**
TIM	0.480	0.481
Heteroscedasticity-Consistent	(0.058)***	(0.075)***
Cluster Firm-Product-Destination	(0.060)***	(0.076)***
Cluster Firm	(0.072)***	(0.081)***
Cluster Product	(0.068)***	(0.084)***
Cluster Destination	(0.117)***	(0.114)***
Cluster Product-Destination	(0.069)***	(0.089)***
Cluster Chapter HS2-Destination	(0.077)***	(0.105)***
Cluster Firm-Product	(0.061)***	(0.076)***
Cluster Firm-Chapter HS2	(0.063)***	(0.078)***
Cluster Firm-Destination	(0.072)***	(0.076)***
Main Custom	(0.135)***	(0.121)***
Main Custom-Destination	(0.101)***	(0.093)***
Firm-Year Fixed Effect	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes
Observations	39,889	34,211

Source: Authors' calculations based on data from DGA and TIM.
The table report OLS estimates of Equation (2) for both the entire sample and the entire sample and when restricting the sample to exports that never used the TIM in the past. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year fixed and product-destination-year effects included (not reported). Robust standard errors are reported in parentheses below the estimated coefficients. Standard errors clustered at alternative levels are shown next. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level. The significance indicator is presented along with the respective standard errors.

Table 4

The Impact of TIM on Firms' Exports									
Alternative Specifications									
	Annual Changes								
TIM	0.295***	0.298***	0.297***	0.290***	0.303***	0.443***	0.480***	0.517***	0.364***
	(0.023)	(0.025)	(0.029)	(0.031)	(0.028)	(0.045)	(0.060)	(0.080)	(0.105)
Firm Fixed Effect	No	Yes	No	Yes	No	No	No	No	No
Product-Destination Fixed Effect	No	No	Yes	Yes	No	No	No	No	No
Firm-Year Fixed Effect	No	No	No	No	Yes	No	Yes	No	No
Product-Destination-Year Fixed Effect	No	No	No	No	No	Yes	Yes	Yes	Yes
Firm-Product-Year Fixed Effect	No	No	No	No	No	No	No	Yes	No
Firm-Destination-Year Fixed Effect	No	No	No	No	No	No	No	No	Yes
Observations	39,889	39,889	39,889	39,889	39,889	39,889	39,889	39,889	39,889
		Semester Changes				**Buyer Level Data**			
TIM		0.300***	0.269***	0.318***	0.288***	0.302***	0.468***	0.393***	0.467***
		(0.020)	(0.052)	(0.021)	(0.053)	(0.020)	(0.067)	(0.036)	(0.138)
Firm-Product-Destination-Year Fixed Effect		No	Yes	No	Yes	No	Yes	No	Yes
Semester/Buyer-Year Fixed Effect		No	No	Yes	Yes	No	No	Yes	Yes
Observations		70,598	70,598	70,598	70,598	55,469	55,469	55,469	55,469
					Lagged Effects				
TIM							0.480***	0.479***	0.630***
							(0.060)	(0.085)	(0.156)
TIM (-1)								0.109	0.349**
								(0.107)	(0.153)
TIM (-2)									0.208
									(0.271)
Firm-Year Fixed Effect							Yes	Yes	Yes
Product-Destination-Year Fixed Effect							Yes	Yes	Yes
Observations							39,889	18,979	7,551

Source: Authors' calculations based on data from DGA and TIM.

The first panel of the table report OLS estimates of alternative specifications of Equation (2). The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. No fixed effects are included in the first column; firm fixed effects are included in the second column; product-destination fixed effects are included in the third column; firm and product-destination fixed effects are included in the fourth column; firm-year fixed effects are included in the fifth column; product-destination-year fixed effects are included in the sixth column; firm-year and product-destination-year fixed effects included in the seventh column; firm-product-year fixed effects and product-destination-year fixed effects are included in the eighth column; and firm-country-year fixed effects and product-destination-year fixed effects are included in the ninth column (not reported). The second panel shows estimates of Equation (2) based on data at the firm-product-destination-year-semester level (left) and at the firm-product-destination-buyer-year level (right). No fixed effects are included in the first and fifth columns; firm-product-destination-year fixed effects are included in the second and sixth columns; semester fixed effects and buyer fixed effects are included in the third and seventh columns, respectively; and firm-product-destination-year fixed effects and semester fixed effects and firm-product-destination-year fixed effects and buyer-year fixed effects are included in the fourth and eight columns, respectively (not reported).The third panel of the table reports OLS a modified version of Equation (2) that incorporates up to two lags of the main explanatory variable. Firm-year and production-destination-year fixed effects are included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 5

