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Abstract

Despite enormous academic interest in international trade costs and keen policy interest in e orts to mitigate them, so far there is very little hard evidence on the impacts of trade facilitation e orts. is paper exploits a dramatic reduction in the rate of physical inspections by Albanian customs to estimate the e ects of fewer inspection-related delays on the level and composition of imports. In this setting, the paper nds evidence that the expected median number of days spent in Albanian customs falls by 7 percent when the probability that a shipment is inspected falls from 50 percent or more to under 50 percent. In turn, this reduction in time produces a 7 percent increase in import value. ere are also reform-induced changes in the composition of trade, including increases in average quantities and unit prices, the number of shipments, and the number of importing rms per product-country pair and the number of countries per rm-product pair. A back-of-the-envelope calculation suggests that the estimate of 7 percent import growth along an intensive margin is roughly consistent with a 0.36 percentage point reduction in average tari -equiva lent trade costs. Applying this gure to the value of Albania's non-oil imports produces a reform-induced trade cost sav ings estimate of approximately US$12 million in 2012. paper nds evidence that the reforms favored imports from preferential trading partners, especially the European Union.

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Trade Effects of Customs Reform: Evidence from Albania*

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1. Introduction

An enormous literature attempts to measure the size of implicit international trade costs and to explain them.[1] Despite all this activity, there is to date very little hard evidence on the effectiveness of policy changes that might be expected to mitigate these costs.[2] But the dearth of hard evidence has not restrained policy makers, who signed an ambitious trade facilitation agreement in the 2013 World Trade Organization (WTO) ministerial while promising hundreds of millions of US dollars in initiatives to support trade facilitation in developing countries.[3] One of the most prominent of the trade facilitation measures contained in the WTO agreement, and one of the most challenging for developing countries to implement, is the adoption of risk-based methods of selecting shipments for inspection. These procedures combine information technology and statistical targeting procedures to sharply reduce the frequency with which goods are physically inspected.

This paper investigates the impacts, on time and on import activity, of a substantial decline in physical inspection rates that occurred as the Albanian customs authority substantially upgraded its risk-based inspection capabilities. During the period for which we have comprehensive data, 2007-2012, the rate of physical inspections fell from 43 percent of import consignments to just 12 percent. This dramatic reduction in inspections - together with an identification strategy that exploits the properties of risk-based selection strategies for inspecting shipments - allow credible estimates of the impact of reduced inspections on the time goods spent under the control of the customs authority, and of the causal impact of time spent in customs on import flows.

The exercise relies on detailed administrative data that report inspection type, time spent in customs, and the value and quantities of imports at the transaction level. A comprehensive vector of fixed effects purges systematic variation in the frequency of inspections across combinations of

[1] Anderson and van Wincoop (2004), a survey article on the topic, had been cited more than 2500 times in Google Scholar as of November 2014. A topic of particular concern in this literature is the impact of national borders for trade, as in McCallum (1995), which had over 2200 citations at that point in time.

[2] Typically, implicit trade costs are estimated in cross-sectional studies, and so are unable to estimate the impact of specific reforms. In some cases, the literature offers rough evidence on high-level policy changes such as the introduction of a preferential trade agreement, but even these studies offer little guidance as to the effects of particular policies that might or might not be included in such agreements.

[3] World Trade Organization (2013) indicates that 1.2 billion US dollars in aid had been disbursed in support of trade facilitation reforms in developing countries since 2006. The document also pledges ongoing support by 27 national and international agencies.

firms, products, countries of origin, and years.[4] The remaining variation acts as an instrumental variable for time spent under customs control, which affects growth in the value of imports in a second stage regression of our instrumental variables (IV) framework. This identification strategy follows that in Volpe Martincus *et al.* (2014), who apply it in a study of Uruguayan exports.

Our main findings are as follows. First, we show that conditional reductions in annual physical inspection rates (evaluated as a change from 50% or greater to less than 50% of shipments inspected) produce a 7% reduction in the median number of days spent in Albanian customs at the importing firm - HS6 product - origin country level. In turn, this reduction in median days in customs generates a 7% increase in the value of imports. Second, the effects of clearance time on imports had differentially larger impacts on imports from richer countries and from preferential trading partners. Most of this effect operates through increased imports from the EU, which appear to be more sensitive to time savings than imports from other high income countries. Further evidence on changes in the decomposition of import flows suggests reform-induced increases in unit prices and average quantities, as well as in the number of shipments. Third, there is reform-induced growth along extensive margins of trade, in particular the number of importing firms per product-country pair and the number of countries per firm-product pair. Fourth, we find little evidence to suggest that the reforms had differential impacts on imports of time-sensitive goods or on differently sized firms. Finally, we find evidence that reduced rates of inspection reduced the variability of time spent in customs, which in turn led to increased imports. The increase in imports due to reduced variability of clearance times survives even after we control for reductions in median clearance times.

A small number of recent studies examine the effect of customs procedures on trade flows, generally relying on cross-country gravity equations and aggregate measures of trade costs from the *Doing Business* database. Djankov, Freund, and Pham (2010) link longer trading times to lower exports in the cross-section, and show that these effects are stronger for time-sensitive goods. Freund and Rocha (2011) investigate sub-components of the Doing Business trade cost

[4] Among other things, the fixed effects serve as controls for macroeconomic fluctuations and changes in trade policy that occurred during the period. Fixed effects at the HS6 product - origin country - year level control for developments that are specific to country-product pairs, such as growth of imported fabrics used in processing trade with the Italian apparel sector.

measures, and find that only inland transit times have significant effects on African countries' exports. Hornok and Koren (2014) and Persson (2013) link time in trade to different measures of the composition of trade.[5] While these studies are interesting because they quantify the effects of cross-country variability in the administrative hurdles required to trade, their findings are not informative about the impacts of policy reforms in customs procedures as our study is for Albania.

To our knowledge the only study on the link between the use of risk management procedures and trade is Volpe Martincus *et al.* (2014). These authors use Uruguayan export transaction data to link allocation to red channel inspections to border delays, and border delays to reduced rates of export growth using the IV framework that we employ. While our methodology follows theirs, our study differs from theirs in two important ways. First, our estimation sample occurs during a period of substantial reductions in the probability of physical inspection. Such reductions in inspections were due, in large part, to increased capabilities for risk management in Albanian customs resulting from an extended episode of trade policy reforms.[6] Second, we focus on imports rather than exports. Estimates of the impact of inspections on imports may be more useful, since countries are generally more interested in controlling imports than exports, inspections and delays are more common for imports, and hence policy reforms in customs are likely to have more impact on imports than exports.

Our study also builds on work by Hummels and Schaur (2013), who estimate a tariff-equivalent of the costs of time in trade. Those authors exploit freight logistics choices in U.S. imports to estimate firms' willingness to pay for reduced time in transport. They calculate that a day in transit acts like an ad-valorem tariff-equivalent trade cost ranging from 0.6 percent to 2.1 percent. Relying on outside estimates of a key structural parameter, we are able to use the structural decomposition in Hummels and Schaur to provide a rough estimate of the tariff-equivalent effect of the customs reforms in Albania. We calculate that those firm-product-country observations for

[5] Hornok and Koren (2014) show that countries with higher administrative trade costs (according to the *Doing Business indicators*) per shipment import fewer and larger shipments. Persson (2013) shows that higher export transaction costs (measured by time to export) decrease the number of exported products (the extensive margin of trade).

[6] Because policy changes other than risk management may also have contributed to lower inspections we are not able to attribute the effects solely to risk management reforms. Technically, the policy reform that we evaluate is the reduced rates of physical inspections that occur over our sample, and clearly most of the observed reduction can be linked to the improvement of risk-based mechanisms for selecting shipments for inspection.

which the median shipment went from inspection to no-inspection saw trade growth that was consistent with a tariff reduction of approximately 1.8 percentage points. Using the fact that about 21 percent of the sample saw such a reduction in inspection activity, we estimate that the reforms generate trade impacts that were roughly equivalent to a 0.36 percent reduction in ad-valorem tariffs. We use this figure to calculate an implied trade cost savings in 2012 of US $12 million that can be attributed to the reforms.[7]

The paper is organized as follows. Section 2 describes risk management procedures and reviews the timeline over which these procedures were implemented in Albania. Section 3 describes the data and provides descriptive evidence about changes in inspection patterns and time in customs. Section 4 discusses the estimating methodology. Our main results on the effects of time on trade are discussed in Section 5 while the heterogeneity in the effects is examined in Section 6. Section 7 presents results for other import-related outcomes and for uncertainty in time. Section 8 concludes.

