Customs[♦]

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Abstract

In this paper, we estimate the effects of custom-related delays on firms' exports. In so doing, we use a unique dataset that consists of the universe of Uruguay's export transactions over the period 2002-2011 and includes precise information on the actual time it took for each of these transactions to go through customs. We account for potential endogeneity of these processing times by exploiting the conditional random allocation of shipments to different verification channels associated with the use of risk-based control procedures. Results suggest that delays have a significant negative impact on firms' exports along several dimensions. Effects are more pronounced on sales to newer buyers.

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1 Introduction

Time matters in international trade. In a seminal paper, Hummels (2001) shows that each additional day spent in transit reduces the probability that the United States sources a manufactured good from a given country by 1.5%.[1] These transit times are influenced by many factors, including actions of public agencies that intervene in the administrative processing of trade flows. This is particularly the case with customs, which oversee the compliance of shipments with trade regulations. In fact, customs are the gatekeepers of international trade. All transactions leaving or entering countries must be processed by their custom agencies and such processing takes time. How long does it take for a shipment to clear customs? The simple answer to this question is that, so far, we do not really know beyond some "perceived national averages". The truth is, however, that the actual within-country distribution of customs delays is far from degenerate. Thus, for example, export processing times by the Uruguayan customs ranged between 1 and 31 days in 2011.[2] Hence, customs-driven, transaction-specific delays can be substantial and highly variable, thus naturally affecting delivery dates. Accordingly, they could have significant effects on buying and selling decisions and thereby on firms' export outcomes. Nevertheless, evidence in this regard is virtually nonexistent. In this paper, we fill precisely this gap using an unprecedented dataset for Uruguay that consists of the entire universe of export transactions and, for the first time to our knowledge, real customs clearance times and information on the individual buyers over the period 2002-2011. Furthermore, by exploiting the institutional design of the customs process combined with this novel dataset, we properly address potential endogeneity of these clearance times

Delays associated with customs inspections can be seen as trade costs accruing to each transaction. Exporters can respond to these costs by adjusting the number and size of their shipments to given destinations, which could potentially result in changes in their foreign sales, and the intensity of this adjustment can vary across products depending on their characteristics (Hornok and Koren, 2014).[3] On the buyer side, timely delivery is a key criterion for choosing a trading partner.[4] For instance, case study-based evidence indicates that if bicycles arrive in the United States warehouses of importers or

[1] Hummels (2001) estimates that such a day is worth 0.8% *ad valorem* for manufactured goods. In the most recent version of this study, Hummels and Schaur (2013) report that each day in transit is equivalent to an *ad valorem* tariff ranging between 0.6% and 2.3%

[2] To put these figures into perspective, 31 days triples the time required to ship a good from Montevideo, Uruguay's main port, to Baltimore in the United States and amounts to 1.5 times that needed to reach Singapore. These shipping times have been taken from Sea Rates (www.searates.com), a sea-freight broker based on Miami, assuming a vessel speed of 20 knots (e.g., Berman et al., 2012).

[3] Hornok and Koren (2011) develop a simple model of shipping frequency which highlights the trade-off faced by exporters in the presence of such per-shipment costs.

[4] In a survey conducted in 2011 by BDP International, one of the leading transport and logistics management companies, on-time delivery appeared as the most important concern for supply chain management.

wholesalers in May instead of April, the season sale peak will be missed, which can result in increased inventory costs and lowered prices. When products are subject to fashion cycles deliveries, delayed by a few days can be similarly disruptive (Egan and Mody, 1992). Demand for timely delivery has even been increasing in recent decades, as suggested by the rising share of air cargo in international trade (Hummels, 2007a). Among other factors, this growing importance of timely delivery can be traced back to the dissemination of business practices such as just-in-time manufacturing and lean retailing. These practices aimed at minimizing inventories and their costs require frequent replenishments of inputs or goods to respond quickly to new market information and cope with demand (e.g., Abernathy et al., 1999; Evans and Harrigan, 2005; and Harrigan and Venables, 2006). Importantly, these developments take place in a context of spatial fragmentation of value chains. Thus, production processes increasingly involve a sequential, vertical trading chain that interconnects several countries and require these connections to be timely (Hummels et al., 2001 and Hummels, 2007b).[5] Delayed delivery of critical inputs from other countries can stop production, which can generate significant costs that can be transmitted throughout the value chain (Harrigan and Venables, 2006; Nordas et al., 2006).[6] Furthermore, such supply chain disruptions have noticeable economic impacts. For instance, firms suffering from these disruptions tend to have lower stock returns relative to relevant counterparts (Hendricks and Singhal, 2005). It is therefore not surprising that companies proactively seek to diversify their suppliers' base and to reduce sourcing from providers with high variability in their lead times.

Since customs procedures add to the transit time between origins and destinations, custom agencies play a crucial role in facilitating or hindering exports and imports.[7] A number of papers have estimated gravity models and variants thereof to examine the effects of total time to trade, customs and technical control times, and time at the border on aggregate bilateral trade (e.g., Djankov et al., 2010; Freund and Rocha, 2011; and Hornok, 2011), sectoral bilateral trade (e.g., Martínez-Zarzoso and Márquez-Ramos, 2008; Bourdet and Persson, 2010; and Zaki, 2010), the product extensive margin (e.g., Persson, 2010), the destination extensive margin (e.g., Nordas, 2006), and the frequency and size of shipments (Hornok and Koren, 2014) for various samples of countries and product categories.[8] A few studies use firm-level trade data to explore the influence of time to clear customs on export statuses, export intensity, and destination

[5] Clark et al. (2013) show that a 10% increase in supply chain uncertainty as proxied by the deviation of actual arrival dates from expected arrival dates is associated with a 4.2% reduction in imports.
[6] For example, recent episodes of production suspensions in companies such as BMW or Nissan due to the delays in arrival of key components caused by the eruption of a volcano in Iceland attest to how critical on-time delivery is in a world in which production is spread across countries.
[7] In fact, according to lead companies interviewed for the "OECD/WTO Aid for Trade Monitoring Survey", streamlining of customs procedures to reduce border delays is one of the most effective public actions that can help engage suppliers from developing countries into their value chains.
[8] Wilson et al. (2005) and Portugal-Pérez and Wilson (2010) investigate how the customs environment and border and transport efficiency affect total bilateral trade.

diversification (Dollar et al., 2006; Yoshino, 2008; Wilson and Li, 2009a, 2009b).[9] These papers conclude that customs delays have a significant negative impact on export outcomes, especially for time-sensitive products.

While certainly insightful, this literature has two main limitations, which makes the evidence on how customs processing times affect firms' export performance at best preliminary and incomplete. First, most analyses rely on cross-country variation in *perceptions* of customs delays to identify the effects of interest. This identification strategy has the drawback that unobserved country characteristics that are relevant for trade and potentially correlated with perceived administrative delays are not satisfactorily controlled for. More generally, endogeneity problems are not convincingly addressed. Further, virtually all studies utilize the single-value, country-level measure of time to trade (or its components) from the World Bank's Doing Business Indicators.[10] These indicators are very useful as a first approximation, but they have shortcomings that are mainly related to the coverage and underlying assumptions of the survey, which in turn echoes in their precision, and to the fact that relevant heterogeneities are out of the picture. In this paper, we aim at filling the aforementioned gaps in the literature while overcoming the estimation and data problems discussed above.

More precisely, this paper addresses three main questions: What are the effects of delays associated with customs processing of shipments on firms' exports? What are the channels through which these effects arise? To what extent are these effects heterogeneous? In answering these questions, we make several contributions to the existing literature. First, we present entirely new, actual measures of the exact time that it takes to complete customs procedures based on official data that cover the whole universe of a country's transactions and hence of its exporters over a long period of time, 2002-2011.

Second, we provide robust evidence on the effects of these customs delays on firms' export outcomes based on estimations that properly address endogeneity concerns associated with both potential reverse causality (i.e., larger shipments may take longer to clear customs) and simultaneity (i.e., shipments from less well prepared firms are likely to spend more time in customs and be less demanded abroad). Specifically, in order to identify their impacts on firms' exports, we exploit the conditional random variation in clearance times associated with the customs procedures: conditional on firms and product-destination combinations, shipments can be considered to be randomly allocated to physical inspection. Depending on whether shipments have to go through this material verification or not, processing times and thereby transit times increase for some exports while those for others remain the same. We therefore instrument observed delays with the allocation to merchandise control and primarily compare the before

[9] These firm-level studies tend to use relatively small samples of manufacturing firms of heterogeneous countries that are pooled together for estimation purposes.

[10] Some recent studies use trade facilitation measures from the World Bank's Logistic Performance Index (e.g., Hoekman and Nicita, 2012) and the World Bank's Enterprise Surveys (e.g., Hoekman and Shepherd, 2013 and Shepherd, 2013). Like those originated from the Doing Business Indicators, these measures also have noticeable limitations in capturing firms' experiences with customs.

and after change in exports subject to increased delays with that in exports that did not suffer from additional delays while rigorously controlling for potential confounding factors. This allows us to consistently estimate the effects of interest. Such effects develop incrementally with the successive transactions over a one year period. We also present the respective ordinary least squares (OLS) estimates, which, notably, convey the same message as their instrumental variables (IV) counterparts.

Admittedly, our identification strategy faces two main challenges. Since variation primarily comes from random shocks to time-in-customs (i.e., deviation from expectations) we might arguably not see any impact on trade. However, this is only true under perfect information. If, as most likely is the case, buyers are imperfectly informed about the reasons behind unexpected delays in delivery, this neutrality does not necessarily hold. We provide evidence thereon mainly by distinguishing between newer and older buyers. The other limitation is that, by the law of large numbers, allocation to verification channels would tend to its population values when exports consist of a relatively large number of shipments passing through the customs. We address this concern by restricting the estimation sample to exports made up of a relatively small number of transactions.

Third, we disentangle the channels through which the effects arise, including the buyer channel as a novelty. Finally, our results provide guidance for future theoretical work on the impact of time on trade and, importantly, shed new light on trade facilitation initiatives in a timely manner as countries will have to implement the agreement recently reached in Bali (WTO, 2014).

We find that delays associated with customs procedures have a significant negative impact on firms' exports. In particular, a 10% increase in customs delays results in a 3.8% decline in exports. This effect comes from higher costs for exporters, who accordingly reduce their foreign sales, as well as for buyers, who appear to lower their exposure to firms whose deliveries are subject to such shocks by downscaling their purchases or directly ceasing to source from the sellers in question altogether. These findings highlight the importance of controls that are expedited without jeopardizing the fulfillment of their purposes.

The remainder of this paper is organized as follows. Section 2 describes the export process in Uruguay. 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 Customs Processing of Exports in Uruguay

In Uruguay as well as in other Latin American countries exports are subject to physical verification because taxes are collected on foreign sales of certain products; other reasons include control of tax reimbursement claims and fighting illegal trade. However, not every single shipment is inspected in Uruguay. The country's customs agency uses risk-based procedures in carrying out these verifications.

The typical export process is illustrated in a stylized manner in Figure 1 (URUGUAY XXI, 2012). Once the terms of the trade deal (i.e., quantity, price, shipment method, etc.) between the exporter and the buyer are established, the former requests the service of a customs broker, who is given the *proforma* invoice or final commercial invoice and the packing list (if applicable).[11] This broker completes an electronic Single Customs Document (*Declaración Única Aduanera*-DUA) and sends it to the customs (*Dirección Nacional de Aduanas*-DNA), which validates the DUA and sends back a message containing the number assigned to the DUA and the registration date. When the shipment is at the customs departure point, the DUA is printed and all export documentation is put into an envelope along with a sworn declaration (signed by the customs broker and the exporter), the *proforma* or final invoice, a copy of the bill of lading and any other documentation required (e.g., sanitary certificates, etc.).

At this stage, the customs broker requests the *ex ante* verification channel for the operation. Customs applying risk management, such as the DNA, use information on the DUA to determine whether shipments are assigned to no verification (*green channel*) or verification of documents and merchandise (*red channel*). This information may include the firm, the product, the destination, the customs broker, the transport company, and the freight forwarder (e.g., Laporte, 2011).[12] While we did not have access to the actual statistical model used by the DNA since it is strictly protected by tax confidentiality, according to our interviews with customs officials and customs specialists at the Inter-American Development Bank, exporting firms and product-destination combinations are the governing criteria of the deterministic allocation to inspections in the particular case of exports. The reason is that these are the main sources of the risk that is being controlled for, specifically, misclassification of goods to avoid taxes or export prohibitions or misreporting of values for similar motives.[13] Conditional on the aforementioned deterministic components, there is random allocation to verification channels (URUGUAY XXI, 2012). Hence, we mimic the actual assignment mechanism such that, conditional on firms and product-destinations, the customs information system would randomly assign shipments to the green or red channels.