The Impact of TIM on Firms' Export Growth Placebo Exercises		
	Placebo 1	**Placebo 2**
	2007-2010	**Artificial First TIM**
TIM (t+3) / TIM (t+1)	0.068	0.051
	(0.128)	(0.111)
Firm-Year Fixed Effect	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes
Observations	17,330	14,827
Baseline with Same Observations, 2010-2013		
TIM	0.388***	0.306***
	(0.112)	(0.092)
Firm-Year Fixed Effect	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes
Observations	17,330	26,744

Source: Authors' calculations based on data from DGA and TIM.
The table report OLS estimates of alternative specifications of Equation (2). Estimates in the upper left panel correspond to a placebo exercise whereby firm-product-destinations using the TIM over the period 2011-2013 are assumed to have used it over the period 2008-2010. Estimates in the lower left panel correspond to our baseline but when the same is restricted to those firm-product-destinations also present in 2007-2010. Estimates in the upper right panel correspond to a placebo exercise whereby firm-product-destinations using the TIM for the first time over the period 2011-2013 are assumed to have used it the year immediately before. Estimates in the lower right panel correspond to our baseline but when the sample is restricted to the same firm-product-destinations. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year and product-destination-year fixed effects included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficient. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 6

The Impact of TIM on Firms' Exports: Guatemala				
Alternative Specifications				
Annual Changes				
TIM	0.462***	0.417***	0.300***	0.377***
	(0.020)	(0.037)	(0.058)	(0.052)
Firm-Year Fixed Effect	No	Yes	No	No
Product-Destination-Year Fixed Effect	No	Yes	Yes	Yes
Firm-Product-Year Fixed Effect	No	No	Yes	No
Firm-Destination-Year Fixed Effect	No	No	No	Yes
Observations	70,146	70,146	70,146	70,146
	First TIM		**Semester Changes**	
TIM	0.368***	0.357***	0.343***	0.317***
	(0.022)	(0.052)	(0.016)	(0.038)
Firm-Year Fixed Effect	No	Yes	No	No
Product-Destination-Year Fixed Effect	No	Yes	No	No
Firm-Product-Destination-Year Fixed Effect	No	No	No	Yes
Semester/Buyer-Year Fixed Effect	No	No	No	Yes
Observations			116,475	116,475
		Lagged Effects		
TIM		0.417***	0.355***	0.309***
		(0.037)	(0.039)	(0.052)
TIM (-1)			0.058	0.044
			(0.045)	(0.061)
TIM (-2)				-0.018
				(0.068)
Firm-Year Fixed Effect		Yes	Yes	Yes
Product-Destination-Year Fixed Effect		Yes	Yes	Yes
Observations		70,146	36,987	20,159

Source: Authors' calculations based on data from SAT and TIM.

The first panel of the table reports OLS estimates of alternative specifications of Equation (2). The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. No fixed effects are included in the first column; firm-year fixed effects and product-destination fixed effects are included in the second column; firm-product-year fixed effects and product-destination-year fixed effects are included in the third column; and firm-country-year fixed effects and product-destination-year fixed effects are included in the fourth column (not reported). The second left panel shows estimates of Equation (2) when restricting the sample to exports that never used the TIM in the past. No fixed effects are included in the first column; and firm-year fixed effects and product-destination fixed effects are included in the second column (not reported). The second right panel presents estimates of Equation (2) based on data at the firm-product-destination-year-semester level. No fixed effects are included in the first column; and firm-product-destination-year fixed effects and semester fixed effects are included in the second column (not reported).The third panel of the table reports OLS a modified version of Equation (2) that incorporates up to two lags of the main explanatory variable. Firm-year and production-destination-year fixed effects are included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7

The Impact of TIM on Firms' Export Growth Channels	
Export Outcomes	**TIM**
Export Value	0.480***
	(0.060)
Export Quantity	0.462***
	(0.062)
Unit Value	0.018
	(0.033)
Number of Shipments	0.354***
	(0.035)
Export Value per Shipment	0.126***
	(0.046)
Export Quantity per Shipment	0.108**
	(0.047)
Number of Buyers	0.089***
	(0.018)
Export Value per Buyer	0.391***
	(0.057)
Export Quantity per Buyer	0.373***
	(0.059)
Number of Shipments per Buyer	0.265***
	(0.032)
Firm-Year Fixed Effect	Yes
Product-Destination-Year Fixed Effect	Yes
Observations	39,889