2. Background

2.1 Why Albania?

Our choice of Albania is primarily motivated by the depth and speed of changes in the probability of physical inspections that occurred there during a very short period of time. During our six-year sample period, the unconditional probability that a consignment would be subject to a physical inspection fell by nearly a factor of four (as will be shown in Section 3). While the administrative reforms that were implemented to achieve these reductions have been implemented in other settings, their implementation in Albania was rapid enough to produce a sharp change in inspection probabilities in a short period of time. The rapid and well documented changes of inspection levels in the Albanian setting offer an unusually good environment for evaluating such reform efforts.

Arguably there are four factors that are important for understanding the rapid reduction in inspection rates that occurred in Albania over this period. First, Albania's trade policy history meant unusually high levels of inspections prior to reform. Albania was unique among the

[7] This is an annual figure that would recur so long as the reforms are in place. It is also a highly conservative figure for reasons that we will outline in Section 5.

Communist states of Eastern Europe in the degree to which it was closed to international trade. In the late 1970s and early 1980s Communist Party leader Enver Hoxha pursued a policy of self-reliance that severely limited international trade. While economic and political reforms in the 1990s regularized international trading activities, the administrative capacity and infrastructure needed to support higher levels of trade suffered from long neglect.[8] Thus Albania entered the 21st century with an international trading system that was lacking in both administrative capacity and infrastructure. Since that time Albania has undertaken a number of trade policy reforms, including membership in the World Trade Organization, unilateral tariff liberalization, the negotiation of several preferential trading arrangements and internal reforms to administrative procedures. Despite these changes, 100% of shipments were subject to physical inspection as recently as April 2006.

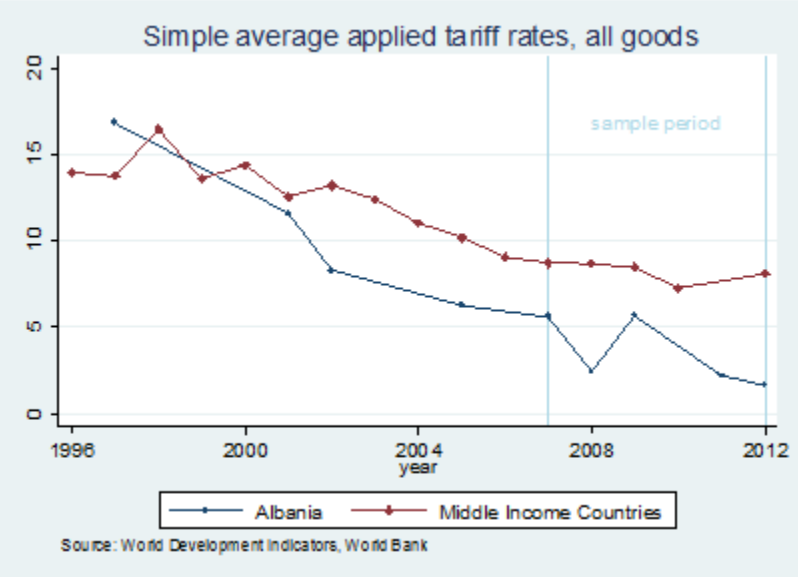
A second factor underpinning rapid reform has been Albania's ambition to accede to the European Union (EU).[9] A key precondition for membership is that Albania conforms to EU standards for border management, in order to support the free movement of goods within an expanded set of EU borders. An example of this joint understanding appears in the 2006 Stabilization and Association Agreement (SAA) between the EU and Albania, which commits the two parties to harmonize customs practices along several dimensions.[10] Article 97, in particular, calls for the parties to achieve "the approximation of the customs system of Albania to that of the Community." In addition to necessary reforms to be undertaken on the Albanian side, the Agreement commits the European Union to provide assistance.[11] It seems likely that the rapid change in inspection rates observed in our sample can be partially attributed to the ongoing support of the European Union, as well as the conditionality of Albania's eventual accession on successful reform to customs procedures.

A third piece of important context for the dramatic reduction in inspections that we observe is the relatively low average tariff rate in Albania during the period we study. Low tariff rates are the

[8] Economic crises in the 1990s and a war in neighboring Kosovo complicated reforms even further.
[9] Albania achieved EU candidate country status in June 2014.
[10] The agreement can be accessed here: http://ec.europa.eu/enlargement/pdf/albania/st08164.06_en.pdf. The SAA is one of a series of agreement between Albania and the European Union member states regarding a potential Albanian accession to the EU.
[11] The details of the nature and form of technical assistance are spelled out in Protocol 6 of the SAA. The European Union has also provided financial assistance to support investments in informational technology and other necessary reforms.

result of a sustained liberalization episode that largely preceded our sample period.[12] Figure 1 shows the simple average applied tariff rate for imports into Albania and for countries designated by the World Bank as middle-income countries.[13] Low average tariff rates are important because they offer the customs authority scope to dramatically reduce inspections. Low tariff rates imply limited incentives to evade tariffs, and limited harm to the customs authority from successful evasion.[14] In our view low average tariffs (and high levels of compliance, to the degree that we can observe it) were important pre-conditions for the reduction in the rate of physical inspections by customs that we observe in Albania.

Figure 1. Simple average applied tariffs, all goods, Albania and Middle Income countries



These conditions produced a setting that was favorable for rapid reductions in the share of shipments that were subject to physical inspection. The fourth ingredient was the ready availability of well-developed electronic systems and risk management strategies that had been developed and

[12] There are important changes in the tariff rates within our sample period, which sees an overall reduction in average rates that is interrupted by the global financial crisis. However, our inclusion of product-country-year fixed effects in the empirical specifications controls for within-sample variation in tariff rates.

[13] Under the World Bank income classification Albania is an Upper Middle Income country. Its gross national income per capita has grown rapidly since 2000, so that now it lies in the upper half of the upper middle income grouping.

[14] Customs agencies have responsibilities with respect to overseeing compliance with all import regulations. But in developing country settings, customs agencies' primary institutional goals often relate to the collection of tariff revenue. In countries where revenue goals are important, tariffs are typically high, and this leads to tariff evasion, high levels of inspection, more intensive inspections, and corruption.

improved in other countries. Ready availability meant that Albania's implementation could be relatively rapid, and translate quickly into decreased inspection rates. While our empirical exercises are only able to identify the impact of reduced inspections, it is nonetheless helpful to review the specific policy changes that were undertaken to support the reduced level of inspections.[15]

In April 1999, the Albanian parliament passed a new customs law designed to reconcile Albanian customs law with that of the European Union. Among the activities authorized in this law was the automation of customs procedures, a precondition for effective risk management. Beginning in 2001, the Albanian customs authority began automatic data processing using the Automated System of Customs Data system (ASYCUDA). An updated IT package, ASYCUDA++, was implemented in 2006.[16] ASYCUDA++ includes a risk module that can be used to separate shipments based on levels of risk. The system also facilitates feedback from physical inspections so that risk profiles can be updated. An even more advanced IT system, ASYCUDAWorld, was introduced in 2008-2009, further improving risk management capabilities. In addition to the IT improvements, Albanian customs also undertook related organizational changes, establishing a "*Directorate for the Risk Analysis and Monitoring*" in April 2009. The Directorate holds a monthly committee meeting to approve and update the profiles that underpin risk-based selection.[17] The adoption of new inspection protocols and IT systems also required substantial efforts to train the relevant staff. Clearly it is difficult to evaluate the entire package of interlocking customs reforms that were implemented over multiple years, but we can exploit a manifestation of these reforms in our data, which is the dramatic reduction in probability that goods are subject physical inspection. Our estimates relate increased imports to reductions in inspections (through their effect on customs clearance time), but the central cause of reduced inspections was the adoption of risk-based assessment in Albania's favorable environment.

[15] The information that follows is based on interviews with customs authorities by the authors in the port of Durres, Albania in March-April 2013. The biennial IMF Section IV reviews of Albania indicate that the customs authority reported quarterly to the IMF on the progress of the introduction of risk management in customs.

[16] IMF (2006) offers some further detail on this implementation.

[17] These profiles determine the weights that the IT system applies to information from the import declaration in order to determine the initial allocation to an inspection channel. Local agents have the ability to upgrade the initial allocation (from documentary to physical inspection), but the automated decision governed by the risk profile determines the final allocation in approximately 99% of the cases, as will be documented in Section 3.