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[11] In order to be able to export, companies must be registered with the tax agency (*Dirección General Impositiva*-DGI), the social security administration (*Banco de Previsión Social*-BPS) and the state insurance company (*Banco de Seguros del Estado*-BSE).

[12] Some "news" about the shipment could be also utilized to decide on physical inspection. Unfortunately, we do not have information in this regard.

[13] Unlike for imports, other participants of the exchange chain such as the freight forwarder, the transport company, or the importing firm in the destination country enter into action after customs controls and do not significantly contribute to these kinds of risks. In order to confirm whether this is the case, we gathered information on the customs broker and the transport company exporting firms worked with in 2011. To start with, the raw data suggest that most exporting firms just use one broker and one transporter. Our firm fixed effects should therefore account to a large extent –if not almost all- for the potential role played by this variable –if any at all- in the assignment to the different types of verifications. More formally, we have regressed a binary indicator taking the value of one if the median allocation of a firm-product-destination export flow is to the red channel (or alternatively a binary indicator taking the value of one if at least one of its shipments is processed through this channel) and zero otherwise on exporting firm, product-destination, customs broker and transport company fixed effects and found that the latter two account for only a marginal portion of the total variation in such allocation jointly explained by all these fixed effects. These results are available from the authors upon request.

This random allocation to the verification channel allows us to directly rule out selection problems in relationship to transactions that suffer from delays. In order to check this randomness, we carry out daily regressions of a binary indicator that takes the value of one if a firm-product-destination flow is allocated to the red channel and zero otherwise on the value of the flow and firm and (HS6) product-destination fixed effects.[14] Estimates together with their confidence intervals are shown in the upper left panel of Figure 2 along with the respective smoothed values obtained from a kernel weighted local polynomial regression.[15] As expected, these estimates are overwhelmingly non-significant. In particular, for the almost 1,000 regressions with at least 20 degrees of freedom, the estimated coefficient on the export value is insignificant in about 99% of the time.[16] Also important for our purposes, and again conditional on firm and product-destinations, there seems not to be an *a priori* systematic relationship between the size of the shipments and the time inspection takes. If we redo previous estimations using the (logarithm of the) median delay experienced instead of the binary allocation indicator as the dependent variable, the estimated coefficient on the export value is again insignificant in 99% of the cases (upper right panel of Figure 2).[17]

In addition, we examine whether allocation to verification channels are conditionally independent over time. In so doing, we estimate a linear probability model in which the dependent variable is a binary indicator that takes the value of one if a firm-product-destination shipment in a given date is allocated to the red channel and zero otherwise and the main explanatory variable is the value taken by the same indicator the previous date the same firm-product-destination shipment went through customs, along with firm and product-destination fixed effects, for each date in our sample period. Moreover, we have explored potential interdependencies among actual delays by regressing the (natural logarithm of the) median delay experienced by a firm-product-destination shipment in a given date on the median delay the same shipment suffered the previous date it cleared customs. Estimates indicate that there is neither systematic association between current and previous allocations to the red channel nor between current and previous delays, both conditional on firm and product-destination combinations. More specifically, the estimated coefficients on lagged allocation to the red channel and lagged delay are insignificant in

[14] The average (median) number of transactions per day ranges between 236.2 and 357 (257 and 427) over the period 2002-2011.

[15] Similar -although slightly lower- ratios are observed when we just consider firm-product-destination export flows processed under the green channel in a given day and use alternatively a binary indicator that takes the value of one if the flow is allocated to the red channel the next time it goes through the customs or the median delay faced this next time as dependent variables. We have also conducted daily unconditional two sample t-tests to assess whether there were significant differences in mean firms' exports (and number of products exported and number of destinations) under the green channel for companies with at least one of their transaction allocated to the red channel in their next visit to the customs and their counterparts with all their transactions going again through the green channel. Furthermore, we have carried out daily conditional two sample t-tests to establish whether firm-product-destination exports that experience positive delays in a given day and their peers that do not face such delays had different mean clearance times in their previous visit to the customs. According to the test statistics, differences are not significant in most of the cases. These tests are available from the authors upon request.

[16] Proportions are virtually identical when regressions with more than 30 degrees of freedom are considered. Estimates and summary statistics are available from the authors upon request.

[17] Tables with detailed estimation results are available from the authors upon request.

98.8% and 95% of the time, respectively (the lower left and right panels of Figure 2). In sum, these exercises confirm that allocation to the red channel can be taken as (conditionally) random.

After the verification, if any, has taken place, customs sends the DUA with the clearance of the shipment. The merchandise is then loaded at the port, airport, or border crossing. Afterwards, the customs broker sends an electronic message to complete the transaction, based on information that will be sent to the DNA in the third and last electronic message with definitive shipping data (i.e., weight, quantity, number of packages, value).[18] Finally, the DNA completes the export in its information system and carries out an *ex post* documentation verification against the third message sent by the customs broker.

In this paper we measure the customs clearance time as the time elapsed between the request of verification channel and the release of the goods by the customs (Figure 1). This precisely corresponds to the time it takes for the customs to carry out the verifications, if any, and hence, to the exact time this public entity adds to transit between origins and destinations. It therefore excludes the time required for previous documentation preparation and inland transportation as well as that for port or airport handling. The reason is threefold. First, there is virtually no delay between the initial submission of the DUA by customs brokers and its registration by customs. Second, exporters may begin work on documentation while production is underway (Hummels, 2007b). Third, several factors can affect the schedule of the domestic transportation of the goods to the exit point and these factors are generally out of the control of the customs (WCO, 2011).

3 Dataset and Descriptive Evidence

Our main dataset consists of transaction level export data from 2002 to 2011 from the Uruguayan customs agency. Specifically, each record includes the firm's tax ID, the product code (10-digit HS), the customs through which the shipment exits Uruguay, the destination country, the foreign buyer, the transport mode, the export value in US dollars, the quantity (weight) in kilograms, the channel through which the transaction was processed (either green or red), the date in which the customs-processing of the shipment was requested (channel request) and date in which the shipment was authorized to leave the customs (release date) (Figure 1). We should mention herein that the sum of these firms' exports virtually adds up to the total merchandise exports as reported by the Uruguayan Central Bank, with the annual difference being always less than 1%.

The upper panel of Table 1 reports Uruguay's total exports in 2002 and 2011 along with key aggregate extensive margin indicators and customs processing patterns, namely, the portion of

[18] In this instance, if exports involve raw wool, live cattle, dried and salted hides, leather and split, or pickled and wet-blue leather, a 5% export tax must be paid to the state bank BROU, which officially acts as collection agent.

transactions going through red channel and the median time spent in customs conditional on this channel. Roughly 15.2% of the transactions went through the red channel and were accordingly subject to material inspection from 2002 to 2011; this portion declined in more recent years.

It is worth noting that shipments going through the green channel are always cleared within one day (i.e., the same day the broker requests the channel), whereas release of goods whose exports were subject to red channel can take one day or substantially longer.[19] This can be seen in Figure 3, which presents a kernel density estimate of the distribution of the number of days spent in customs over all transactions allocated to the red channel in 2011.[20] This highlights that single dimensional figures can hide an ample variability of administrative-driven delays, which may potentially have significant and heterogeneous implications for firms' export outcomes and their dynamics. In particular, in the case of Uruguay, evidence (weakly) suggest that time-sensitive and differentiated products would be less likely to be allocated to the red channel and, conditional on being physically inspected, the time shipments consisting of these goods spend in customs tends to be shorter.[21]

Further, customs delays can substantially change over time. In fact, the median clearance time for those transactions subject to red channel increased from 2 to 5 days between 2003 and 2011. More generally, as illustrated by Figure 4, the distribution of these delays experienced a substantial shift to the right between these years, particularly in its upper part.

In this regard, it should be noted that the absolute number of transactions subject to material inspection slightly declined in most recent years, which suggests that increased delays cannot be traced back to the expansion in the number of export shipments registered over this period. Instead, the reduction in the number of employees that carry out the verifications of export shipments is likely to have played a role in this development. This number decreased 30% from 2003 to 2011, primarily because of the pensioning of employees who reached the retirement age and the fact that there were no incorporations of personnel due to the 1995 public administration law that froze hiring of public employees. In fact, a regression of the median delay under the red channel on the total number of officials conducting physical inspections at individual customs offices over the period 2003-2011 reveals that a 10% reduction in the number of inspectors is associated with a 5.8% increase in the median number of

[19] Some of the delays we observe in the data are unreasonably high (several hundred days) likely due to entry error. To address this problem we drop the highest 0.5 percentile of the delays from the dataset. However, our main results are robust to including these observations. These alternative estimation results are available from the authors upon request.

[20] Longer customs delays could cause a shipment to miss a ship leaving the port, thereby increasing the time needed to reach customers. Unfortunately, we cannot examine whether this actually happens or not because we lack the required information.

[21] This has been established by regressing a binary indicator taking the value of one if a shipment is allocated to the red channel and zero otherwise on a binary indicator taking the value of one if the good is time-sensitive as defined in Section 5 (or alternatively differentiated according to Rauch (1999)'s classification) and zero otherwise, and month-year fixed effects, firm-destination fixed effects, or firm-destination-month-year fixed effects. Results using the (natural logarithm of the) time-in-customs conditional on being assigned to the red channel as dependent variable convey the same message. Estimates are available from the authors upon request.

days spent in customs when allocated to the red channel, after netting out time invariant customs offices and year-specific factors.[22]

The lower panel of Table 1 characterizes the average Uruguayan exporter in these years. On average, in 2011 exporting firms sold 4.4 products to 7 buyers in 3.3 countries for approximately 4.2 million US dollars. In so doing, each of these firms made 59.6 annual shipments through 1.8 customs.

4 Empirical Methodology

We aim at estimating the effects of time spent in customs on exports. Clearly, factors other than customs procedures may affect firms' foreign sales. Thus, exports may have changed because of lower firm 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:

$$lnX_{fpct} = \alpha lnD_{fpct} + \lambda_{fpc} + \delta_{ft} + \rho_{\tilde{p}ct} + \varepsilon_{fpct} \qquad (1)$$

where f denotes firm, p ($\tilde{p}$) stands for product at the HS-10 (HS-6) digit-level, c indicates country, and t indexes year (i.e., transaction-level data are aggregated by year).[23] The main variables are X and D. The former represents export value.[24] The latter is the median delay experienced by all shipments of product p from firm f to destination country c in year t.[25] We use the median delay because it is more representative of the central tendency of the data. The average, instead, can be strongly affected by extreme delays (e.g., Greene, 1997). The coefficient on D, α, is accordingly our parameter of interest. If $\alpha < 0$ ($\alpha = 0$), then increased delays associated with longer customs processing times have a negative (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

[22] More formally, we regress the (natural logarithm of the) median delay under the red channel on the (natural logarithm of the) total number of inspectors and customs office and year fixed effects. A table with the estimation results is available from the authors upon request.

[23] Ideally, one would like to take advantage of transaction-level data to compare exports before and after allocation to the red channel or a delay in a given transaction. However, there are two strong reasons to work with lower frequency data. First, firms export at different points in time, which makes it particularly difficult to properly identify the comparison group for those shipments subject to inspections and delays. Second and related, there is lumpiness in exports, i.e., most firms sell abroad at specific dates and then there are long periods of inaction (e.g., Armenter and Koren, 2014). As a consequence, estimations based on higher frequency data and accordingly shorter variations (e.g., month-to-month changes) would primarily identify the effects of delays on a particular set of export flows-those with year-round shipments. In short, lumpiness complicates the identification of the impacts of interest using highest frequency data.

[24] 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).

[25] Note that shipments of a given firm-product-destination export flow that are all cleared within one day in a given year have a median delay of one, that is, *ln(1)=0*. Those taking generally longer to go through customs have higher values.