Source: Authors' calculations based on data from DGA and TIM.
The table report OLS estimates of Equation (2). The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, number of shipments, average export value per shipment, average export quantity per shipment, number of buyers, number of shipments per buyer, average export value per buyer, and average export quantity per buyer at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year and product-destination-year fixed effects included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficient. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 8

The Impact of TIM on Firms' Export Growth Heterogeneous Effects by Firm Size							
		Threshold:					
Export Outcomes	**Baseline**	**200 Employees**		**100 Employees**		**50 Employees**	
		Large	**Small**	**Large**	**Small**	**Large**	**Small**
Export Value	0.471***	0.440***	0.501***	0.458***	0.498***	0.461***	0.505***
	(0.091)	(0.119)	(0.117)	(0.106)	(0.138)	(0.099)	(0.166)
Export Quantity	0.444***	0.329***	0.552***	0.413***	0.505***	0.424***	0.507***
	(0.098)	(0.124)	(0.127)	(0.111)	(0.155)	(0.106)	(0.182)
Unit Value	0.028	0.111	-0.050	0.045	-0.006	0.037	-0.002
	(0.055)	(0.074)	(0.066)	(0.063)	(0.083)	(0.059)	(0.102)
Number of Shipments	0.317***	0.292***	0.340***	0.324***	0.302***	0.307***	0.349***
	(0.049)	(0.067)	(0.061)	(0.058)	(0.074)	(0.055)	(0.083)
Export Value per Shipment	0.155**	0.148	0.161*	0.134	0.196*	0.154**	0.157
	(0.072)	(0.092)	(0.093)	(0.084)	(0.111)	(0.078)	(0.137)
Export Quantity per Shipment	0.127*	0.037	0.211**	0.089	0.202	0.117	0.159
	(0.076)	(0.092)	(0.103)	(0.084)	(0.129)	(0.080)	(0.155)
Number of Buyers	0.109***	0.091**	0.126***	0.112***	0.104**	0.103***	0.128**
	(0.027)	(0.036)	(0.036)	(0.032)	(0.043)	(0.030)	(0.052)
Export Value per Buyer	0.362***	0.348***	0.376***	0.346***	0.395***	0.358***	0.377**
	(0.087)	(0.115)	(0.112)	(0.101)	(0.134)	(0.095)	(0.163)
Export Quantity per Buyer	0.335***	0.237**	0.426***	0.301***	0.401***	0.321***	0.379**
	(0.094)	(0.120)	(0.123)	(0.105)	(0.152)	(0.101)	(0.180)
Number of Shipments per Buyer	0.208***	0.200***	0.215***	0.212***	0.199***	0.204***	0.221***
	(0.045)	(0.063)	(0.055)	(0.054)	(0.066)	(0.051)	(0.074)
Firm-Year Fixed Effect	Yes	Yes		Yes		Yes	
Product-Destination-Year Fixed Effect	Yes	Yes		Yes		Yes	
Observations	23,991	23,991		23,991		23,991	

The left panel of table reports OLS estimates of a specification of Equation (3) that allow for different effects on exports from small and large firms. Firms are classified as large (small) if their number of employees exceeds (does not exceed) 200, 100, or 50. The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, number of shipments, average export value per shipment, average export quantity per shipment, number of buyers, number of shipments per buyer, average export value per buyer, and average export quantity per buyer at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year and product-destination-year fixed effects included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficient. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 9