2.2 Risk Management in Albanian Customs

The application of risk management systems in inspection regimes is considered modern best practice.[18] In brief, risk management systems like those in use in Albania employ statistical targeting of shipments based upon several variables that are retrieved automatically from the import declaration, including the product, the firms involved in the transaction, and the country of origin. The system assigns a vector of predetermined weights to these variables, thereby generating a risk score for the shipment. The risk score is used to determine the probability of inspection and the rigor of the inspection should it occur. High-risk shipments face a high degree of scrutiny including physical inspection. Shipments judged to be low-risk are given less scrutiny, except in the cases where they are randomly sampled. Evidence of non-compliance observed in the inspections is fed back into the risk model, raising the probability of inspection attached to subsequent shipments with similar characteristics.[19]

In the Albanian customs' risk management system there are two dominant levels of scrutiny, designated as yellow and red channels.[20] Allocation to the red channel causes a shipment to undergo physical inspection. Physical inspection may involve tailgate examination (visual inspection; opening truck, looking at markings, etc.), intensive examination (opening truck, opening boxes, unloading of goods), or sampling for laboratory testing. Allocation to the yellow channel implies that the shipment only requires inspection of import documents before clearance. Irregularities in the documentation can mean that the goods initially sent to the yellow channel are subsequently allocated to the red channel.[21]

[18] The recent WTO Trade Facilitation Agreement lists a variety of policies and procedures that jointly, represent a common understanding of best practice in border management. The 1999 revised Kyoto Convention of the World Customs Organization also offers a list of such practices. Risk management is one of the policies included in both documents. Widdowson and Holloway (2011) offer a comprehensive overview of risk management and the issues associated with the implementation of risk management procedures in a developing country context.

[19] Our discussions with Albanian customs officials suggested that the automated feedback capabilities (from inspector to the IT system) were not being fully exploited even as of 2013. This is an example of how sophisticated procedures like risk management can be difficult to operate optimally.

[20] There is a barely used blue channel (0.003% of import declarations) from 2007 to 2010 that indicates no inspection, with a probability of post-clearance audit.

[21] We observe these irregularities in our customs transaction dataset. In Section 3 we show that they are rare, accounting for roughly 1 percent of the declarations that assigned to the yellow channel. In such cases we consider the transaction to be allocated to the highest level of scrutiny, the red channel.

An important feature of risk management for our identification strategy is that the selection of goods for inspection occurs for two reasons. Some shipments are selected for inspection because their risk score is high enough to merit a "targeted" inspection. Other shipments are selected randomly for inspection, in order to monitor compliance for consignments that are deemed to be low-risk.[22] If our data identified the shipments that were selected randomly, these shipments would provide a perfect instrument for the IV strategy we employ. Unfortunately our data do not identify the randomly-selected shipments. Instead, our identification strategy mimics the systematic components of the risk model with a comprehensive vector of fixed effects, thereby isolating pseudo-random variation in inspection probabilities in the first-stage regression. [23]

Another contextual matter that is important for understanding the Albanian setting we study is the relationship between the level of traders' compliance with import regulations and the ability of improved risk management capabilities to facilitate reductions in inspection rates. Responsible reductions in inspection rates are only possible in environments in which a presumption of compliant behavior is justified. We present evidence in Section 3 that suggests that levels of compliance in Albania during the reform period were quite high. While this evidence alone is not sufficient to conclude that compliance was indeed high, we argue that Albania's low tariffs during the reform episode meant that incentives for tariff evasion, at least, were quite low.

3. Data and Descriptive Evidence

3.1 Data

We obtained from the Albanian customs agency administrative data tracking imports at the transaction level for the period 2007-2012 (extracted through the ASYCUDA system). These highly disaggregated data cover a large number of variables that describe each import transaction. The variables available to us include an importing firm numeric identifier, the date (day/month/year) of the registration/submission of administrative documents and the date of the

[22] Random selection is both an enforcement tool and a strategy that facilitates the updating of selection weights for use with future shipments with the same characteristics.

[23] In Appendix B we check to see that, in addition to removing systematic variation at the level of countries, products and firms, our methods purge the two most plausible sources of additional non-random variation: endogeneity of the inspection to value of the consignment, and serial correlation observed as an inspection allocation that depends on the previous inspection allocation for a similar consignment.

release/clearance of goods from customs, an HS-8 digit product code, the exporting country, import value, weight (in kilograms), mode of transportation, border post of entry, and the inspection channel (red, yellow, or blue). We also obtained from the Albanian customs agency a separate data set with information on customs infractions and penalties that was merged to the import transaction level data.

A key variable in our analysis - the time spent under control of the customs agency - is calculated as the difference between the time stamp associated with the filing of the import declaration and the time stamp for the release of the goods to the market. Since during the 2007-2012 period in Albania an import declaration - formally designated as single administrative document (SAD) - can only be submitted upon arrival of the freight to the customs office (electronic submission ahead of time was not possible), the variable defined above captures accurately the time spent in customs.[24] The ASYCUDA++ system that captured these data in the first half of our sample only retained the days of submission and clearance. The introduction of an updated IT system, ASYCUDAWorld, in 2009 allowed for a finer recording of the registration and clearance times for each import declaration in the latter half of the sample. For the period 2007-2012 we measure clearance times as a discrete number of days. For the sub-period 2010-2012 we have a continuous measure of clearance time, which we express in terms of (fractional) hours.

Another key variable in our analysis, the inspection rate, is also measured at the declaration level since that is the level at which customs officials decide the allocation to the red, yellow or blue inspection channels. As mentioned in Section 2, allocation of a declaration to the red channel implies the highest degree of inspection in the customs' risk management system – involving both the inspection of documents and the physical examination of goods.[25] The yellow channel implies an inspection of documents alone. The rarely used blue channel indicates that goods are cleared without inspection, but there remains a possibility of a post-clearance audit. The focus of our attention is the red channel, an indicator for physical inspection.

[24] A single SAD may contain more than one transaction (e.g. more than one type of good is being declared for import). But the clearance times we have available are for the clearance of the SAD, and so can apply to multiple transactions in cases where the declaration contains more than one transaction. We will often refer to a transaction as a shipment.

[25] The intensity of physical inspection can vary substantially, in some cases the truck is simply opened and inspected visually from the back, and in other cases the goods must be physically unpacked for inspection. Some goods are even sampled for testing in laboratories. Unfortunately our data do not distinguish among types of physical inspections, they only indicate the presence of a red channel.

The Albanian customs transaction data are recorded at the 8-digit of the Harmonized System (HS) classification using different revisions of that classification (HS2002 for data in 2007-2008, HS2007 for data in 2009-2011, and HS2012 for data in 2012). To obtain a consistent product classification over time, which is crucial for our analysis, we first aggregate the raw transaction data to the HS 6-digit level and concord the HS2012 product codes to HS2007 product codes using a concordance table provided by WITS/COMTRADE. Then we concord these (HS2002 or HS2007) codes to a set of 'consolidated' HS 6-digit codes consistent over time and described in Cebeci *et al.* (2012).[26]

At its most disaggregated level, the raw import data set includes 3,097,103 observations covering 5 types of imports – final imports for consumption, in transit, re-imports, warehouse, and other – but our analysis will focus on the 2,694,837 observations (87%) that are final imports for consumption.[27] Note that our data are comprehensive, covering the universe of Albanian formal import transactions.[28] Different parts of our analysis will rely on different aggregations of the raw import transaction data set: (i) the descriptive statistics in Section 3.2 will mostly employ data at the import declaration level while (ii) the econometric analysis that will estimate the effects of customs clearance time on trade growth will rely on an aggregation of the raw import transaction data to the importing firm-HS 6-digit product-origin country-year level. Each firm-HS 6-digit product-origin country-year cell is based on the set of import shipments made by that particular firm, of that same product, from that same country over the course of the year.

Armenter and Koren (2014) show that trade data are very sparse, even for a large country such as the U.S., in that the typical number of shipments for a given firm-product-country in a year is often 1. Not surprisingly this is also true in Albania where 61 percent of the 716,225 observations in the data set at the importing firm-HS 6-digit product-origin country-year level are a single shipment, and the average number of shipments per observation is 2.9. However, note that in the estimating

[26] The principles behind this consolidation are to combine all the codes existing under the different HS classifications into a list of unique HS 6-digit codes then the basic principle of 'consolidation' is to identify the HS codes related to each other (e.g., codes that were split or merged with the modifications introduced by HS2002 or HS2007) and to replace them with a single code for the entire period. Cebeci (2012) provides additional details.