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 regulations and probabilities of being selected for material inspection (which we assume might potentially occur if a firm fails a verification in the past); $\rho_{\tilde{p}ct}$ is a set of product-destination-year fixed effects that controls for product-destination shocks such as changes in tariffs applied on products across importing countries, specific variations in international transport costs, and fluctuations in demand for goods across markets; for potentially different probabilities of being allocated to the red channel across product-destination pairs; 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. We therefore estimate the following baseline equation:

$$\Delta lnX_{fpct} = \alpha \Delta \ln D_{fpct} + \delta'_{ft} + \rho'_{\tilde{p}ct} + \varepsilon'_{fpct} \tag{2}$$

where $\Delta \ln D_{fpct} = lnD_{fpct} - lnD_{fpct-1}$; $\delta'_{ft} = \delta_{ft} - \delta_{ft-1}$ accounts for firm heterogeneity; $\rho'_{\tilde{p}ct} = \rho_{\tilde{p}ct} - \rho_{\tilde{p}ct-1}$ absorbs all product-destination shocks; and $\varepsilon'_{fpct} = \varepsilon_{fpct} - \varepsilon_{fpct-1}$.[26]

Note that, by comparing changes over time in exports that do not suffer from changes in delays and those for exports that experience increased delays, 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 being exposed to customs delays 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. Further in this sense, given the mechanism of allocation to the verification channel (see Section 2) and that exporters might be aware of its main criteria, these fixed effects can be considered to also at least partially account for exporters' expectations on time-in-customs over time. Under this interpretation, we are primarily identifying the effects of deviations from these expected delays. Such deviations can be costly in terms of trade. More specifically, uncertainty in time to complete customs procedures and uncertainty in delivery times in general make it harder to meet delivery deadlines and can thereby negatively affect exports (e.g., Freund and Rocha, 2011; Clark et al., 2013). In particular, buyers are likely to be imperfectly informed about the nature of the delays in the delivery of the goods they ordered and, faced with these delays, may simply opt to buy less from the firms in question and even directly source elsewhere.

[26] We are implicitly assuming that increases and decreases of delays have symmetric effects. Note, however, that our results on the first delay (as well as first red channel) reported in Section 5, which only consider non-negative changes in delays (or in allocation to the red channel), are entirely consistent with the baseline based on Equation (2). From an economic point of view, exporters can expand their foreign sales in response to the lower trade costs associated with shorter delays.

The issue remains, though, that actual delays can be endogenous to firms' exports for several reasons. Thus, for instance, one could conceivably think that larger foreign sales in given firm-product-destination-year quadruples lead to longer time-in-customs. In order to isolate a source of variation in these administrative delays that is exogenous with respect to exports, we exploit the mechanics of customs procedures described in Section 2. As explained there, conditional on firms and product-destination combinations, shipments can be seen as randomly allocated to physical inspection, which may result in longer customs processing times. Hence, we use the median allocation to the red channel as an instrument for the median delay and estimate Equation (2) by IV. The first stage equation is as follows:

$$\Delta lnD_{fpct} = \beta \Delta \mathrm{RC}_{fpct} + \gamma_{ft} + \pi_{\tilde{p}ct} + \mu_{fpct} \tag{3}$$

where RC is the median allocation to the red channel; $\Delta\mathrm{RC}_{fpct} = RC_{fpct} - RC_{fpct-1}$; γ_{ft} is a set of firm-year fixed effects; $\pi_{\tilde{p}ct}$ is a set of product-country-year fixed effects; and μ is the error term. RC takes the value of one if 50% or more of the shipments in a given firm-product-destination-year quadruple is assigned to the red channel. The rationale for using this indicator, which also corresponds to the modal allocation, is threefold. First, we use the median to summarize the main explanatory variable –actual time spent in customs- at the level of the estimating data for the reasons explained above. We also resort to the median in the case of channel assignment for consistency. Second, the natural alternative, the sample proportion, has the drawback that the total number of shipments appears explicitly in the denominator. As shown later, this is affected by customs delays, thus making an average-based instrument less clean. In contrast, the median does not depend directly on the actual number of transactions.[27] Third, as for the specific share of firm-product-destination transactions under the red channel, it should be kept in mind that a non-negligible portion of the red-channeled transactions are released within one day as their counterparts processed under the green channel (see Figure 4). As a consequence, the relationship between delays and allocation to the red channel conditional on having at least one shipment assigned to physical inspection becomes weaker as one becomes "more liberal" in considering a flow as red-channeled (i.e., requires that the red channel makes up smaller portions of the total number of shipments). In other words, using higher percentiles will imply moving several firm-product-destination flows that do no experience any delays relative to similar flows processed under the green channel from the "control group" to the "treated group", thus negatively affecting the strength of our instrument. This can be clearly seen by estimating the equivalent to our first stage equation for the sample of observations with at least one transaction subject to the red channel. Our preferred median-based specification has a

[27] Moreover, most export flows consist of a relatively small number of shipments. Specifically, 75% of these flows have 8 transactions or less. Hence, the distribution of proportions is not necessarily smoother. In fact, 60%of the changes in the allocation to the red channel over time as determined using the median coincide with those computed based on the mean.

higher F-statistics than the alternatives. In fact, it maximizes the F-statistics of this partial and thereby of our actual first stage estimation.[28]

To be a valid instrument, the median allocation to the red channel should predict observed delays, but it should be otherwise uncorrelated with exports. This involves two conditions. First, allocation to material verification must be correlated with delays once other relevant variables have been netted out. This can be expected to be the case, as firm-product-destination exports with more than half of their transactions subject to physical inspection are likely to experience longer delays. Second, the assignment to the red channel must be uncorrelated with the error term once conditioned on all other relevant explanatory variables. In other words, it must be exogenous, which requires properly controlling for factors that influence exports and are correlated with this assignment. This is precisely what the firm-year and product-destination-year fixed effects do. While the exclusion restriction cannot be formally tested because there is only one instrument for the endogenous variable, this restriction is fulfilled by definition since allocation to the red channel cannot affect foreign sales through channels other than delays themselves.

Two issues are worth mentioning here. First, customs controls aim at detecting irregularities. Some of the shipments that are inspected and are delayed can have such irregularities. In this case, delays cannot be attributed to customs operation but to exporters' actions, which can also make them endogenous. In order to ensure that this does not contaminate our estimates, we use a unique piece of information contained in our dataset that indicates whether there was an issue with a particular shipment and, if so, which type (e.g., inconsistency between documents and actual shipment). In particular, we proceed to remove all these irregular transactions or all transactions from involved firm-product-destinations or firms in the years in which an irregularity was detected. Second, by the law of large numbers, when exports consist of several transactions going through customs in a given period, probabilities of being allocated to the red channel will tend to their respective expected values, thus reducing their randomness component. A strategy to deal with this is to restrict the sample to exports with relatively few shipments. However, this could come at a price in terms of external validity, as estimates will likely be more representative for certain firms and product-destinations than for all of them. We therefore estimate Equations (2) and (3) both on the entire sample and on subsamples including only those exports with relatively small number of transactions.

Estimation of Equations (2) and (3) 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

[28] One could work with percentiles other than the median. Note, however, that only from the 70th percentile downwards (i.e., firm-product-destination flows with 30% or more of their shipments under the red channel), the F-statistics is above 1, and only from the 60th percentile downwards (i.e., firm-product-destination flows with 40% or more of their shipments under the red channel), the F-statistics exceeds 10. It is worth noting that our findings remain robust to using these percentiles instead of the median allocation to the red channel. These estimation results are available from the authors upon request.

structure over time within firm-product-destinations, which may differ across them (Bertrand et al., 2004).

The baseline equation assumes that the effect of customs delays on exports is symmetric across firms, products, and destinations. There are, however, reasons to believe that these effects may differ among groups of firms, products, and destinations, in which case such a restriction would not hold. Thus, for instance, impacts can be larger for time-sensitive products (e.g., Djankov et al., 2010) or in destinations with tougher competition (e.g., Mayer et al., 2013; and Carballo et al., 2013). Hence, we also generalize this equation to explore the existence of heterogeneous effects across those groups as follows:

$$\Delta lnX_{fpct} = \sum_{i=1}^{I}\alpha_i\Theta_i\Delta\ln D_{fpct} + \delta'_{ft} + \rho'_{\tilde{p}c} + \varepsilon'_{fpc} \quad (4)$$

where i indexes the groups of firms, products, or countries, and their combinations; and Θ is the corresponding group indicator.[29] These potentially asymmetric effects can inform how clearance times impact on exports.

5 Estimation Results

5.1 Baseline Results and Robustness

The first four columns of Table 2 present OLS and IV estimates of Equation (2) along with the respective estimates of Equation (3) for the latter, both for the entire sample and for the "First Delay" subsample. This latter subsample creates a common "before treatment" period for both "treated" and "control" observations. It includes all exports that never faced delays before ("First Delay"), that is, we are strictly comparing exports that experience a delay in a certain year and exports that do not suffer from delays the same year conditional on not having been subject to delays in the past.[30] Both OLS and IV estimates concur in suggesting that customs-driven delays have a significant negative effect on exports.[31] According to the latter, exports decline by 3.8% in response to a 10% increase in customs delays. Columns four to eight of Table 2 report the estimates of a variant of Equation (2) where the main explanatory variable is the absolute change in the time it takes for customs to release the goods instead of its logarithmic change.[32] In particular, the IV estimated coefficient indicates that an increase of one day in the

[29] The non-conditional effects of the variables that form the interaction terms are already accounted for by the sets of fixed effects.
[30] Thus, for 2003 we only include exports that did not experience delays in 2002 and for 2004 we consider exports that did not suffer from any delay in 2002 and 2003, and so on. The number of observations accordingly differs between the upper panel (entire sample) and the lower panel (first delay) of Table 2. Results are similar when we also exclude from the sample flows consisting of shipments allocated to the red channel but not facing longer delays than their counterparts processed under the green channel. These alternative results are available from the authors upon request.
[31] Estimations have been carried out using the STATA command *felsdvreg* (Cornelissen, 2008).
[32] In all subsequent tables we use the specification with delays in natural logarithm. Results based on the non-log specification are virtually the same. An appendix that reproduces all tables in the paper for this specification is available from the authors upon request.

time spent in customs translates into a reduction of 11.4% in exports.[33] Note that the IV estimates are larger (in absolute value) than their OLS counterparts.[34] This is precisely what one would expect if, conditional on being assigned to the red channel, larger exports are associated with longer time-in-customs. This could be the case because it simply takes longer to verify larger shipments.[35]

The F-test statistic is well above 10 (Staiger and Stock, 1997) and 11.52 (Stock and Yogo, 2005) in all cases, thus indicating that allocation to physical inspection is correlated with actual delays. As for the exclusion restriction, recall that it holds by definition as this allocation can only affect exports through clearance times. 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 Equations (2) and (3) using alternative clustered errors to account for these potential correlations. More specifically, we also consider standard errors clustered at the firm, product, destination, product-destination, firm-destination, and firm-product levels. The results are robust to these alternative clusterings.

A simple back-of-the-envelope calculation based on the IV estimates reveals that, if all exports would have been physically inspected and such inspections would have taken two days, total exports in 2011 would have been 16.4% smaller than they actually were (8.4% if OLS estimates are used).[36] This provides us with a simple, direct measure of the benefits of having risk-based inspection procedures as opposed to manually inspecting every single transaction as done in certain countries.[37] In addition to their actual coverage, the speed of the controls also matters. In this sense, if all shipments that were subject to the red channel and spent more than two days in customs would have been released within two days as suggested by the Doing Business, total foreign sales in 2011 would have been 3.6% larger. Further, if these shipments would have been authorized to leave customs within one day as those processed under the green channel were, exports would have been 5.9% larger. This latter export response is far from

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[33] We have also estimated an alternative specification which additionally includes the quadratic delay. This term is not significant in the log specification and marginally significant and extremely small in the no-log specification. Further, the significance of this term in the latter does not survive to robustness checks. These estimation results are available from the authors upon request.

[34] Still, both sets of estimates are qualitatively comparable. This is hardly surprising given the evidence on the randomness of delays presented in Section 2.

[35] We have also exploited our transaction-level data to estimate by IV a cross-section variant of our baseline equation day-by-day based on two-year windows around each of these dates –one year before and one year after-. In so doing, we have first considered all transactions in the respective dates and, second, we have restricted the sample to those shipments processed under the green channel the previous year. Results from these roughly 2,500 regressions shows that approximately 80% of the IV estimates of the coefficient on the variable capturing delay are negative and significant. These estimation results are fully in line with our baseline and are available from the authors upon request.

[36] This simulation assumes that there are no cross-effects, i.e., decreased exports of a product to a destination by Uruguayan firms experiencing longer customs delays are not compensated by increased exports of the same product to the same destination by other Uruguayan firms not suffering from such delays. 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 delay faced by other firms selling the same product to the same destination. These results are available from the authors upon request.