The Impact of TIM on Firms' Export Growth Heterogeneous Effects by Product Categories: Time Sensitiveness and Sectors								
Export Outcomes	**Time-Sensitive Products vs. Time-Insensitive Products**		**Sectoral Effects**					
	TS	**TI**	**Food**	**Textiles**	**Other Industrial Supplies**	**Capital Goods**	**Transport Equipment**	**Other Consumer Goods**
Export Value	0.484***	0.221	0.629***	0.435***	0.435***	0.553***	0.308	0.567***
	(0.060)	(0.250)	(0.234)	(0.104)	(0.106)	(0.143)	(0.247)	(0.114)
Export Quantity	0.465***	0.262	0.667***	0.373***	0.466***	0.444***	0.316*	0.578***
	(0.062)	(0.252)	(0.219)	(0.105)	(0.108)	(0.156)	(0.187)	(0.117)
Unit Value	0.019	-0.041	-0.038	0.062	-0.031	0.108	-0.009	-0.012
	(0.033)	(0.133)	(0.084)	(0.049)	(0.066)	(0.101)	(0.196)	(0.067)
Number of Shipments	0.354***	0.318*	0.509***	0.270***	0.358***	0.367***	0.286**	0.452***
	(0.035)	(0.182)	(0.154)	(0.061)	(0.056)	(0.074)	(0.138)	(0.073)
Export Value per Shipment	0.129***	-0.097	0.120	0.165**	0.077	0.186*	0.021	0.114
	(0.046)	(0.195)	(0.170)	(0.075)	(0.084)	(0.111)	(0.218)	(0.091)
Export Quantity per Shipment	0.111**	-0.056	0.158	0.103	0.108	0.077	0.030	0.126
	(0.048)	(0.204)	(0.147)	(0.077)	(0.084)	(0.124)	(0.177)	(0.098)
Number of Buyers	0.092***	-0.136	0.067	0.110***	0.101***	0.100***	0.066	0.049
	(0.018)	(0.108)	(0.081)	(0.034)	(0.029)	(0.038)	(0.088)	(0.032)
Export Value per Buyer	0.392***	0.356	0.388**	0.320***	0.334***	0.452***	0.242	0.518***
	(0.057)	(0.260)	(0.169)	(0.078)	(0.100)	(0.139)	(0.237)	(0.114)
Export Quantity per Buyer	0.373***	0.398	0.599***	0.263***	0.365***	0.344**	0.251	0.530***
	(0.059)	(0.253)	(0.218)	(0.098)	(0.104)	(0.151)	(0.178)	(0.117)
Number of Shipments per Buyer	0.262***	0.454**	0.441***	0.160***	0.257***	0.267***	0.221**	0.404***
	(0.033)	(0.194)	(0.163)	(0.056)	(0.049)	(0.067)	(0.104)	(0.075)
Firm-Year Fixed Effect	Yes		Yes					
Product-Destination-Year Fixed Effect	Yes		Yes					
Observations	39,732		39,889					

Source: Authors' calculations based on data from DGA and TIM.
The left panel of table reports OLS estimates of a specification of Equation (3) that allow for different effects on exports of time-sensitive products (TS) and time-insensitive products (TI). Products are classified using estimation results reported in Hummels and Schaur (2013). We use the estimated effect of shipping times on the share of air relative to ocean shipments. In particular, products are identified as time-sensitive if the estimated coefficient on shipping time (i.e., days/rate ratio) of the respective 2 digit HS is positive and significant. The right panel of the table presents OLS estimates of Equation (3) that allow for different effects on exports of different product categories: food products, textile products, other industrial supplies, capital goods, transport equipment, and other consumer goods. The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, number of shipments, average export value per shipment, average export quantity per shipment, number of buyers, number of shipments per buyer, average export value per buyer, and average export quantity per buyer at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year and product-destination-year fixed effects included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficient. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 10

The Impact of TIM on Firms' Export Growth Heterogeneous Effects by Product Categories: Differentiation and Weight-to-Value				
Export Outcomes	**Differentiated Products vs. Non-Differentiated Products**		**Heavy Products vs. Light Products**	
	D	**ND**	**H**	**L**
Export Value	0.511***	0.291**	0.451***	0.500***
	(0.063)	(0.135)	(0.088)	(0.070)
Export Quantity	0.494***	0.266*	0.480***	0.452***
	(0.065)	(0.142)	(0.089)	(0.073)
Unit Value	0.017	0.026	-0.029	0.048
	(0.035)	(0.074)	(0.048)	(0.040)
Number of Shipments	0.366***	0.279***	0.402***	0.325***
	(0.038)	(0.069)	(0.051)	(0.042)
Export Value per Shipment	0.145***	0.012	0.049	0.175***
	(0.049)	(0.107)	(0.067)	(0.054)
Export Quantity per Shipment	0.128**	-0.013	0.078	0.128**
	(0.050)	(0.111)	(0.067)	(0.057)
Number of Buyers	0.096***	0.049	0.090***	0.089***
	(0.019)	(0.040)	(0.025)	(0.022)
Export Value per Buyer	0.415***	0.242*	0.361***	0.411***
	(0.060)	(0.131)	(0.084)	(0.067)
Export Quantity per Buyer	0.398***	0.216	0.389***	0.363***
	(0.062)	(0.137)	(0.085)	(0.070)
Number of Shipments per Buyer	0.270***	0.230***	0.312***	0.235***
	(0.035)	(0.063)	(0.047)	(0.040)
Firm-Year Fixed Effect	Yes		Yes	
Product-Destination-Year Fixed Effect	Yes		Yes	
Observations	39,889		39,396	

Source: Authors' calculations based on data from DGA and TIM.