[27] By observation (often designated as transaction or shipment) we refer to each item registered per import declaration.

[28] The sum of import values across the 5 types of imports from our raw import dataset matches closely the total import values reported for Albania by WITS/COMTRADE over the period 2007-2012.

sample for the econometric analysis where the panel dimension of the data at the firm-HS 6-digit product-origin country level is exploited (through the calculation of first-differences) the median number of shipments per firm-product-country-year is 2 and the average is 5.[29] We retain single-shipment observations in our estimation of the first-difference equations, assigning 1 to the median inspection if the shipment was inspected and zero if it was not. Since single-shipment observations exhibit inherent variability in this regard (and allocation to the red channel of a single shipment cannot decrease trade because the shipment is already en route), it is likely that this treatment attenuates any evidence that we might find that reductions in inspections increase trade through reductions in time.

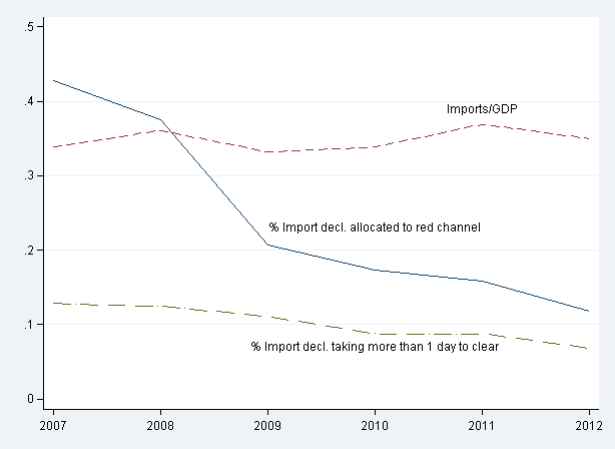
3.2 Descriptive Evidence

In this section we present some descriptive statistics characterizing changes over time in the rates of physical inspection, in the days required to clear customs, as well as in compliance with customs regulations over the sample period. Figure 2 shows that over the sample period the share of Albanian import declarations allocated to the red channel for physical inspection declines dramatically, from 42.9% in 2007 to 11.9% in 2012.[30] The proportion of import declarations taking more than one day to clear customs is cut in half over the period, declining from 12.8% in 2007 to 6.8% in 2012. These changes take place in a context of moderate growth in imports as a share of GDP.

[29] A firm-product-country importing just 1 shipment over the course of a given year is more likely to be a sporadic importer that will not repeat the transaction in the following year, in which case first-differences will not be defined for such firm-product-country and thus it will not enter the estimating sample.

[30] The actual number of import declarations allocated to the red channel also declines four-fold in absolute numbers from 2007 to 2012.

Figure 2. Time to clear customs, inspection rates, and import to GDP ratio in Albania



Source: Authors' calculations based on Albanian import transaction level data.

To document further the reductions in the time spent under the control of customs, Panel A of Table 1 shows the distribution of clearance times across categories defined by the number of days required to clear customs.[31] In 2007 about 10 percent of import declarations cleared customs in 2-3 days, but that share declined to 5 percent in 2012 as more declarations were cleared in a single day. In fact, the category of declarations clearing in 2 days saw the largest decline over the sample period. Whereas 0.5 percent of import declarations took more than 10 days to get cleared in 2007, that share was reduced to only 0.2 percent in 2012.

The time to clear customs for declarations in the category of 19 or more days is further examined in the boxplots in Appendix Figure A1, where it is shown that a small set of declarations take a (possibly unreasonably) large number of days to clear customs (e.g., more than 50 days). Hence, for the remainder of our analysis we drop from the data set the declarations that take 19 days or more to clear customs (which corresponds to dropping the top 0.1% of the distribution of clearance time). However, as we will discuss in Section 5 our results are robust to the inclusion of those dropped declarations in the sample.

[31] If goods are released on the same day as the declaration is submitted we code the data with the value of 1 day. If they clear customs on the day following the submission, we code that as 2 days, etc. For our primary specification, in which time enters linearly, the choice of units is not important. We also conducted some exercises with time measured in log days and for these exercises it is useful not to define same day clearance as zero days.

Panel B of Table 1 shows that the average time to clear customs for imports and its standard deviation decline from 2008 onwards. Interestingly, most of the reduction in average clearance times occurs after 2009, a time period that coincides with the implementation of ASYCUDAWorld, the most advanced of the IT systems that Albania used in our time frame. Summary statistics for the subset of declarations allocated to the red channel indicate that declarations in the red channel always spend more time, on average, in customs, and also have larger standard deviations in their time in customs than is the case for the declarations that are not allocated to the red channel and the differences are statistically significant according to unreported t-tests. Overall, the descriptive evidence so far suggests that the comprehensive customs reforms discussed in Section 2 produced reductions in the share of shipments that are physically inspected, and in the time that a typical shipment spends under the control of customs officials.

Table 1. Time to clear customs in Albania

Panel A. Distribution of time for declarations taking more than one day

	2007	2008	2009	2010	2011	2012
Share of import declarations that clear customs in:						
1 day	87.2%	87.5%	88.9%	91.2%	91.2%	93.2%
2 days	8.3%	7.3%	7.9%	5.6%	5.6%	4.4%
3 days	1.8%	2.1%	1.7%	1.4%	1.4%	1.0%
4 days	0.9%	0.9%	0.6%	0.5%	0.5%	0.4%
5-9 days	1.5%	1.6%	0.7%	0.9%	0.9%	0.8%
10-14 days	0.3%	0.4%	0.1%	0.2%	0.2%	0.1%
15-18 days	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%
19 or more days	0.1%	0.2%	0.1%	0.1%	0.1%	0.1%
Total number of import declarations	180,984	182,857	187,119	194,370	219,028	227,267

Panel B. Mean and standard deviation of time in customs

	2007	2008	2009	2010	2011	2012
Declarations not allocated to the red channel for physical inspection						
Mean number of days	1.22	1.23	1.20	1.16	1.15	1.12
Standard deviation of number of days	0.89	0.94	0.79	0.68	0.77	0.72
Declarations allocated to the red channel for physical inspection						
Mean number of days	1.33	1.35	1.33	1.30	1.29	1.22
Standard deviation of number of days	1.22	1.37	1.13	1.05	1.12	0.93

Source: Authors' calculations based on Albanian import transaction level data.
Note: the statistics shown in Panel B are based on all declarations that are not considered to be outliers, i.e., those spending less than 19 days in customs.

Figure 2 and Table 1 provide a perspective on the unconditional changes in inspections and time to clear customs in Albania from 2007 to 2012. But modern risk management systems condition the probability of inspection on information from the import declaration, including the identity of the importing firm, the type of product imported and the origin country. It is therefore important to condition on such criteria when describing changes in the probability of inspections over the sample period. Using the data at the importing firm-HS 6-digit product-origin country-year level, we estimate OLS regressions of the median allocation to the red channel on year fixed effects while controlling for importing firm-HS 6-digit product-origin country fixed effects.[32] The results in Table 2 show that the conditional probability of a red channel inspection declines steadily and significantly over the period. By 2012 our measure of the conditional inspection rate is 21 percentage points lower than in 2007. This magnitude is very large, even comparing to the decline in the unconditional inspection rate in Figure 2. This dramatic variation in conditional inspection probabilities underpins our subsequent analysis.

Table 2. Conditional change in inspections over the sample period

	Dependent variable is median allocation to red channel at firm-HS6 product-origin country-year level OLS estimation (1)
Year 2008	-0.039***
	(0.003)
Year 2009	-0.117***
	(0.003)
Year 2010	-0.161***
	(0.003)
Year 2011	-0.199***
	(0.003)
Year 2012	-0.210***
	(0.003)
Year 2007 (constant)	0.463***
	(0.002)
Firm*HS6*country fixed effects	Yes
Observations	784,340
R-squared	0.805

Note: Standard errors in parentheses. *** indicates significance at the 1% confidence level.