[37] We should acknowledge that there might be a partially compensating effect. Controlling all shipments might potentially induce exporters to better prepare their shipments and the associated documentations, which could reduce the share of shipments with irregularities and thereby the time in customs.

negligible as, for instance, it corresponds to more than 6 times the annual budget allocated to Uruguay's national customs DNA and more than 100 times the annual budget of Uruguay's national export promotion organization URUGUAY XXI, but is still smaller than those estimated from aggregated data (e.g., Djankov et al., 2010).[38]

As discussed in Section 4, documental and physical inspections aim at detecting irregularities such as inconsistencies between different customs documents (e.g., bill and declaration) as well as between documents and actual composition of shipments. According to customs registers, a fraction of observed delays can be traced back to such irregularities. These delays, which are caused by deviations that controls precisely seek to uncover, can be endogenous to firms' actions. In fact, if we regress the (natural logarithm of the) delay of a firm-product-destination export transaction on a binary indicator taking the value of one if an irregularity was detected and zero otherwise, and month-year fixed effects, product-destination fixed effects, or product-destination-month-year fixed effects, we observe that the estimated coefficient on the irregularity indicator is positive and significant. This suggests precisely that delays can be partially attributed to firms' actions or omissions and could therefore be reduced by them.[39] We therefore drop from the estimating sample the specific irregular transactions, all transactions of involved firm-product-destinations, and all transactions of involved firms in the respective years and re-estimate Equations (2) and (3).[40] Results are shown in in the upper panel of Table 3. These results corroborate the baseline. The same holds when we exclude all irregular transactions at the firm-product-destination and firm levels from the year in which these are observed onwards.[41]

In addition, probabilities of physical inspection will tend to their population proportions as the number of shipments grows. In order to address this issue, we also estimate Equations (2) and (3) on a subsample of firm-product-destination exports consisting of relatively small number of shipments (5 to 10). Estimates are reported in in the lower panel of Table 3. These –potentially less general- estimates are entirely consistent with those shown above.

Even though there seems to be a clear case for a causal interpretation of our results, we next present further supporting evidence that rule out other competing explanations, which is particularly relevant for our OLS estimates. Thus, 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, tariffs or transport costs may have caused heterogeneous demand shifts across countries at narrower product-levels than those accounted for by our

[38] According to the estimates reported in Djankov et al. (2010), a 10% increase a in country's delay is associated with a 4% reduction in its total exports under the assumption that only own delays matter. Based on our estimates, export losses generated by such increased delay would amount to 2.8% (1.4% if OLS estimates are used).

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

[40] While shipments with irregularities tend to spend more time in customs, their removal does not seem to substantially modify the underlying distribution of delays.

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

HS 6-digit product-destination-year fixed effects. Furthermore, firms less affected by delays may have received support from URUGUAY XXI to participate in trade missions and international marketing events leading to foreign sales in specific sectors or destinations, in which case we would be overestimating the effect of interest (e.g., Volpe Martincus and Carballo, 2010). 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. We have therefore also estimated alternative specifications of Equation (2) in which product-destination-year fixed effects are defined at the HS 10 digit-level and firm-destination-year or firm-product-year fixed effects are included instead of merely firm fixed-year effects.[42] Estimates of these alternative specifications along with those of variants based on subsets of fixed effects are reported in the first row of the first panel of Table 4. These estimates essentially corroborate our initial findings.[43]

Unfortunately, previous estimation cannot control for potential remaining unobserved confounding factors, i.e., idiosyncratic firm-specific market developments that are correlated with customs delays. 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.[44]

If shipments are ordered in advance, trade can only respond sluggishly to changes in clearance times. In other words, increased customs delays can potentially have lagged effects on export growth. We therefore also control for these effects by incorporating the change in time-in-customs variable lagged up to three years in the estimating equation.[45] The results, which are shown in the third panel of Table 4, do not substantially differ from our baseline.[46]

[42] In our baseline estimations we do not distinguish across the 16 customs offices operating in Uruguay (Table 1). It might be the case that our results are driven by a specific subset of branches. Hence, we have also added main customs-year or individual customs-year fixed effects. Results based on these alternative specifications of the main estimating equation are similar to those shown here. Moreover, the same holds when we restrict the sample to those firm-product-destination-year quadruples that exit the country through just one customs office (roughly 90% of the cases). These results are available from the authors upon request.

[43] 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 confirm that customs delays have a significant negative impact on export growth although smaller in absolute value (Columns 1 and 2 in the upper panel of Table 4). Alternative specifications that just include firm fixed effects, product fixed effects, destination effects or their alternative pairwise combination at a time yield similar results. These estimation results are available from the authors upon request.

[44] We have also estimated this variant of Equation (2) on firm-product-destination-custom level data as well as on four-month frequency data. Both corroborate our main findings. A table with these alternative estimates is available from the authors upon request.

[45] Including these lagged delays 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.

[46] 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.

Finally, we carry out a placebo test as an additional robustness check. More specifically, customs delays in particular periods should not cause any gap in exports subject to material verification and their counterparts exempted thereof in previous periods. The plausibility of this identifying assumption can be assessed by artificially allocating the first delays to the immediately previous period and re-estimating Equation (2) on the sample of firm-product-destination-year exports actually not suffering from any delay, both on annual data and semester data. In short, we are regressing current export changes in future changes in delays. These placebo estimates are shown in Table 5 along with those for the respective real first delays, as obtained from the same firm-product-destination combinations.[47] Reassuringly, none of the former estimated coefficients are significantly different from zero, but the latter are.[48]

Hence, both OLS and IV estimates coincide in providing robust evidence suggesting that customs delays can have a significant negative effect on exports. Still, it might be argued that, under perfect information, delays that can be traced back to (conditional) random allocation to customs verification channels might or even should not have any significant impact on exports. However, as mentioned above, buyers are probably not perfectly informed about the causes of delivery delays. In particular, it is hard for them to establish whether these delays are due to firms' fault or factors beyond firms' control such as customs intervention. As long as repetitive interactions are associated with increased information for and on trading partners, this is more likely to be the case and to matter more for commercial relationships at their initial stages. Our database notably identifies the specific foreign companies Uruguayan exporters sell to and therewith allows us to informally assess this imperfect information hypothesis. More precisely, we can distinguish between new buyers (i.e., importing companies that bought for the first time from the exporting firm in the years in question or that began to buy from this firm at most three years ago) and older buyers (i.e., importing companies that were already buying from the exporting firm before).[49] As expected, these groups of buyers have substantially different levels of interaction with their providers. More specifically, exporter-importer pairs whose relationship is one (three) year(s) old interact on average only 2.3 (9) times, whereas those whose commercial links are older than one (three) year(s) accumulate 61.1 (98.7) interactions.[50] Results based on estimations that allow for different effects across these groups of buyers are reported in columns 1 to 4 of Table 6. These results indicate that the impact of customs delays varies depending on how mature is the buyer-seller

[47] The number of observations differs between the first two columns and the third column because in the latter we restrict the sample to non-delay observations, thus excluding the year in which the first delay was observed. Note also that the number of observations in the first two columns do not coincide with that corresponding to the first delay estimates presented in Table 1 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.

[48] Estimation results are the same when we consider higher frequency data such as monthly data. These results are available from the authors upon request.

[49] In order to ensure comparability, we only consider firm-product-destination-year exports that simultaneously have new and old buyers.

[50] Interactions are measured through the accumulated number of seller-buyer specific shipments.

relationship, being greater on exports to new buyers.[51] In the same vein, we can differentiate between main buyers (i.e., the importing company that accounts for the largest share of exports) and secondary buyers (i.e., remaining importing companies) in a given product-destination market.[52] In this case, we find that the effect of longer clearance times is significantly larger on exports to relatively less important customers (last two columns of Table 6). These results might be seen as suggesting that imperfect information is actually mediating observed effects.[53]

5.2 *Channels and Mechanisms*

In this subsection we explore the channels through which this effect arises and whether there are heterogeneous effects along various dimensions. For the sake of brevity, only OLS estimates will be presented here.[54]

In disentangling the channels, we estimate the impact of customs delays 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 customs delays 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 the average value and quantity of exports per buyer. Thus, a 10% increase in the number of days spent in customs reduces the number of shipments by 1.6% and the number of buyers and exports per buyer by 0.6% and 1.3%, respectively. This is consistent with findings reported Hornok and Koren (2014) according to which exporters react to increases in per-shipment costs by reducing shipping frequency. Nevertheless, delays have neither influenced the unit values nor the size of the shipments in terms of value or quantity.[55]

Second, we investigate the underlying mechanisms of observed effects.[56] This is done by estimating alternative specifications of Equation (4), in which we primarily allow for different impacts across groups of products and destinations.[57]

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[51] We have also examined whether previous firm-product-specific experience instead of the overall experience with given exporting firms makes a difference. As expected, effects tend to be smaller, although those on new buyers remain larger than their counterparts on older buyers. These results are available from the authors upon request.
[52] Here, we also restrict the sample to those firm-product-destination-year exports with two or more buyers.
[53] Responses to delay may vary depending on whether trade is intra-firm or not. In order to informally check whether this is affecting our results, we drop all firm-product-destination exports to related companies as identified using our information on buyers and data on multinationals from the WorldBase (e.g., Alfaro and Chen, 2012). Estimation results based on this sample are entirely consistent with those reported here and are available from the authors upon request.
[54] IV estimates are available from the authors upon request.
[55] Hornok and Koren (2014) find a positive impact on the size of the shipment. Note that whereas our estimates are at the firm-product-destination level, they are not able to distinguish among firms.
[56] It is well-known that exporters can be intermediaries (e.g., Bernard et al., 2010; Blum et al., 2010; Ahn et al., 2011; Crozet et al., 2013). Intermediaries can potentially react in a different way to longer time-in-customs. We accordingly remove from our estimating sample all HS2 chapters for which the share of intermediaries (wholesalers and retailers) is above the median across chapters

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, 2007b). It can therefore be expected that delays 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 (2001), who analyzes how ocean shipping times and air freight rates affect the probability that air transport is chosen.[58] 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 (4) are reported in Table 8. These estimates confirm that the negative effects of increased transit times are generally stronger on sales of time-sensitive goods. This is particularly the case with food and textile (clothing) products (right panel of Table 8).[59]

Heterogeneous effects can also arise across destinations. Thus, longer customs delays are likely to hurt exports more to markets that are subject to more intense competition or are harder to reach. In the left panel of Table 9, we examine whether the former holds in our data by distinguishing, first, between OECD and non-OECD countries, and, second, between destinations whose supply access as computed following Redding and Venables (2004) and Mayer et al. (2013) is high (at or above the median) and those for which it is low (below the median).[60] Evidence presented in this table would seem to suggest that the negative response of foreign sales to increased customs processing times is larger in markets with tougher competition.[61]

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alternatively using data from Bernard et al. (2010) and Ahn et al. (2011). Estimates obtained on these restricted samples do not differ from those shown here and are available from the authors upon request.

[57] Regrettably, we do not have additional data on the exporters to properly evaluate whether there are heterogeneous effects across groups of firms. Probably one of the cleanest indicative exercises we can conduct using information available in our dataset is to analyze whether the effects of customs delays differ for newer exporters (e.g., firms that started to export three years ago) and older exporters (e.g., firms that have been exporting for four or more years). Estimation results point to the absence of significant differences. These suggestive estimation results are available from the authors upon request.

[58] We use the estimated effect of shipping times on the probability of selecting air transport. 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 SITC is positive and significant.

[59] Alternatively, we use the frequency at which goods were shipped abroad over the period 2000-2002 to distinguish between time-sensitive goods (i.e., goods whose frequency of shipment was at or above the median) and time-insensitive goods (i.e., goods whose frequency of shipment was below the median) and re-estimate Equation (4), this time permitting different effects for these so-defined groups of goods (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.

[60] Supply access is defined as the aggregate predicted exports to a destination based on a bilateral trade gravity equation (in natural logarithms) with both exporter and importer fixed effects and the standard bilateral measures of trade barriers/enhancers. We compute these measures for each sample year using country-level trade data from COMTRADE and data on trade barriers/enhancers from CEPII and the WTO and take the average over these years.

[61] Building on these previous results, we have also explored whether the impacts of longer time-in-customs vary across products categories in the different destinations by combining the time-sensitive/time-insensitive and OECD/non-OECD breakdowns used before. From the estimates of this variant of Equation (4), we can conclude that the negative effects of increased transit times are generally stronger on sales of time-sensitive goods to OECD countries. In contrast, there is virtually no impact on exports of time-insensitive goods to non-OECD countries. These results are available from the authors upon request.