The left panel of table reports OLS estimates of a specification of Equation (3) that allow for different effects on exports of differentiated products (D) and non-differentiated products (ND). Products are categorized using the liberal version of the classification proposed by Rauch (1999). The right panel of table reports OLS estimates of a specification of Equation (3) that allow for different effects on exports of heavy products (H) and light products (L). Products are categorized as heavy (light) is their weight-to-value ratio exceeds (does not exceed the median) as computed using worldwide data from COMTRADE. The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, number of shipments, average export value per shipment, average export quantity per shipment, number of buyers, number of shipments per buyer, average export value per buyer, and average export quantity per buyer at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year and product-destination-year fixed effects included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficient. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 11

Export Outcomes	CA and ROW		Individual CA Countries and ROW					
	CA	**ROW**	**CR**	**GT**	**HN**	**NI**	**PA**	**ROW**
The Impact of TIM on Firms' Export Growth — Heterogeneous Effects by Destinations								
Export Value	0.469***	0.557***	0.227	0.760***	0.552***	0.306***	0.381*	0.565***
	(0.062)	(0.182)	(0.150)	(0.140)	(0.103)	(0.113)	(0.196)	(0.182)
Export Quantity	0.462***	0.463**	0.241	0.712***	0.578***	0.281**	0.339	0.472**
	(0.065)	(0.183)	(0.174)	(0.133)	(0.107)	(0.114)	(0.214)	(0.183)
Unit Value	0.007	0.094	-0.014	0.048	-0.026	0.026	0.042	0.093
	(0.035)	(0.086)	(0.091)	(0.083)	(0.060)	(0.063)	(0.111)	(0.086)
Number of Shipments	0.364***	0.283***	0.215**	0.587***	0.401***	0.241***	0.363***	0.288***
	(0.037)	(0.097)	(0.083)	(0.101)	(0.057)	(0.057)	(0.113)	(0.097)
Export Value per Shipment	0.106**	0.274**	0.013	0.173*	0.151*	0.065	0.018	0.277**
	(0.048)	(0.135)	(0.116)	(0.101)	(0.080)	(0.092)	(0.181)	(0.135)
Export Quantity per Shipment	0.098*	0.180	0.027	0.125	0.177**	0.039	-0.023	0.183
	(0.050)	(0.136)	(0.142)	(0.101)	(0.082)	(0.089)	(0.185)	(0.136)
Number of Buyers	0.088***	0.095	0.127***	0.069*	0.097***	0.056*	0.176**	0.095
	(0.018)	(0.058)	(0.046)	(0.040)	(0.032)	(0.033)	(0.076)	(0.058)
Export Value per Buyer	0.381***	0.462***	0.101	0.691***	0.455***	0.251**	0.205	0.470***
	(0.060)	(0.172)	(0.142)	(0.137)	(0.098)	(0.109)	(0.186)	(0.172)
Export Quantity per Buyer	0.374***	0.368**	0.115	0.643***	0.481***	0.225**	0.163	0.377**
	(0.062)	(0.175)	(0.171)	(0.129)	(0.102)	(0.111)	(0.201)	(0.174)
Number of Shipments per Buyer	0.276***	0.188**	0.088	0.518***	0.304***	0.185***	0.187**	0.193**
	(0.034)	(0.092)	(0.075)	(0.100)	(0.051)	(0.054)	(0.089)	(0.092)
Firm-Year Fixed Effect	Yes				Yes			
Product-Destination-Year Fixed Effect	Yes				Yes			
Observations	39,889				39,889			