Improved risk management capabilities are not always associated with substantial reductions in the inspection burden. In environments where traders are frequently non-compliant, these

[32] Median allocation to the red channel means that an observation at the importing firm-HS 6-digit product-origin country-year level takes the value of one if 50 percent or more of the shipments in that cell are assigned to the red channel and zero if less than 50 percent of shipments are assigned to the red channel. We discuss our reasons for defining inspection activities like this in Section 5.

mechanisms may aid detection but not facilitate sharp reductions in the share of consignments undergoing physical inspection. In Section 2 we argue that Albania's tariff liberalization, which largely preceded the risk management reforms, would have reduced incentives to evade tariffs. Here we offer evidence from administrative data suggesting that compliance was indeed high in Albania. We rely on two indicators of possible non-compliance. The first indicator is the number of consignments that were allocated to yellow channel (documentary inspection) but then upgraded to red channels on the decision of the customs agent. An upgrade to physical inspection does not necessarily indicate non-compliance, but it does imply that there are grounds for more intrusive inspection. The second indicator is the existence and amount of a penalty, which is evidence of infractions (i.e., violations of customs regulations) severe enough to incur one.

Table 3 shows that even at the onset of our reform period the degree of measured compliance with customs regulations was very high. Panel A shows that the proportion of Albanian import declarations going from the yellow channel to the red channel is low in every year from 2007 to 2012. For example, in 2007, 50 out of 102,163 declarations allocated to the yellow channel (Panel A) and only 82 out of 76,476 declarations allocated to the red channel (Panel B) committed an infraction of customs regulations and hence paid a penalty. This high degree of measured compliance was maintained throughout the sample period. The high degree of compliance we observe suggests that *ex-post* most of the physical inspections prove to be unnecessary. Conditions like these are amenable to rapid reductions in inspections once the risk management systems are in place and operating.

Table 3. Customs infractions over the sample period

Panel A. Declarations allocated to yellow channel for documentary verification

	Number of declarations	Number of declarations going from yellow to red channel	Share of declarations going from yellow to red channel	Number of declarations with a penalty	Share of declarations with a penalty	Average penalty in USD	Average penalty as a share of import value
2007	102,163	975	0.95%	50	0.05%	1,286	11.08%
2008	112,508	822	0.73%	30	0.03%	1,465	8.04%
2009	149,365	1,714	1.15%	66	0.04%	2,780	20.95%
2010	161,810	1,398	0.86%	85	0.05%	1,614	32.21%
2011	187,328	3,072	1.64%	277	0.15%	1,169	12.14%
2012	200,996	846	0.42%	536	0.27%	907	11.79%

Panel B. Declarations allocated to the red channel for physical inspection

	Number of declarations	Number of declarations with a penalty	Share of declarations with a penalty	Average penalty in USD	Average penalty as a share of import value
2007	76,476	82	0.11%	3,248	10.80%
2008	67,562	71	0.11%	4,829	23.47%
2009	36,931	64	0.17%	2,056	12.99%
2010	32,303	91	0.28%	3,812	14.41%
2011	31,467	64	0.20%	2,342	12.51%
2012	26,077	104	0.40%	1,318	8.29%

Note: average penalties and average penalties as a share of import values are calculated based only on declarations with a penalty, i.e., those paying a positive penalty.

Finally, we report some summary statistics on the data at the importing firm-HS 6-digit product-origin country level that will be used for the econometric estimation of the effects of inspections on time and the effects of time on trade are shown for each year in Table 4. The number of importing firms grows over the period, while the number of products and origin countries stays relatively stable. The number of firm-product pairs is also relatively stable, which suggests that new firms are largely replacing incumbents in product space. Increases in firm-country pairs suggest that a given importing firm sources from more countries over time. Numbers of product-country pairs also rise, suggesting that consumers are able to choose among more source countries for a given product. The net impact of all this change is a nearly 7% increase in the number of firm-product-country cells over the sample period, indicating moderate growth along the extensive margin of trade over the period.

Table 4. Numbers of firms, products, and countries in estimating sample

	2007	2008	2009	2010	2011	2012
Total number of importing firms	6,933	7,075	7,220	7,330	7,396	7,303
Total number of imported HS 6-digit products	4,003	4,265	4,021	3,966	3,967	3,912
Total number of origin countries	156	155	160	154	161	153
Total number of importing firm-HS 6-digit product pairs	93,115	100,817	102,928	99,824	97,653	92,577
Total number of importing firm-origin country pairs	17,534	19,210	20,180	21,260	21,629	21,403
Total number of HS 6-digit products-origin country pairs	25,915	29,266	29,328	30,100	30,228	29,161
Total number of importing firm-HS 6-digit products-origin country cells	108,887	120,640	124,660	123,929	121,854	116,255

4. Estimating Framework

In this section we describe the IV strategy that we employ to link changes in the probability of inspection to contemporaneous changes in import value and in import composition. The outcomes of interest are measured at the level of an importing firm, HS 6-digit product, origin country, and year. While our raw data are more disaggregated, on the whole our interest is in annual outcomes (e.g., total import value in a year). Analysis at more disaggregated levels would only illustrate the impact of customs reforms on a very specific type of intensive margin, i.e., how does the value of a shipment depend on the probability of allocation to the red channel?[33] In Appendix B we conduct some exercises at much more disaggregated level in an effort to support our argument that the vector of fixed effects included in our specifications is effective in removing non-random variation in inspection behavior. Nonetheless our primary interest remains in outcomes at the firm-product-country level, measured over the period of one year.

In broad terms the sources of plausibly exogenous variation in physical inspection rates are a) random variation in inspection activity that arises because the automated risk management system allocates some shipments to inspection on a random basis, and b) year-to-year reductions in inspection probabilities that are common to all importing firm-HS 6-digit product-country cells, which are exogenous at the level of an individual observation. Our estimation strategy is

[33] We do study this question along with other questions about the composition of trade in Section 6, but approach this by calculating the average value of shipments rather than the value of individual shipments.

constructed to isolate variation like that in (a). Because product-country-year fixed effects play a role in our estimation strategy, variation arising from (b) is swept out. However in later calculations where we quantify the impact of the customs reforms on trade we characterize the customs reforms in terms of reductions, over time, in (b).[34]

Our working hypothesis is that reduced inspections affect trade through the channel of less time spent to clear customs (which implies a lower cost burden). A key parameter is the causal impact of time to clear customs on trade flows. Absent any endogeneity concerns, we would wish to estimate the following equation:[35]

$$\ln M_{ijct} = \beta T_{ijct} + \gamma_{ijc} + \gamma_{it} + \gamma_{jct} + \varepsilon_{ijct} \quad (1)$$

where *i* stands for an importing firm, *j* for an HS 6-digit product, *c* for an origin country, and *t* for a year, M_{ijct} is import value, and ε_{ijct} is an independent and identically distributed (i.i.d.) error. The main coefficient of interest is that on the variable T_{ijct}, which is the median time spent at customs by imports of product *j* from country *c* by firm *i* during year *t*. Our choice of median instead of average time spent at customs for T_{ijct} follows Volpe Martincus *et al.* (2014). The use of median minimizes the influence of transactions with more extreme delays. Use of the average time in customs would also be problematic because the formula for the average includes the number of shipments in the denominator, and the number of shipments affects the left-hand-side variable, M_{ijct}.

The various types of fixed effects included in Eq. (1) play a crucial role: (i) firm-HS 6-digit product-origin country fixed effects γ_{ijc} allow the effect of clearance time on imports to be identified based on the within (time-series) variability in clearance times, (ii) firm-year fixed effects γ_{it} account for importing firms' evolving probabilities of being inspected and/or any firm time-varying shocks to profitability or performance which could affect their import decisions, (iii) HS 6-digit product-origin country-year fixed effects γ_{jct} account for the possibility that different product-origin country pairs face a different probability of being subject to inspections by customs and for any trade policy, transport, or demand shocks that hit the product-origin country pair. In

[34] These estimates are taken from Table 2.

[35] This follows the baseline specification that Volpe Martincus *et al.* (2014) propose for Uruguayan exports.

particular these latter fixed effects control for tariff liberalization during the period even if it occurs at different speeds for different products originating in different partner countries.

For computational feasibility the specification in Eq. (1) is first-differenced so as to sweep out the firm-HS 6-digit product-origin country fixed effects γ_{ijc}. The specification in first-differences relates changes in imports experiencing decreases in the time to clear customs to changes in imports not experiencing changes (or experiencing increases) in the time to clear customs, after controlling for time-varying and time-invariant heterogeneity at various levels of disaggregation. OLS estimates of β may be biased due to potential reverse causality if customs clearance time is endogenous to import value.