Now, given Uruguay's location in the world, these results may well be capturing effects of distance to relevant markets. We assess whether this is the case by specifying and estimating a variant of Equation (4) which allows for heterogeneous impacts of delays depending on the distance. In particular, this specification adds an interaction between the delay variable and a binary indicator that takes the value of one if the distance to the importing country is at or above the median and zero otherwise. Estimates of this equation indicate that indeed effects are larger the farther away are the destinations (third panel of Table 9).[62] When we additionally permit impacts to differ along both the competition and distance dimensions, we do not observe asymmetries across the former. More precisely, delays do not have a greater impact on exports to distant OECD countries than to distant non-OECD countries. Hence, distance appears to be the primary factor behind the heterogeneous effects across destinations observed above.[63]

Not only distance, but also financial conditions in the destination countries can interact with the customs delays in shaping export behavior. Berman et al. (2012) show that, during financial crises, the transit time between origin and destination amplifies the negative impact of a higher probability of default on trade. Putting it differently, time to ship increases the elasticity of exports to the expected cost of default. The rationale is that exporters react by increasing their price and decreasing their export quantities and values more for importers at larger shipping times because, during banking crisis, the probability that these importers default on their payment obligations rises as time passes and hence with shipping time. Moreover, the opportunity costs of funds increases with transit lags and the interest rate, which can jump upward suddenly during those episodes. Schmidt-Eisenlohr (2013) also shows that time to trade magnifies the effect of financing on trade. In particular, countries tend to trade less with each other the higher are the financing costs, and the less so the more time is needed to trade (as proxied by distance). Similarly, Levchenko et al. (2011) argue that, if trade finance needs are positively related to the time it takes for shipments to reach their destination, trade finance costs can be expected to increase with delivery delays and accordingly, in those cases, trade in sectors with longer lags to fall the most. Here, we examine the role played by financial factors by differentiating between destinations that suffer from a banking crisis in the year in question and those destinations that do not. In making this distinction, we follow Berman et al. (2012) in using the Reinhart and Rogoff (2011)'s dataset on financial crises over the period 1800-2010.[64] The binary indicator taken from this database is then interacted with our measure of change in time-in-customs.[65] Estimation results of this version of Equation (4) are presented in the fourth

[62] Results are comparable when we split the distribution of distances to destinations in three segments and accordingly introduce the same number of interacting binary indicators. These results are available from the authors upon request.
[63] These estimates are available from the authors upon request.
[64] Results are identical when we utilize instead an indicator based on the Laeven and Valencia (2012)'s database on systemic banking crises over the period 1970-2011.
[65] Notice that the direct impact of financial crisis is accounted for by the product-destination-year fixed effects.

panel of Table 9. Consistent with previous findings, these results reveal that longer customs clearance times have a stronger impact on exports to countries experiencing banking crises.

Time also makes a difference when demand is uncertain, i.e., consumers prefer certain good varieties over others and their preferences change quickly overt time (e.g., Deardorff, 2001). If the time elapsed between ordering and delivery is long enough, the volume and composition of shipments must be decided well before the resolution of demand uncertainty, in which case forecasting errors will result in lost profitability because of inventory-holding costs or forgone business opportunities derived from over- or undersupplying the market or mismatch between varieties offered and demanded (Hummels and Schaur, 2012). A series of papers precisely analyze how the interplay between timeliness and demand uncertainty affects trade, location, and modal choice (e.g., Aizenman, 2004; Evans and Harrigan, 2005; Harrigan and Venables, 2006; Hummels and Schaur, 2010; and Harrigan, 2010). The main messages that come out of these papers is that, when timely delivery is important, firms tend to rely more on closer providers the higher is their products' restocking rate; resort more to air shipping the more volatile is the demand for their products and the lighter these products are; and co-agglomerate in the presence of vertical linkages. It has also been shown that exporters react to increased volatility by reducing their number of shipments (i.e., their frequency) and that this response is amplified by the time needed to serve the destination market from the origin country (Békés et al., 2013).

This literature highlights that exports from firms facing volatile demand are likely to be particularly affected by long transit lags because these delays create an important barrier to ex-post adjustments to shocks (Hummels and Schaur, 2010). In our case, this implies that the negative effect of customs clearance times on exports would be magnified when demand is volatile. We investigate whether this is observed in our data. In so doing, we first calculate a volatility measure following Hummels and Schaur (2010). In particular, for each product-destination pair, we compute the median of the coefficient of variation of the quantities sold by each firm in the different transactions within a given year, averaged over the period 2000-2002.[66] Second, we estimate a variant of Equation (4) whereby the change in the median number of days spent in customs is interacted by a binary indicator that takes the value of one if the volatility of the demand in a particular product-destination combination computed as indicated above is at or above the median and zero otherwise. Estimates of this equation are shown in the left panel of Table 10, both when considering all product-destination combinations existing in 2000-2002 or only those for which firms register more than 10 transactions in the year in question. These estimates confirm that the negative impact of increased administrative-driven delays on exports is larger for product-destinations with more volatile demand.

[66] As with the exercise on time-sensitiveness, we rely on data for 2000-2002, which are not contaminated by customs delays.

As mentioned above, firms tend to rely more on air-shipping the more volatile is the demand (Hummels and Schaur, 2010). If we breakdown exports by transport mode, we consistently find that the impact of increased time-in-customs is larger on those flows that are air-shipped (right panel of Table 10).[67] Note, further, that if we take transport mode as a proxy for the length of time-to-ship overseas with air-shipping taking less time than ocean-shipping, these results also indicate that, for given destinations, the effect of longer delays is greater the shorter is the international shipping time, i.e., the higher is the importance of the time spent in customs relative to the total transit time.[68]

So far the analysis has focused on the effect of longer times spent in customs on the export intensive margin (i.e., continuing flows).[69] In addition, these delays may have caused some exports to disappear. Hence, we also examine the effects of changes in customs clearance times on the firm-product-destination and firm extensive margins. Thus, we estimate of variant of Equation (2) where the dependent variable is a binary indicator that takes the value of one if a firm-product-destination export flow is present in the year in question and zero otherwise and the main explanatory variable is the change in the median customs processing times between the two previous years. In addition, we estimate another variant of this equation at the product-destination level in which the dependent variable is the change in the number of firms exporting a given product to a given destination and the main explanatory variable is the change in the respective median clearance times, and which includes alternative sets of fixed effects (i.e., destination-year fixed effects and product-year fixed effects) to account for unobserved factors. According to the estimates of these equations, increased time in transit due to customs procedures has had a significant negative effect on both the firm-product-destination and the firm export extensive margins. Interestingly, when we allow for different impacts across groups of buyers, we observe that longer time-in-customs primarily affect trade relationships with new buyers. This is consistent with the

[67] We have also carried out the same estimation on a sample that only includes firm-product-destination exports with more than one transport mode. Results are similar to those presented here and are available from the authors upon request. Caution, however, should be exercised when interpreting these results based on data considering the transport mode dimension. The reason is that, while the firm-year and the product-destination fixed effects account for firm-level characteristics, volatility of demand, and other relevant factors over time that can influence the modal choice, this is an endogenous decision.

[68] We observe different effects across customs offices but these seem to be entirely driven by differences in the transport modes used in shipping the goods cleared in each of them. Estimates are available from the authors upon request.

[69] From an economic policy point of view, it is also important to know whether exports in product-destination combinations that are more likely to be targeted for inspection tend to be differently affected by delays. Evidence indicates that targeting by the Uruguayan customs does not seem to be biased towards (nor against) product-destinations whose exports suffer more from longer time-in-customs. In order to investigate this, we split the product-destination pairs year-by-year in a group with high probability of being allocated to the red channel (i.e., above the median) and a group with low probability of being allocated to the red channel (i.e., up to the median) based on their respective estimated probabilities, and estimate a variant of Equation (4) in which we allow delays to have different effects on the exports of these groups. Needless to say, care should be taken when reading the respective estimates because such estimated probabilities are based on a regression of binary indicators that take the value of one if a firm-product-destination is allocated to the red channel and zero otherwise on firm-year and product-destination-year fixed effects, thereby being potentially noisy (e.g., Wooldridge, 2002). Keeping this in mind and taking into account that we are primarily using the distribution of the estimates instead of the individual ones, estimations results do not point to any significant differences in these effects. These results are available from the authors upon request.

evidence found on the export intensive margin, thus also suggesting that imperfect information is likely to play an important role in accounting for the economic decisions driving our results.[70]

Summing up, our estimation results indicate that delays caused by customs procedures seem to have particularly affected firms' exports of goods that are time-sensitive and have more volatile demand and to countries that are farther apart or that suffer from banking crises, and appear to have even induced some firms to stop exporting certain products to certain destinations.

6 Concluding Remarks

Time matters for trade, probably more now than ever, and its importance is likely to continue to grow because of increasingly segmented production chains and rising lean retailing, among other reasons. In this context, which is also characterized by relatively low traditional trade barriers such as tariffs, the effectiveness of public entities in affecting the transit times between origins and destinations becomes critical. This is particularly the case with customs, which process all trade flows entering and leaving the countries. While a number of studies have analyzed the impact of time to trade on trade, our understanding of the effects of delays specifically associated with customs procedures has been so far limited because of methodological problems, absence of precise measures of these delays, and virtual lack of evidence on firm-level responses based on comprehensive samples.

This paper fills these gaps in the previous literature. We investigate how increased transit times caused by customs processing of shipments affect firms' exports outcomes. In so doing, we exploit a unique database that contains export transaction and actual customs clearance time data and covers the entire universe of these transactions in Uruguay over the period 2002-2011, and properly account for potential endogeneity biases. We find that customs-driven delays have a significant negative effect on firms' foreign sales. This impact is more pronounced for sales to newer buyers, of time-sensitive goods, and to countries that are harder to reach or are under banking crisis. These effects can be traced back to reduced number of shipments, number of buyers, and exports per buyer, in terms of both value and quantity. Estimates further suggest that some firms may have been forced to cease to exports to certain markets.

In light of the recent agreement in Bali, our results convey a clear message to customs of developing countries. Implementation of risk-based verification procedures –as opposed to material inspection of every single shipment- should be a key component of trade facilitation strategies. Furthermore, this

[70] In this case, the dependent variable is a binary indicator that takes the value of one if an export flow at the firm-product-destination-type of buyer (new vs. old) level is present in the year in question and zero otherwise and the main explanatory variable is the change in the respective median customs processing times between the two previous years. Results are essentially the same regardless of whether presence if defined as all buyers of a type being present or at least one of them. All these results are available from the authors upon request.

monitoring can and should be done in an expedited manner, so that no substantial increase in transit time occurs relative to those shipments exempted from physical control. This requires endowing customs agencies with proper personnel and technological means. Caution, however, is needed in moving in this direction. Expediting should by no means come at the expense of the quality of the verifications. In other words, the time that controls take should be minimized whenever possible, but always subject to the condition that their goals are actually achieved. Also crucial, as already done by some export promotion organizations, training on the export process' formalities can be provided to firms without previous trade experience to minimize delays caused by unintended mistakes in filling out customs documents (Volpe Martincus, 2010). We should mention in closing that our findings can serve as a basis for further theoretical developments on time as a trade barrier, which will be the subject of future research.

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Table 1

Aggregate Export Indicators		
Indicators	**2002**	**2011**
Export Value	1,855.0	8,011.5
Number of Shipments	64,747	113,533
Number of Exporters	1,498	1,904
Number of Products	2,464	2,969
Number of Destinations	146	186
Number of Buyers	7,896	10,249
Number of Customs	15	16
Transactions through Red Channel	0.0	0.1
Median Delay in Red Channel	N/A	5.0

Average Exporter		
Indicators	**2002**	**2011**
Export Value	1238.3	4207.7
Number of Shipments	43.2	59.6
Exports per Shipment	23.7	67.8
Number of Products	4.3	4.4
Exports per Product	238.5	981.7
Number of Destinations	2.9	3.3
Exports per Destination	207.6	837.3
Number of Buyers	6.4	7.0
Exports per Buyer	121.3	598.1
Number of Customs	1.8	1.8
Exports per Customs	385.1	1398.3
Exports per Product and Destination	127.7	564.7
Number of Shipments per Product and Destination	3.5	4.9
Number of Buyers per Product and Destination	1.3	1.4
Number of Customs per Product and Destination	1.1	1.1

Source: Authors' calculations based on data from DNA.
Export values are expressed in millions of US dollars in the upper panel and in thousands of US dollars in the lower panel.