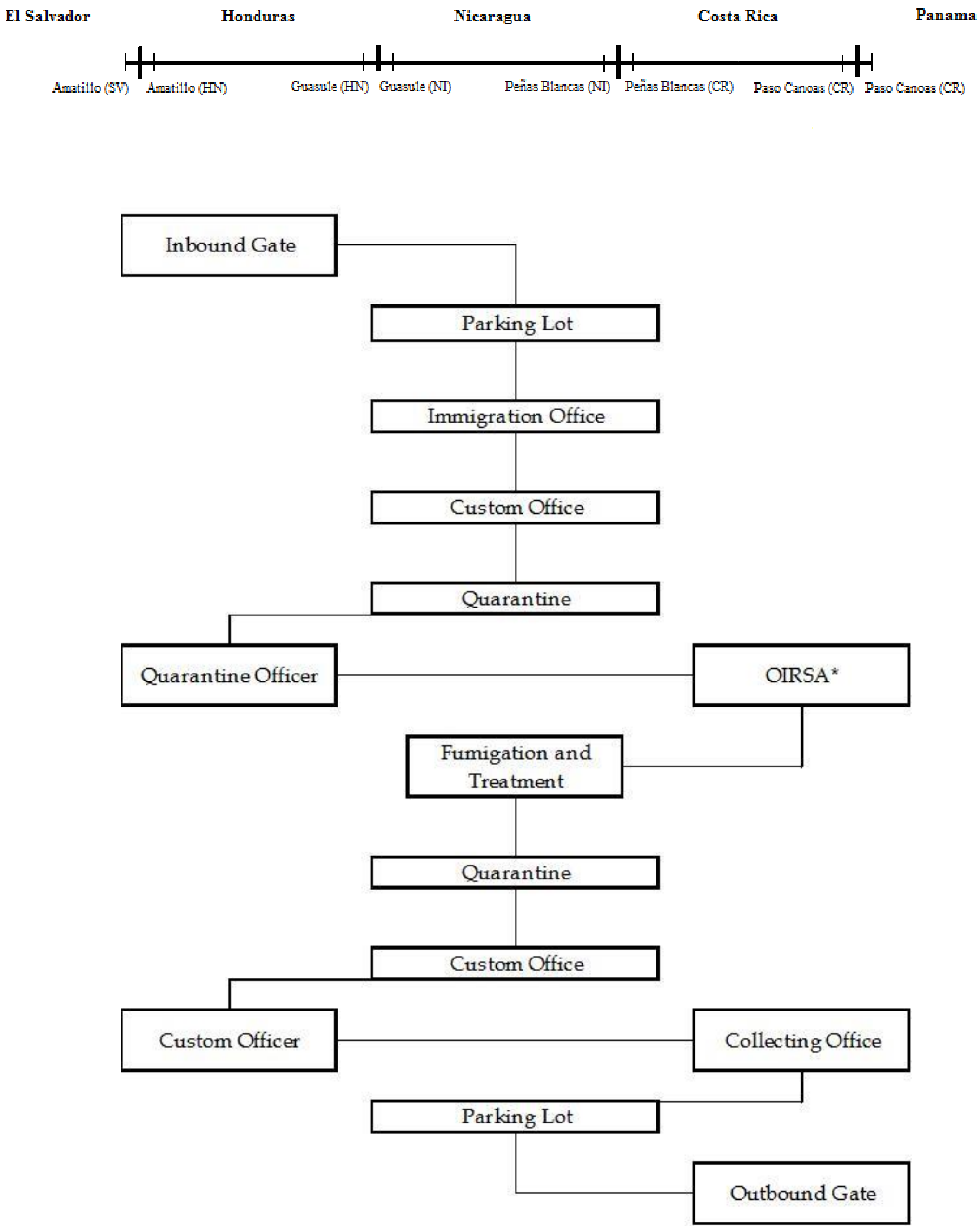
Source: Authors' calculations based on data from DGA and TIM.

The table reports OLS estimates of a specification of Equation (3) that allow for different effects across destinations (CA: Central America – CR: Costa Rica, GT: Guatemala; HN: Honduras; NI: Nicaragua; and PA: Panama- and ROW: Rest of the world). The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, number of shipments, average export value per shipment, average export quantity per shipment, number of buyers, number of shipments per buyer, average export value per buyer, and average export quantity per buyer at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm uses the TIM in shipping to the product to the destination in question and zero otherwise. Firm-year and product-destination-year fixed effects included (not reported). Standard errors clustered by firm-product-destination are reported in parentheses below the estimated coefficient. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Figure 1
Typical Export Route from El Salvador to Panama