We use the allocation to the red channel for physical inspections as an exogenous source of variation for customs clearance time. Specifically, our identification assumption is that the vector of fixed effects we employ is sufficient to remove any systematic sources of variation in inspections. By emphasizing conditional reductions in the probability of assignment to the red channel we are conceptually limiting the analysis to identification via changes in the probability of (pseudo-) random assignment to the red channel.

While we are unable to offer formal proof that our methods are sufficient for isolating random variation in inspection probabilities, the two exercises in Appendix B support this claim. In particular, we show that, after including our vector of fixed effects, two plausible sources of endogeneity are not present in the more disaggregated data. First, we show that, after conditioning on our vector of fixed effects, allocation to the red channel is independent of import value. Second, we show that, conditioning on our fixed effects, allocation to the red channel is independent of the previous allocation decision. Both of these exercises support the argument that our fixed effects capture any systematic variation in the decision to physically inspect the goods. See Appendix B for more details.

We therefore proceed under the assumption that, conditioning on importing firm and on HS 6-digit product-origin country fixed effects, shipments are randomly allocated to the red channel for

physical inspection by Albanian customs. We propose as the first-stage equation for our IV framework the first-differenced equation:

$$\Delta T_{ijct} = \beta_1 \Delta Red\_channel_{ijct} + \gamma_{it} + \gamma_{jct} + v_{ijct} \quad (2)$$

where $\Delta Red\_channel_{ijct}$ is the first-difference in an indicator variable equal to 1 if more than 50% of import shipments of a firm-HS 6-digit product-origin country in a year is allocated to the red channel and zero otherwise and v_{ijct} is an i.i.d. error term. Our use of the median allocation to the red channel also follows Volpe Martincus *et al*. (2014), who offer three justifications for the practice. Perhaps the strongest of these is that which we used above for the time measure, that median statistic, unlike the mean, does not depend on the number of transactions. Given the later evidence that we provide of a causal effect of time in customs on the number of shipments this is an important property to require of the instrument in the first-stage regression.

The second-stage equation is Eq. (1) in first-differences:

$$\Delta \ln M_{ijct} = \beta_2 \hat{\Delta} T_{ijct} + \gamma_{it} + \gamma_{jct} + \varepsilon_{ijct} \quad (3)$$

where $\hat{\Delta} T_{ijct}$ is estimated from the first stage (in a 2-Stage Least Squares framework (2SLS)) and where for simplicity we retain the same nomenclature for the fixed effects and the error term as in Eq. (1) (rather than generating first-differenced fixed effects and an error term).[36] This equation produces a causal estimate of the impact of customs clearance time on the intensive margin of imports, β_2. Combining this estimate with β_1 from Eq. (2) gives us a joint estimate of the effect of changes in the (median) allocation to the red channel on the intensive margin of imports. In order to understand the quantitative implications of the policy change we will apply these estimates to the estimated change in median red channel allocations – a decline of 21 percent (-0.21) - reported in Table 2.

5. Effects of Customs Clearance Time on Import Value

5.1 Main Results

Table 5 shows our baseline OLS estimates of Eq. (3) and our preferred 2SLS IV estimates of Eqs. (2)-(3) with standard errors robust to heteroskedasticity. Columns (1)-(7) focus on clearance time

[36] Our use of 2SLS rather than GMM for the IV strategy is driven by computational reasons, i.e., the presence of a very large set of fixed effects in our equations requires us to use the *reghdfe* Stata command drawing on Guimaraes and Portugal (2010) for which the only possible IV estimates to obtain are 2SLS estimates.

measured in days over the period 2007-2012 while columns (8)-(14) provide estimates for clearance time measured in hours over the period 2010-2012. Note that some columns show coefficients from specifications with fewer fixed effects than are shown in Eqs. (2)-(3). The estimates from the first-stage regression show a positive and significant effect of the allocation to the red channel on customs clearance time, as expected. The F-statistics from the first-stage regressions are very large and indicate a strong correlation between the exogenous instrument and clearance time. The first-stage coefficient implies that a firm-product-country cell that moves from having the majority to having only a minority of its shipments physically inspected in a year has a decline in the expected median time to clear customs of 7% (=-1*0.07).

The second-stage regression estimates show a clear negative and significant effect of customs clearance time on import value.[37] The IV estimates are substantially larger in magnitude than the OLS estimates. Our preferred specification in column (6) implies that a decrease of 1 day in the (instrumented) time to clear customs increases on average the value of imports in a firm-product-country cell by 164%.[38] Column (7) provides estimates for the effects of a change in the log number of days instead of a change in days. Focusing on clearance time measured in hours in column (13) implies that a 1-hour decrease in the time to clear customs (induced by lower physical inspections) increases on average the import value of a firm-product-country cell by 2.3%.[39]

Because there are so few estimates like these in the literature, and because our specification follows Volpe Martincus *et al.* (2014), an interesting exercise is to compare our estimates from Albanian imports to theirs from Uruguayan exports. Because our primary specification uses days as units, we compare with their secondary specification of the same form. Our first-stage regression estimates suggest much smaller impacts of changes in inspections on changes in median days in customs (0.07 in Albanian imports versus 2.726 in Uruguayan exports). The second-stage regression implies much larger effects of delays on trade in our sample (-0.97 versus -0.114). These are very different settings, of course, but it seems that in our settings inspections are much less likely to induce delays; but delays, once induced, have much larger impacts on trade flows.

[37] The magnitude of the OLS and the IV estimates increases in absolute value the richer is the set of included fixed effects.
[38] The magnitude is calculated as $(e^{(-0.97)*(-1)}-1)$.
[39] The magnitude is calculated as $(e^{(-0.023)*(-1)}-1)$.

The findings in Table 5 rely on inference based on standard errors robust to heteroskedasticity. While there is no natural clustering level to consider for our specifications, we check the robustness of our findings to a variety of clustering structures: at the firm-product-country (to account for potential serial correlation), the firm, the firm-product, and the firm-country levels but also the product-country level. The significance of the effect of customs time on imports is maintained in all cases. We also note that while we drop import declarations taking longer than 18 days to clear customs from the raw data set before aggregating it to the firm-HS 6-digit product-origin country-year level, the estimation results are robust to including those declarations.[40]

Table 5. Effect of customs clearance time on imports

	Dependent variable is first-diff. in log import value at firm-HS6 product-origin country-year level													
	Clearance time measured in days - 2007-2012 period							*Clearance time measured in hours - 2010-2012 period*						
	OLS estimation			IV estimation				OLS estimation				IV estimation		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
First-diff. in median clearance time	-0.067***	-0.076***	-0.081***	-0.654***	-0.789***	-0.970***		-0.004***	-0.004***	-0.005***	-0.018***	-0.021***	-0.023***	
	(0.005)	(0.005)	(0.006)	(0.104)	(0.106)	(0.149)		(0.000)	0.000	0.000	(0.005)	(0.006)	(0.008)	
First-diff. in log median clearance time							-1.899***							-0.096***
							(0.283)							(0.031)
Firm*year fixed effects		Yes	Yes		Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes
HS6 product*origin country*year fixed effects			Yes			Yes	Yes			Yes			Yes	Yes
Observations	200,281	200,281	200,281	200,281	200,281	200,281	200,281	84,298	84,298	84,298	84,298	84,298	84,298	84,298
R-squared	0.001	0.149	0.466	-0.104	0.032	0.370	0.406	0.002	0.138	0.462	-0.029	0.106	0.440	0.460
F-statistic from first-stage regression				311	422	405	600				211	260	267	3268
First-stage coefficient on first-diff. in median allocation to red channel				0.071***	0.077***	0.070***	0.036***				2.092***	2.133***	1.987***	0.481***
				(0.004)	(0.004)	(0.003)	(0.001)				(0.144)	(0.132)	(0.122)	(0.008)

Notes: Robust standard errors in parentheses. *** indicates significance at the 1% confidence level.