Table 2

The Impact of Customs Delays on Firms' Exports								
Baseline Specification								
	ΔlnD				**ΔD**			
	OLS	**IV**			**OLS**	**IV**		
		1st Stage	**F-Statistics**	**2nd Stage**		**1st Stage**	**F-Statistics**	**2nd Stage**
Customs Delay	-0.184	0.816		-0.380	-0.028	2.726		-0.114
Heteroscedasticity-Consistent	(0.028)***	(0.024)***	1172.3	(0.047)***	(0.006)***	(0.129)***	447.1	(0.014)***
Cluster Firm-Product-Destination	(0.030)***	(0.030)***	732.1	(0.051)***	(0.006)***	(0.152)***	323.4	(0.015)***
Cluster Firm	(0.037)***	(0.120)***	46.2	(0.070)***	(0.008)***	(0.446)***	37.3	(0.021)***
Cluster Product	(0.041)***	(0.081)***	100.4	(0.063)***	(0.008)***	(0.279)***	95.5	(0.019)***
Cluster Destination	(0.059)***	(0.173)***	22.2	(0.069)***	(0.013)**	(0.580)***	22.1	(0.021)***
Cluster Product-Destination	(0.033)***	(0.043)***	360.4	(0.055)***	(0.007)***	(0.189)***	208.0	(0.016)***
Cluster Chapter HS2-Destination	(0.044)***	(0.112)***	52.9	(0.065)***	(0.010)***	(0.413)***	43.7	(0.019)***
Cluster Firm-Product	(0.031)***	(0.041)***	396.6	(0.053)***	(0.006)***	(0.182)***	223.4	(0.016)***
Cluster Firm-Chapter HS2	(0.037)***	(0.112)***	53.4	(0.071)***	(0.008)***	(0.420)***	42.2	(0.021)***
Cluster Firm-Destination	(0.034)***	(0.054)***	224.2	(0.056)***	(0.007)***	(0.228)***	143.4	(0.017)***
Firm-Year Fixed Effect	Yes	Yes		Yes	Yes	Yes		Yes
Product-Destination-Year Fixed Effect	Yes	Yes		Yes	Yes	Yes		Yes
Observations	63,471	63,471		63,471	63,471	63,471		63,471
First Delay								
	ΔlnD				**ΔD**			
	OLS	**IV**			**OLS**	**IV**		
		1st Stage	**F-Statistics**	**2nd Stage**		**1st Stage**	**F-Statistics**	**2nd Stage**
Customs Delay	-0.188	0.683		-0.455	-0.028	2.357		-0.132
Heteroscedasticity-Consistent	(0.035)***	(0.026)***	673.9	(0.063)***	(0.007)***	(0.143)***	270.8	(0.018)***
Cluster Firm-Product-Destination	(0.035)***	(0.030)***	533.4	(0.066)***	(0.007)***	(0.152)***	241.6	(0.019)***
Cluster Firm	(0.039)***	(0.119)***	32.9	(0.089)***	(0.009)***	(0.450)***	27.4	(0.026)***
Cluster Product	(0.045)***	(0.080)***	72.4	(0.078)***	(0.009)***	(0.281)***	70.5	(0.023)***
Cluster Destination	(0.051)***	(0.174)***	15.3	(0.079)***	(0.012)**	(0.628)***	14.1	(0.023)***
Cluster Product-Destination	(0.038)***	(0.042)***	268.2	(0.069)***	(0.008)***	(0.188)***	157.4	(0.020)***
Cluster Chapter HS2-Destination	(0.046)***	(0.114)***	36.2	(0.080)***	(0.010)***	(0.426)***	30.7	(0.023)***
Cluster Firm-Product	(0.036)***	(0.040)***	286.7	(0.070)***	(0.007)***	(0.181)***	169.0	(0.020)***
Cluster Firm-Chapter HS2	(0.038)***	(0.111)***	37.6	(0.090)***	(0.008)***	(0.424)***	31.0	(0.026)***
Cluster Firm-Destination	(0.039)***	(0.053)***	165.8	(0.071)***	(0.008)***	(0.228)***	107.1	(0.021)***
Firm-Year Fixed Effect	Yes	Yes		Yes	Yes	Yes		Yes
Product-Destination-Year Fixed Effect	Yes	Yes		Yes	Yes	Yes		Yes
Observations	59,061	59,061		59,061	59,061	59,061		59,061

Source: Authors' calculations based on data from DNA.

The table reports OLS and IV estimates of Equation (2) along with estimates of Equation (3) for both the entire sample and when restricting the sample to exports that never faced a delay in the past. 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 variables are the change in natural logarithm of the median number of days spent in customs ($\Delta \ln D$) or the absolute change in the median number of days spent in customs (ΔD). Equation (3): The dependent variable is the change in the natural logarithm of the median number of days spent in customs ($\Delta \ln D$) or the absolute change in the median number of days spent in customs (ΔD). The main explanatory variable is the change in the median allocation to the red channel ($\Delta \mathrm{RC}$). Firm-year fixed effects and product-destination-year fixed effects are 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 3

The Impact of Customs Delays on Firms' Exports						
Sample Excluding Shipments with Irregularities						
	Shipments		**Firm-Product-Country-Year**		**Firm-Year**	
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**
ΔlnD	-0.191***	-0.393***	-0.186***	-0.398***	-0.197***	-0.381***
	(0.030)	(0.052)	(0.033)	(0.055)	(0.049)	(0.085)
ΔRC (1st Stage)		0.812***		0.806***		0.692***
		(0.030)		(0.031)		(0.037)
F-Statistics		721.5		670.6		344.2
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	63,098	63,098	58,765	58,765	39,947	39,947
Sample Excluding Firm-Product-Country Exports Consisting of a Large Number of Shipments						
	Up to 10 Shipments		**Up to 7 Shipments**		**Up to 5 Shipments**	
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**
ΔlnD	-0.155***	-0.348***	-0.123***	-0.304***	-0.098*	-0.221**
	(0.039)	(0.068)	(0.043)	(0.077)	(0.052)	(0.089)
ΔRC (1st Stage)		0.857***		0.878***		0.922***
		(0.039)		(0.045)		(0.055)
F-Statistics		471.4		380.5		284.6
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	44,155	44,155	38,138	38,138	31,803	31,803

Source: Authors' calculations based on data from DNA.

The table reports OLS and IV estimates of Equation (2) along with estimates of Equation (3). In the upper panel the specific irregular shipments (Shipments), all shipments of involved firm-product-destinations (Firm-Country-Product-Year), and all shipments of involved firms (Firm-Year) in the respective years are alternatively dropped from the estimating sample. In the lower panel firm-product-destination exports consisting of more than 10 shipments (up to 10 Shipments), more than 7 shipments (up to 7 Shipments), and more than 5 shipments (up to 5 Shipments) are alternatively removed from the estimating sample. 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 the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). Equation (3): The dependent variable is the change in the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). The main explanatory variable is the change in the median allocation to the red channel ($\Delta \mathrm{RC}$). Firm-year fixed effects and product-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 4

The Impact of Customs Delays on Firms' Exports								
Alternative Specifications								
Year to Year Changes								
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
ΔlnD	-0.108***	-0.248***	-0.197***	-0.395***	-0.191***	-0.374***	-0.193***	-0.468***
	(0.015)	(0.028)	(0.042)	(0.063)	(0.035)	(0.060)	(0.044)	(0.074)
ΔRC (1st Stage)		0.677***		0.937***		0.854***		0.800***
		(0.013)		(0.043)		(0.038)		(0.041)
F-Statistics		2749.5		481.7		508.1		378.0
Firm-Year Fixed Effect	No	No	Yes	Yes	No	No	No	No
Product-Destination-Year Fixed Effects	No	No	No	No	Yes	Yes	Yes	Yes
Product HS10-Destination-Year Fixed Effect	No	No	Yes	Yes	No	No	No	No
Firm-Product-Year Fixed Effect	No	No	No	No	Yes	Yes	No	No
Firm-Destination-Year Fixed Effect	No	No	No	No	No	No	Yes	Yes
Observations	63,471	63,471	63,471	63,471	63,471	63,471	63,471	63,471
	Semester-to-Semester Changes				Firm-Product-Destination-Buyer Level Data			
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
ΔlnD	-0.053***	-0.216***	-0.057***	-0.245***	-0.152***	-0.286***	-0.163**	-0.244**
	(0.017)	(0.056)	(0.014)	(0.043)	(0.043)	(0.068)	(0.079)	(0.120)
ΔRC (1st Stage)		0.768***		0.787***		0.976***		1.044***
		(0.035)		(0.028)		(0.057)		(0.107)
F-Statistics		802.7		486.6		289.6		95.6
Firm-Product-Destination-Year Fixed Effect	Yes	Yes	No	No	Yes	Yes	No	No
Firm-Product HS10 Destination-Year Fixed Effect	No	No	Yes	Yes	No	No	Yes	Yes
Semester/Buyer-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	87,482	87,482	87,482	87,482	79,365	79,365	79,365	79,365
Lagged Effects								
			OLS	IV	OLS	IV	OLS	IV
ΔlnD			-0.252***	-0.465***	-0.246***	-0.469***	-0.313***	-0.562***
			(0.046)	(0.075)	(0.059)	(0.099)	(0.072)	(0.120)
ΔlnD (-1)			-0.006	-0.030	0.032	-0.050	-0.021	-0.237**
			(0.040)	(0.064)	(0.056)	(0.093)	(0.074)	(0.120)
ΔlnD (-2)					-0.012	-0.072	-0.050	-0.190
					(0.047)	(0.081)	(0.066)	(0.120)
ΔlnD (-3)							-0.053	-0.078
							(0.056)	(0.107)
Firm-Year Fixed Effect			Yes	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect			Yes	Yes	Yes	Yes	Yes	Yes
Observations			39,301	39,301	26,183	26,183	17,801	17,801

Source: Authors' calculations based on data from DNA.

The first panel of the table report OLS and IV estimates of Equation (2) along with the respective estimates of Equation (3). Equation (2): The dependent variable is the change in the natural logarithm of export value at the firm-product-destination level. The main explanatory variable is the change in the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). Equation (3): The dependent variable is the change in the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). The main explanatory variable is change in the median allocation to the red channel (ΔRC). In the first panel, changes are computed across years. No fixed effects are included in the first and second columns; firm-year fixed effects and HS 10-digit product-destination-year fixed effects are included in the third and fourth columns; firm-product-year fixed effects and product-destination-year fixed effects are included in the fifth and sixth columns; and firm-country-year fixed effects and product-destination-year fixed effects are included in the seventh and eight columns (not reported). The second panel shows OLS and IV estimates of Equation (2) along with the respective estimates of Equation (3) based on data at the firm-product-destination-year-semester level (left) and at the firm-product-destination-buyer-year level (right). Firm-product-destination-year fixed effects and semester fixed effects are included in the first and second columns; firm-HS10 product-destination-year fixed effects and semester fixed effects are included in the third and fourth column; firm-product-destination-year fixed effects and buyer-year fixed effects are included in the fifth and sixth columns; and firm-HS10 product-destination-year fixed effects and buyer-year fixed effects are included in the seventh and eight columns (not reported).The third panel of the table reports OLS and IV estimates of a modified version of Equation (2) that incorporates up to three lags of the main explanatory variable along with the respective estimates of Equation (3). A table with the F-statistics is available from the authors upon request. Firm-year and production-destination-year fixed effects are included (not reported). 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 Customs Delays on Firms' Exports First Delays and Placebos			
Year-to-Year Changes			
	OLS	**IV**	**Placebo**
ΔlnD	-0.268***	-0.630***	0.028
	(0.064)	(0.116)	(0.083)
ΔRC (1st Stage)		0.691***	
		(0.050)	
F-Statistics		187.9	
Firm-Year Fixed Effect	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes
Observations	44,569	44,569	32,290
Semester-to-Semester Changes			
	OLS	**IV**	**Placebo**
ΔlnD	-0.169***	-0.633***	0.052
	(0.062)	(0.153)	(0.059)
ΔRC (1st Stage)		0.290***	
		(0.017)	
F-Statistics		307.4	
Firm-Product-Destination Year Fixed Effect	Yes	Yes	Yes
Semester Fixed Effect	Yes	Yes	Yes
Observations	65,769	65,769	50,298

Source: Authors' calculations based on data from DNA.

The table reports OLS and IV estimates of Equation (2) along with estimates of Equation (3) when restricting the sample to exports that never faced a delay in the past. In the placebo exercises first delays are allocated to the immediately previous period and these equations are on the sample of firm-product-destination exports actually not suffering from any delay. In each panel the same set of firm-product-destinations is considered. In the first panel, estimates are based on data at the firm-product-destination-year level, whereas in the second panel, estimates are based on data at the firm-product-destination-year-semester level. Equation (2): The dependent variable is the change in the natural logarithm of export value. The main explanatory variables is the change in natural logarithm of the median number of days spent in customs ($\Delta \ln D$) . Equation (3): The dependent variable is the change in the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). The main explanatory variable is the change in the median allocation to the red channel (ΔRC). Firm-year fixed effects and product-destination-year fixed effects are included in the first panel and firm-product-destination-year fixed effects and semester fixed effects are included in the second panel (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 6

The Impact of Customs Delays on Firms' Exports New vs. Old Trade Relationships and Main vs. Secondary Trade Relationships						
Export Outcomes	**New: 1 Year**		**New: Up to 3 Years**		**Main vs. Other Buyers**	
	New Buyers	**Old Buyers**	**New Buyers**	**Old Buyers**	**Main Buyers**	**Secondary Buyers**
Export Value	-0.206***	-0.165**	-0.201***	-0.107	-0.073***	-0.114***
	(0.057)	(0.074)	(0.062)	(0.068)	(0.021)	(0.03)
Firm-Year Fixed Effect	Yes		Yes		Yes	
Product-Destination-Year Fixed Effect	Yes		Yes		Yes	
Observations	17,242		13,786		37,309	

Source: Authors' calculations based on data from DNA.