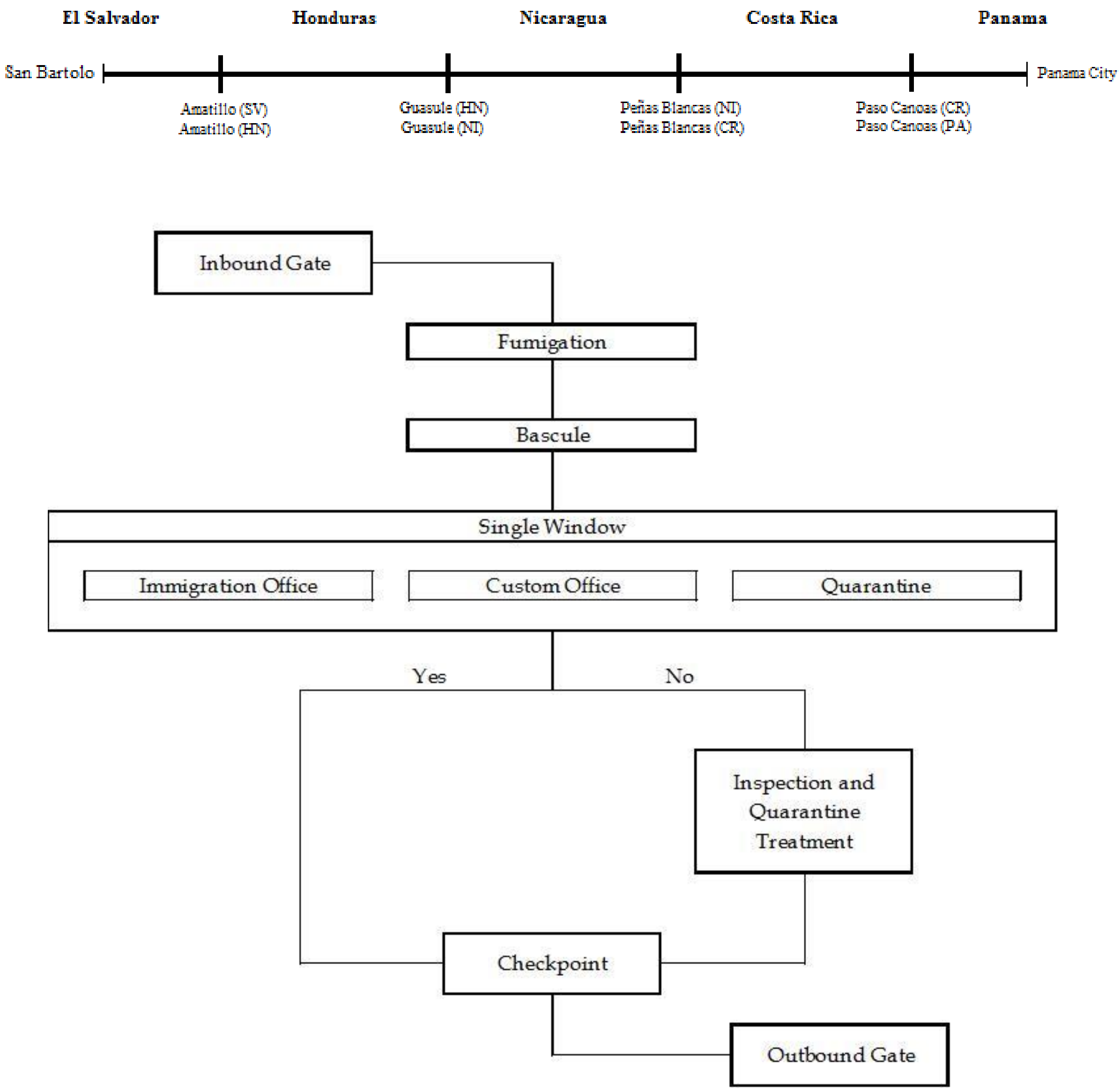
Source: Authors' preparation based on data from DGA, TIM, and Google Maps.

Figure 2
Stylized Processing of an Export Shipment from El Salvador to Panama: Pre-TIM



OIRSA: Regional Organization for Animal and Plant Health.
Source: Authors' preparation based on Sarmiento (2013).

Figure 3
Stylized Processing of an Export Shipment from El Salvador to Panama: Post-TIM



Source: Authors' preparation based on Sarmiento (2013).