5.2 Economic Interpretation

Because the identification strategy we employ calculates effects at the intensive margin of trade (and because the two stages in the analysis can complicate interpretation) it is useful to offer some back-of-the-envelope calculations that illustrate the economic magnitude of the estimates in Table 5. Focusing on our preferred specification in column (6), the first-stage regression implies that a representative firm-product-country affected by the customs reform (thus changing its status from 1 to 0 in the median allocation of its import shipments to the red channel) decreases its expected median number of days in customs by 7%, with all else constant. Multiplying this change by the elasticity of import value with respect to customs clearance time from the second-stage IV

[40] The results using different clustering of standard errors and those including outlier declarations in the sample are available from the authors upon request.

regression implies an expected increase in log import value of 0.068 (=-0.07*-0.97) which corresponds to an increase in that firm-product-country's actual import value by 7%, with all else constant.[41] This 7% figure is our intensive margin effect of the reduced inspections on import value.

Another way to interpret this number is as an implied reduction in the ad valorem tariff equivalent trade cost that applies to a given observation, which in the case of the regressions in Table 5 is a firm-HS 6-digit product-origin country-year. Following Hummels and Schaur (2014), we can decompose a given percentage change in the trade volume into two structural parameters: a trade elasticity (σ) that summarizes trade response to changes in prices, and an ad valorem tariff-equivalent trade cost (τ).[42] Unlike Hummels and Schaur our data do not allow us to separately estimate σ in our sample, but we can make statements about the size of τ conditional on a choice of σ taken from the literature. The trade growth we measure is along an intensive margin of trade, so we use an intensive margin elasticity of 3.8 estimated by Bernard *et al.* (2003).[43] Assuming this elasticity our estimate of a causal increase in imports of 7% is consistent with a 1.8 (=7%/-3.8) percentage point reduction in the tariff equivalent effect of reductions in the probability of inspection (from 50% or greater to less than 50% of shipments) for a firm-product-country cell.

But this tariff equivalent effect was not experienced by all Albanian import declarations. Our evidence in Table 2 shows that the conditional decline in median allocations to the red channel from 2007 to 2012 was about 21 percent. Therefore we argue that only 21 percent of the sample of firm-HS 6-digit product-origin country-years experienced the decline in inspections that resulted in a decline in customs clearance days and an increase in import value. Thus for Albanian imports overall, the reform contributed to trade growth in a manner that was roughly equivalent to an average tariff cut of 0.36 (=21%*-1.8) percentage points.

[41] The figure of 7% is calculated as ($e^{0.068}$-1).

[42] Specifically, the change in log trade volume is equal to $\sigma*\tau$.

[43] This Bernard *et al.* estimate is of similar magnitude to others in the literature. The advantage of this estimate over most others is that it is specifically an estimate of the intensive margin of trade. It should be considered a long-run estimate, however, and so it may overstate the trade response possible in our sample (whose regressions are based on first-differences that capture the short-run), and therefore understate the tariff equivalent. Our estimate should be considered a rough lower bound on the tariff equivalent impact of the reduced inspections on those firm-product-country triplets that experienced a reduction in the median level of inspection activities.

Note that while the trade impacts of the reform are modest, the welfare consequences are presumably much larger than would be the case for an average tariff reduction of 0.36 percentage points. When tariffs are reduced, the gains to producers and consumers are mostly offset by reduced revenues to the treasury. In the case of trade facilitation measures, the gains from trade are much larger because there is no direct offsetting loss of tariff revenue. In the case of these particular reforms there are costs of implementation that should be considered. But these do not mechanically consume the vast majority of the benefits of reform in the way that lost tariff revenues do for tariff reductions. An illustrative guide to the savings generated by the reform program can be calculated as the product of the estimated change in ad valorem trade costs and the value of affected imports. Multiplying 0.0036 by the value of Albania's 2012 non-oil imports (USD 3.3 billion) returns a rough estimate of trade cost savings in 2012 that can be attributed to the reforms: US $12 million.[44]

This is a conservative estimate of the benefits of the reforms. First, the estimated effects are limited to those that operate through a single channel: inspections reduce time and reduced time increases import growth. Second, we only attribute import growth to the reforms if it is contemporaneous to a change in the firm-product-country cell's median allocation to the red channel. Reductions in inspection activity that lead to import growth elsewhere in the distribution of red channel allocations are not attributed to the reforms, and, if anything would bias our estimate towards not finding an effect. Third, the structural trade elasticity we use is a long-run estimate even though we are estimating short-run contemporaneous impacts of reductions in inspections and in time on imports. We choose the long-run elasticity because it is available, and transparent, but a short-run elasticity would presumably be smaller and thus generate a larger tariff equivalent estimate from the same change in trade flows. Finally, growth at the extensive margin of trade might have larger welfare effects than changes in the intensive margin. But, since the estimated magnitudes of the extensive margin of trade are roughly consistent with the implied tariff cuts we infer, we focus our

[44] Conceptually we are asking what would the trade cost be of importing the same import value assuming than ad valorem trade cost of 0.36% were applied to the imports. This is slightly different than a welfare calculation, which would also take into account changes in behavior. Welfare calculations should also take a strong stand on valuing the extensive margin of trade, which we do not do in this instance.

estimate of the economic impact on trade cost savings rather than welfare, which is considerably more difficult to calculate.

5.3 Effects across Sub-Periods and over the Longer Term

Given that the introduction of the ASYCUDAWorld system in 2008-2009 brought improved capabilities for risk management in Albanian customs, we examine whether there were differences in the link between inspections and the number of days to clear customs, and between the number of days to clear customs and import value for the two sub-periods 2007-2009 and 2010-2012.[45] The results in columns (1)-(2) of Table 6 show that the strength of the elasticity of import value to customs clearance time increases from the first to the second period while the strength of the link between inspections and clearance time decreases.

Our interpretation of these results is speculative, but we offer some possible explanations for the change in the relationships over time. The increase in the elasticity of import value to time reductions over the sample period may suggest that firms adopted leaner supply chains by the latter half of the sample (quite possibly because of improved customs). As the number of inspections and/or delays in customs fall, one might expect firms to reorganize supply chains in ways that make them more susceptible to delay (now that delays are less common). Just-in-time supply chains for example, are not feasible when the chances of delays in customs are sufficiently large. But, if supply chains of this type are put in place (because delays are generally less common), the occasional delay may have more impact on the import flow.

The decline in strength of the link between inspections and delays in the first-stage may be attributable to improvements in customs that complemented the reduction in inspections. One might expect that a customs agency that was willing to adopt new inspection procedures to facilitate trade might also take other steps aimed at facilitating trade, conditional on inspection. For example, electronic systems that allowed more effective communication of inspectors from

[45] Unreported results from a separate conceptual exercise split the sample according to the customs office in which the goods were cleared. Subsamples included shipments cleared in the principal sea port (Durres), in the principal overland terminal (Tirana) and in the group of remaining customs offices. The sign pattern for our main results was consistent across all specifications, and results were statistically significant when we estimate over the 2007-2012 sample and measure time in days. The second-stage estimates were not significant for Tirana and Durres when we estimate over the shorter 2010-2012 sample and measure time in hours rather than in days. Estimates are available from the authors upon request.

different agencies or faster payment of fines associated with infractions would weaken the link between inspections and delays. Weaker links between inspections and time in customs might also arise if the declining number of inspections led to less congestion at the border.[46]

As a different exercise we allow for longer-term effects of reduced inspections on import values by limiting the sample to observations in 2007 and 2012 that occur in both years and re-estimating by 2SLS-IV Eqs. (2)-(3) over the long-differences defined in this way. Our baseline specification in first-differences exploits contemporaneous variation in inspections, time and import flows, but one might expect firms to have longer-run responses to the reforms that are not observable at this frequency.[47] Estimating over long-differences is one way to observe longer run responses. Naturally, the sample size used for such specifications is much smaller since it covers only firm-HS 6-digit product-origin country import flows observed at the beginning and the end of the sample period and it is well known that trade flows have low survival rates.[48]

Our identification assumption for the 2SLS-IV framework is that the very rich vector of fixed effects included in Eqs. (2)-(3) account for the risk model used by Albanian customs when determining whether declarations are allocated to the red channel for physical inspection. However, as described in Section 2, our sample period was characterized by substantial reforms and it is possible that the risk model of the customs agency changed during the period. As such, it is not entirely clear what fixed effects should be included in the long-difference specifications. We consider two versions: including only HS 6-digit product-country fixed effects in column (3) of Table 6 or including firm fixed effects in addition to product-country fixed effects in column (4) of Table 6.[49] Our estimates indicate that reductions in median customs clearance time from 2007

[46] The length of time goods spend in customs is not solely dependent on the customs office, but also depends on the products and firms in question. Delays may occur because firms do not quickly pay their fines, for example. Firms might also simply prepare goods in ways that allow inspections to occur more quickly (because they are more obviously compliant, for example). It could therefore be that changing firm behavior (which might be endogenous to the efficiency of customs) also contributed to the weaker link between inspections and delays as reform proceeded.