The table reports OLS estimates of a specification of Equation (4) that allows for (1) different effects on exports to buyers who bought for the first time from the exporting firm in the years in question and to buyers who were already buying from the exporting firm before; (2) different effects on exports to buyers who began to buy from the exporting firm at most three years ago and to buyers who were already buying from the exporting firm before; and (3) different effects on exports to main buyers (i.e., the importing company that accounts for the largest share of exports of the product in the destination) and to secondary buyers (i.e., remaining importing companies). The dependent variable is the change in the natural logarithm of export value. The main explanatory variable is the change in the natural logarithm of the median number of days spent in customs (ΔlnD). All relevant interacting terms and their combination are included. Firm-year fixed effects and product-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 Customs Delays on Firms' Exports Channels

Export Outcomes	**ΔlnD**
Export Value	-0.184***
	(0.030)
Export Quantity	-0.178***
	(0.030)
Unit Value	-0.006
	(0.007)
Number of Shipments	-0.160***
	(0.022)
Export Value per Shipment	-0.024
	(0.020)
Export Quantity per Shipment	-0.019
	(0.020)
Number of Buyers	-0.059***
	(0.014)
Number of Shipments per Buyer	-0.100***
	(0.018)
Export Value per Buyer	-0.125***
	(0.026)
Export Quantity per Buyer	-0.119***
	(0.027)
Firm-Year Fixed Effect	Yes
Product-Destination-Year Fixed Effect	Yes
Observations	63,471

Source: Authors' calculations based on data from DNA.
The table reports 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 the natural logarithm of the median number of days spent in customs (ΔlnD). Firm-year fixed effects and product-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 8

The Impact of Customs Delays on Firms' Exports Heterogeneous Effects by Product Categories									
	Product Categories		**Sectorial Effects**						
Export Outcomes	**Time Sensitive**	**Time Insensitive**	**Food**	**Textiles**	**Others**	*Other Industrial Supplies*	*Capital Goods*	*Transport Equipment*	*Other Consumer Goods*
Export Value	-0.233***	-0.148***	-0.191***	-0.239***	-0.114*	-0.086	-1.291	0.153	-0.082
	(0.046)	(0.040)	(0.032)	(0.085)	(0.069)	(0.094)	(0.886)	(1.203)	(0.124)
Export Quantity	-0.226***	-0.141***	-0.181***	-0.220**	-0.125*	-0.093	-1.258	0.072	-0.084
	(0.045)	(0.040)	(0.032)	(0.087)	(0.074)	(0.102)	(0.845)	(0.900)	(0.136)
Unit Value	-0.007	-0.007	-0.010	-0.019	0.011	0.007	-0.033	0.081	0.002
	(0.011)	(0.009)	(0.007)	(0.017)	(0.025)	(0.035)	(0.242)	(0.512)	(0.049)
Number of Shipments	-0.176***	-0.146***	-0.161***	-0.180***	-0.139***	-0.095	-0.639	-0.551***	-0.238***
	(0.035)	(0.027)	(0.024)	(0.054)	(0.051)	(0.073)	(0.419)	(0.203)	(0.076)
Export Value per Shipment	-0.056*	-0.002	-0.030	-0.059	0.025	0.008	-0.652	0.704	0.156*
	(0.032)	(0.026)	(0.022)	(0.053)	(0.048)	(0.057)	(0.602)	(1.085)	(0.083)
Export Quantity per Shipment	-0.050	0.005	-0.021	-0.040	0.014	0.002	-0.619	0.623	0.154
	(0.032)	(0.026)	(0.022)	(0.054)	(0.053)	(0.066)	(0.543)	(0.820)	(0.094)
Number of Buyers	-0.065***	-0.054***	-0.058***	-0.089**	-0.040	-0.034	0.098	-0.392*	-0.051*
	(0.022)	(0.018)	(0.015)	(0.040)	(0.029)	(0.045)	(0.254)	(0.201)	(0.028)
Number of Shipments per Buyer	-0.111***	-0.092***	-0.102***	-0.091**	-0.099*	-0.061	-0.738*	-0.159	-0.187***
	(0.028)	(0.023)	(0.019)	(0.045)	(0.051)	(0.070)	(0.406)	(0.184)	(0.072)
Export Value per Buyer	-0.167***	-0.094***	-0.133***	-0.150**	-0.074	-0.052	-1.390*	0.545	-0.031
	(0.041)	(0.034)	(0.027)	(0.072)	(0.068)	(0.091)	(0.809)	(1.233)	(0.119)
Export Quantity per Buyer	-0.161***	-0.087**	-0.123***	-0.131*	-0.085	-0.059	-1.356*	0.464	-0.032
	(0.041)	(0.035)	(0.027)	(0.074)	(0.073)	(0.098)	(0.750)	(0.965)	(0.131)
Firm-Year Fixed Effect	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	63,096		22,669	14,328	26,473	13,669	3,505	737	8,266

Source: Authors' calculations based on data from DNA.

The left panel of table reports OLS estimates of a specification of Equation (4) that allows for different effects on exports of time-sensitive goods and time-insensitive goods. Goods are classified using estimation results reported in Hummels (2001). We use the estimated effect of shipping times on the probability of selecting air transport. 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 SITC is positive and significant. The right panel of the table presents OLS estimates of Equation (2) for different product categories (subsamples): food products, textile products, and other products, which are then disaggregated in 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 the natural logarithm of the median number of days spent in customs (ΔlnD). All relevant interacting terms and their combination are included. Firm-year fixed effects and product-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 9

The Impact of Customs Delays on Firms' Exports Heterogeneous Effects by Destinations								
	Toughness of Competition				Distance		Banking Crises	
Export Outcomes	**OECD**	**N-OECD**	**High Supply Access**	**Low Supply Access**	**Distant**	**Close**	**Banking Crisis (RR)**	**N-Banking Crisis (RR)**
Export Value	-0.276***	-0.117***	-0.245***	-0.010	-0.288***	-0.098**	-0.332***	-0.169***
	(0.049)	(0.037)	(0.036)	(0.059)	(0.046)	(0.040)	(0.082)	(0.038)
Export Quantity	-0.263***	-0.117***	-0.237***	-0.013	-0.274***	-0.100**	-0.327***	-0.164***
	(0.049)	(0.037)	(0.036)	(0.060)	(0.046)	(0.040)	(0.084)	(0.038)
Unit Value	-0.013	-0.000	-0.009	0.003	-0.014	0.001	-0.004	-0.005
	(0.012)	(0.009)	(0.009)	(0.015)	(0.012)	(0.009)	(0.020)	(0.009)
Number of Shipments	-0.201***	-0.130***	-0.197***	-0.060	-0.203***	-0.121***	-0.194***	-0.168***
	(0.034)	(0.028)	(0.025)	(0.044)	(0.033)	(0.029)	(0.056)	(0.027)
Export Value per Shipment	-0.075**	0.012	-0.049*	0.050	-0.085***	0.022	-0.138**	-0.002
	(0.034)	(0.024)	(0.025)	(0.035)	(0.033)	(0.026)	(0.058)	(0.025)
Export Quantity per Shipment	-0.062*	0.013	-0.040	0.047	-0.071**	0.021	-0.134**	0.004
	(0.034)	(0.025)	(0.025)	(0.038)	(0.033)	(0.026)	(0.059)	(0.025)
Number of Buyers	-0.067***	-0.054***	-0.079***	-0.006	-0.078***	-0.045**	-0.049	-0.072***
	(0.022)	(0.018)	(0.016)	(0.029)	(0.023)	(0.018)	(0.037)	(0.018)
Number of Shipments per Buyer	-0.135***	-0.076***	-0.118***	-0.054	-0.125***	-0.075***	-0.145***	-0.096***
	(0.028)	(0.022)	(0.021)	(0.036)	(0.027)	(0.023)	(0.045)	(0.022)
Export Value per Buyer	-0.210***	-0.063**	-0.167***	-0.004	-0.210***	-0.053	-0.283***	-0.098***
	(0.044)	(0.031)	(0.032)	(0.048)	(0.042)	(0.034)	(0.075)	(0.032)
Export Quantity per Buyer	-0.196***	-0.063**	-0.158***	-0.008	-0.196***	-0.054	-0.279***	-0.093***
	(0.044)	(0.032)	(0.032)	(0.051)	(0.042)	(0.034)	(0.078)	(0.032)
Firm-Year Fixed Effect	Yes		Yes		Yes		Yes	
Product-Destination-Year Fixed Effect	Yes		Yes		Yes		Yes	
Observations	63,471		62,041		62,901		51,635	

Source: Authors' calculations based on data from DNA.

The first two panels of table report OLS estimates of a specification of Equation (4) that allows for different effects on exports to OECD countries (excluding Chile and Mexico, which are regional partners for Uruguay) and non-OECD countries and for countries with high (at or above the median) and low (below the median) supply access. Supply access is defined as the aggregate predicted exports to a destination based on a bilateral trade gravity equation (in logs) with both exporter and importer fixed effects and the standard bilateral measures of trade barriers/enhancers (see Redding and Venables, 2004; and Mayer et al., 2013). These measures correspond to the average 2002-2011 and have been computed using country-level trade data from COMTRADE and data on trade barriers/enhancers from CEPII and the WTO. The third panel of the table reports OLS estimates of a specification of Equation (4) that allow for different effects on exports to countries that are far away (with distance at or above the median across destinations) and countries that are nearby (with distances below the median across destinations). The fourth panel of table reports OLS estimates of a specification of Equation (4) that allows for different effects on exports to countries that are experiencing a banking crisis ("Banking Crisis") and countries that are not experiencing a banking crisis ("N-Banking Crisis"). Banking crisis episodes are identified using the dataset constructed by Reinhart and Rogoff (2011). 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 the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). All relevant interacting terms and their combination are included. Firm-year fixed effects and product-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.

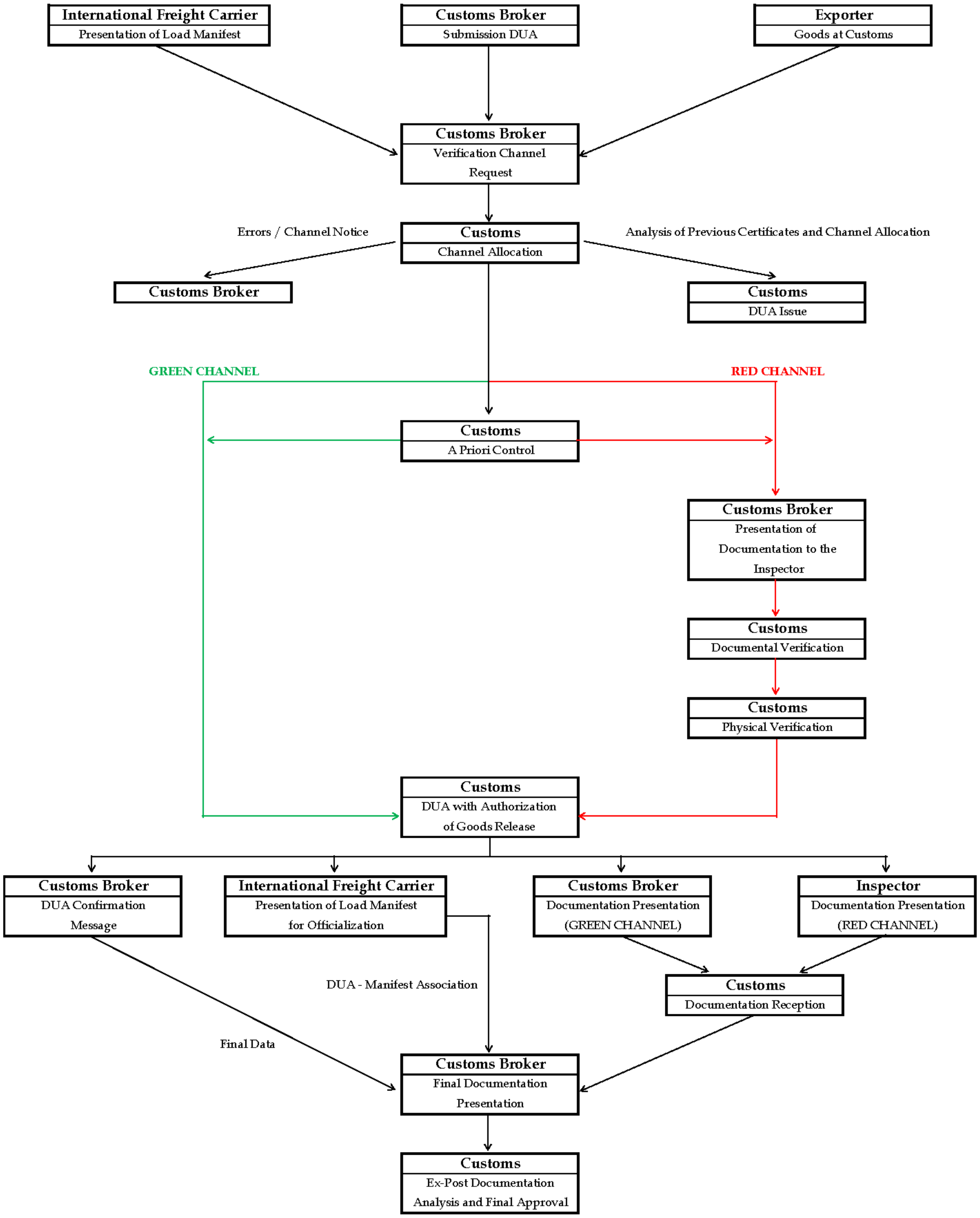
Table 10

The Impact of Customs Delays on Firms' Exports Heterogeneous Effects by Levels of Demand Volatility and Transport Modes							
	Demand Volatility				Transport Modes		
	All Observations		More than 10 Transactions				
Export Outcomes	High Volatility	Low Volatility	High Volatility	Low Volatility	Sea	Air	Others
Export Value	-0.243***	-0.163***	-0.237***	-0.162***	-0.211***	-0.642***	-0.016
	(0.055)	(0.044)	(0.061)	(0.060)	(0.031)	-0.236	(0.074)
Export Quantity	-0.224***	-0.162***	-0.221***	-0.161***	-0.212***	-0.623***	-0.016
	(0.056)	(0.043)	(0.061)	(0.058)	(0.031)	(0.210)	(0.078)
Unit Value	-0.019	-0.001	-0.016	-0.002	0.001	-0.018	0.000
	(0.014)	(0.009)	(0.013)	(0.012)	(0.007)	(0.063)	(0.014)
Number of Shipments	-0.174***	-0.154***	-0.199***	-0.147***	-0.161***	-0.246***	-0.135***
	(0.041)	(0.032)	(0.050)	(0.044)	(0.022)	(0.085)	(0.048)
Export Value per Shipment	-0.069*	-0.009	-0.038	-0.015	-0.050**	-0.396*	0.119**
	(0.037)	(0.028)	(0.045)	(0.036)	(0.021)	(0.204)	(0.051)
Export Quantity per Shipment	-0.050	-0.008	-0.022	-0.014	-0.050**	-0.378**	0.119**
	(0.039)	(0.027)	(0.047)	(0.034)	(0.021)	(0.180)	(0.055)
Number of Buyers	-0.086***	-0.049**	-0.055*	-0.063**	-0.056***	-0.096*	-0.053*
	(0.024)	(0.022)	(0.030)	(0.028)	(0.014)	(0.055)	(0.030)
Number of Shipments per Buyer	-0.088***	-0.105***	-0.144***	-0.084***	-0.105***	-0.150*	-0.082**
	(0.033)	(0.025)	(0.044)	(0.032)	(0.017)	(0.080)	(0.039)
Export Value per Buyer	-0.157***	-0.114***	-0.182***	-0.099**	-0.155***	-0.546**	0.037
	(0.048)	(0.037)	(0.059)	(0.047)	(0.027)	(0.219)	(0.065)
Export Quantity per Buyer	-0.138***	-0.113***	-0.166***	-0.097**	-0.156***	-0.528***	0.037
	(0.050)	(0.036)	(0.059)	(0.046)	(0.027)	(0.192)	(0.069)
Firm-Year Fixed Effect	Yes		Yes			Yes	
Product-Destination-Year Fixed Effect	Yes		Yes			Yes	
Observations	39,743		21,761			66,099	

Source: Authors' calculations based on data from DNA.

The left panel of table reports OLS estimates of a specification of Equation (4) that allows for different effects on exports facing high volatility of demand (at or above the median) and low volatility of demand (below the median). Volatility is measured as the median of the coefficient of variation of the quantities sold by each firm in the different transactions in each product-destination pair within a given year, averaged over the period 2000-2002. In the first two columns all product-destination combinations existing in 2000-2002 are considered, whereas in the third and fourth columns only those for which firms register more than 10 transactions in the year in question are taken into account. 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 (left panel) and at the firm-product-destination-transport mode-year level (right panel). The main explanatory variable is the change in the natural logarithm of the median number of days spent in customs ($\Delta \ln D$). The right panel of the table presents estimates of a specification of Equation (4) that allows for different effects on exports depending on the transport mode (air-shipping, ocean-shipping, and others). This equation has been estimated on data at the firm-product-destination-transport mode-year level. All relevant interacting terms and their combination are included. Firm-year fixed effects and product-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.

Figure 1
Stylized Export Process in Uruguay

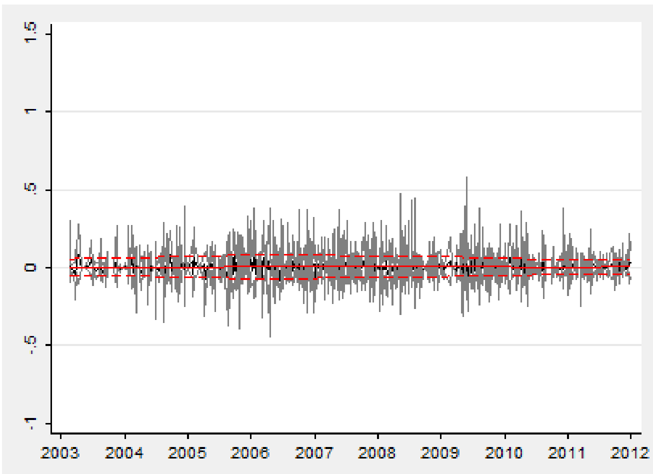


Source: Authors' preparation based on DNA.

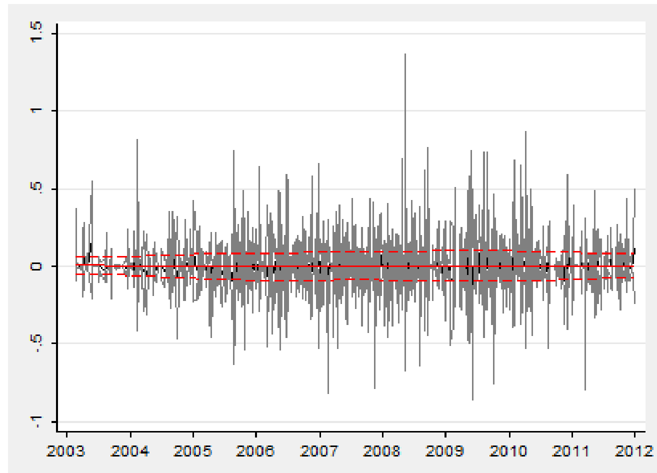
Figure 2

Allocation to Verification Channels, Delays, and Exports

Allocation to Red Channel

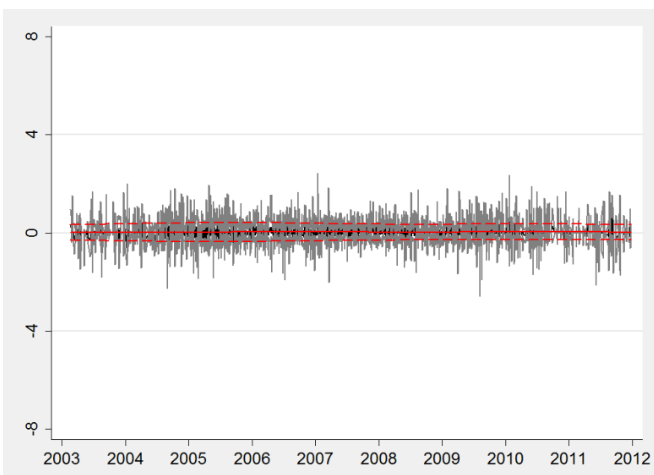


Delay

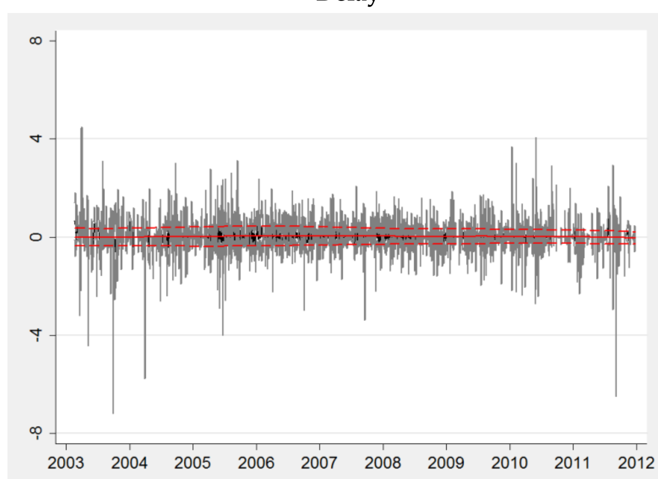


Correlation of Allocation to Verification Channels and Delays over Time

Allocation to Red Channel



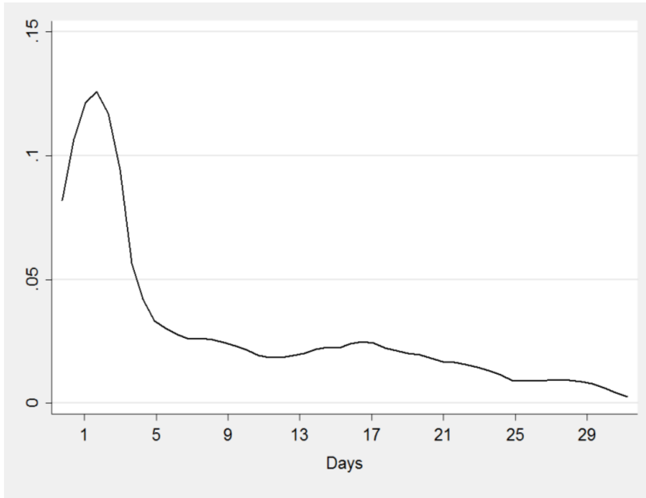
Delay



Source: Authors' calculations based on data from DNA.

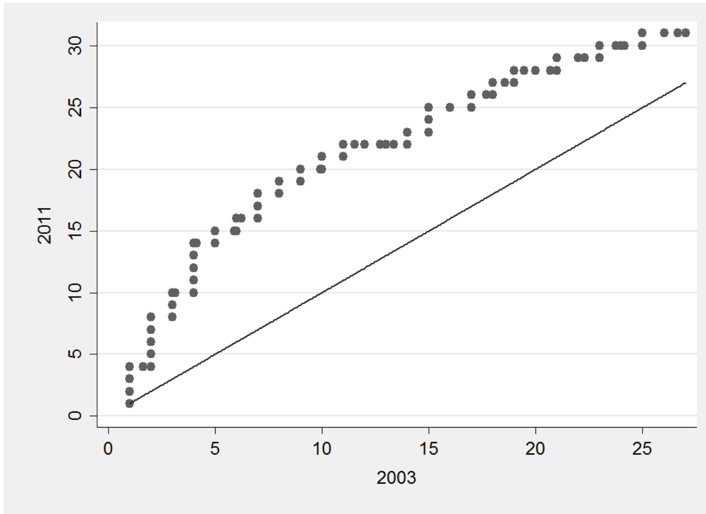
The upper panel of the figure shows the estimated coefficients (black) and the confidence intervals (grey) from daily regressions of a binary indicator of allocation to the red channel (left panel) and the natural logarithm of the delays (right panel) on the value of the firm-product-destination flow along with the respective smoothed values from a kernel-weighted local polynomial regression (red). The lower panel of the figure shows the estimated coefficients (black) and the confidence intervals (grey) from daily regressions of a binary indicator of allocation to the red channel (left panel) and the natural logarithm of the delays (right panel) on the value taken by the same variable the previous date the same firm-product-destination shipment went through customs along with the respective smoothed values from a kernel-weighted local polynomial regression (red). Firm and product-destination fixed effects are always included. Only regressions with at least 20 degrees of freedom are considered.

Figure 3
Distribution of Customs Clearance Times for Shipments Subject to Red Channel, 2011



Source: Authors' calculations based on data from DNA.
The figure shows the distribution of customs clearance times until the 99.5th percentile (i.e., the highest 0.5 percentile is excluded) for shipments that were subject to physical inspection.

Figure 4
Distribution of Customs Clearance Times Conditional to Red Channel, 2003 and 2011



Source: Authors' calculations based on data from DNA.
The figure shows the distributions of customs clearance times in days in 2003 and 2011 until the 99.5th percentile (i.e., the highest 0.5 percentile is excluded).