[47] In particular one might expect firms to reorganize their supply chains, which might bring greater efficiency. Some reorganizations might not be possible within a year's time. Moreover larger changes might not be warranted unless the reforms seem credible. Because the reforms were deep and sustained over our sample period, it is particularly valuable to investigate longer run responses here.

[48] See for example Cadot, Brenton, and Pierola (2012) for evidence focused on Africa.

[49] This second type of specification is what would correspond closely to the specifications in first-differences in Table 5 and would indicate a possibly more sophisticated risk model.

to 2012 have a significant negative effect on import growth over the long term but only when we do not include the firm fixed effects. This suggests that there is important variation across firms (within product-country pairs), which pins down the estimates in column (3), but that there is not sufficient evidence once we control for variation across firms in column (4). If identification comes from variation within firms across HS 6-digit product-origin countries the effect is negative but insignificant and moreover the IV strategy does not work so well because the link between reductions in physical inspections and customs clearance time in the first stage is also insignificant.

Table 6. Effect of customs clearance time on imports across periods and over the longer term

	Dependent variable is first-difference in log import value at firm-HS6 product-origin country-year level		Dependent variable is long-difference in log import value at firm-HS6 product-origin country level	
	Clearance time measured in days		*Clearance time measured in days*	
	2007-2009 period	*2010-2012 period*	*2007-2012 period*	
	IV estimation		IV estimation	
	(1)	(2)	(3)	(4)
First-diff. in median clearance time	-0.522***	-1.370***		
	(0.180)	(0.239)		
Long-diff. in median clearance time			-4.769**	-9.962
			(2.106)	(10.379)
Firm*year fixed effects	Yes	Yes		
HS6 product*origin country*year fixed effects	Yes	Yes		
Firm fixed effects			No	Yes
HS6 product*origin country fixed effects			Yes	Yes
Observations	73,700	126,581	14,556	14,556
R-squared	0.442	0.286	-1.59	-4.568
F-statistic from first-stage regression	216	196	11	2
First-stage coefficient on first-diff. in median allocation to red channel	0.094***	0.057***		
	(0.006)	(0.004)		
First-stage coefficient on long-diff. in median allocation to red channel			0.038***	0.018
			(0.011)	(0.012)

Notes: Robust standard errors in parentheses. *** indicates significance at the 1% confidence level.

6. Heterogeneity in Effects of Customs Clearance Time on Import Values

Section 5 shows the effects of customs clearance time on import values, where time is instrumented by physical inspections, estimated as an *average across all* firm-HS 6-digit-product-origin countries. Next, we allow those effects to be heterogeneous along several dimensions at the country, product and firm levels. In each case we estimate variants of Eqs. (2) and (3) by 2SLS-IV given by:

$$\Delta T_{ijct} = \beta_1 \Delta Red\_channel_{ijct} + \beta_{1Z} \Delta Red\_channel_{ijct} * Z + \gamma_{it} + \gamma_{jct} + v_{ijct} \quad (4)$$

$$\Delta \ln M_{ijct} = \beta_2 \hat{\Delta} T_{ijct} + \beta_{2Z} \hat{\Delta} T_{ijct} * Z + \gamma_{it} + \gamma_{jct} + \varepsilon_{ijct} \quad (5)$$

where Z is a characteristic that can vary at different disaggregation levels and all else is defined as before. The variable Z does not enter by itself in the equations since it is always accounted for by some of the fixed effects included.

6.1 Heterogeneity across Country Type

We begin by exploring differential effects of reductions in customs clearance time on import growth for imports coming from different types of partner countries, focusing either on their preferential trade relationship with Albania or on their level of income. Because preferential trade agreements often include language on the mutual recognition of documents, one might expect that inspection rates to fall more quickly for goods coming from those countries. It may also be that, conditional on inspection, goods imported from preferential trade partners will clear more quickly. Columns (1)-(2) and (5)-(6) of Table 7 show results from estimating by 2SLS-IV Eqs. (4)-(5) with the variable Z being an indicator variable for Albania's preferential trading partners: the European Union (EU) countries with which it has a free trade agreement, the Central Europe Free Trade Agreement (CEFTA) countries, and Turkey.[50] Whether all preferential trading partners are combined or separated into those in the EU versus the others, the estimates show very clearly that the significant effect of reductions in customs delays on import growth are driven entirely by imports from those countries whereas by contrast the effect for the imports from the average country is actually of the opposite sign (and significant). Columns (2) and (6) show that among the preferential trading partners, growth in imports from the EU responds more strongly to reductions in customs clearance time than growth in imports from CEFTA or from Turkey, although the latter also responds significantly.

We also look for differential effects that can be linked to per capita income in the origin countries. On the one hand, lower rates of inspection might favor imports from countries with high per capita

[50] The CEFTA countries are Bosnia, Croatia, Macedonia, Moldova, Montenegro, Serbia, and Kosovo. Croatia subsequently joined the EU in 2014 (after the end of our sample period). While the free trade agreement with Turkey enters into force only in May 2008, for simplicity in our regressions we consider Turkey as a preferential trading partner throughout the 2007-2012 period.

incomes because they tend to export higher quality products that might be more time-sensitive.[51] On the other hand, exporters from lower-income countries may have more difficulties coping with delays in customs.[52] Columns (3)-(4) and (7)-(8) of Table 7 show results from estimating by 2SLS-IV Eqs. (4)-(5) with the variable Z being an indicator variable for high-income trading partners.[53] The effect of reductions in customs delays on import growth is driven entirely by imports from high-income countries whereas by contrast the effect for the imports from the average country is insignificant. If we investigate more thoroughly the identity of the high-income countries separating the high-income trading partners in the EU from those elsewhere (e.g., Australia, Canada, Switzerland, the U.S.) in columns (4) and (8) we find that the effects are attributable to the high-income countries in the EU alone. This suggests that whatever the impacts of inspections on trade with high-income countries, they are specific to factors that are particular to the EU countries. Perhaps the most likely factors are geographic proximity or membership in a preferential trading arrangement.

To understand further our finding of a stronger effect on EU imports we explore two possible channels. First, one might suspect that inspection rates fell relatively faster for imports from the EU, given the preferential trading arrangement with the EU, for example. To explore this we estimated conditional probabilities of inspection over the sample period for the different types of countries, reporting the results in Appendix Table C.1. There is a larger decline in conditional inspection rates for imports from EU countries relative to those from non-preferential partner countries and for rich EU countries relative to poor countries. But the declines for EU imports are relatively similar to those of other preferential partners (CEFTA countries and Turkey) and imports from other rich countries. Imports from the EU did not enjoy substantially larger reductions in inspection rates than imports from other preferential partners or imports from other rich countries.

[51] For example, apparel from high-income countries may be more time-sensitive because it is more oriented to fashion. More generally it may be that the time cost of delay for higher-value goods is higher, and it may be that, conditional on product, high-income countries send higher-value products.

[52] It may be for example, that firms from lower-income countries must pay higher interest rates for trade finance, and thus face a higher cost of delays. Such firms may also have less sophisticated logistics operations, which could mean they have fewer mechanisms for coping with delays, but might also mean that they are constructed to be less time-sensitive.

[53] High-income countries are defined according to the World Bank country income classification.

Second, one could imagine that imports from the EU might have had relatively less disruptive inspections. To evaluate this we ask whether customs clearance time had a differentially larger effect on clearance times for imports from the EU. The first-stage regressions in Table 7 show no significant difference in the link between inspections and time for import from the EU relative to imports from the average country. Hence, it does not seem that this channel explains our finding. Instead, it seems that imports from the EU are more sensitive to time in customs than are imports from other preferential partners or imports from other rich countries. Our conjecture is that given the proximity of Albania to several EU countries, a one-day reduction in customs represents a proportionally large reduction of the total time in transit for imports from the EU when compared to imports from more distant preferential partners or high-income countries and this helps explain the stronger responsiveness of imports from the EU to time. These results differ from those in Volpe Martincus *et al.* (2014), where exports to more distant countries are more responsive to reductions in time. However, since they consider exports, it is not surprising that they find that longer delays to countries that are more difficult to reach are more harmful.

Table 7. Effect of customs clearance time on imports by country type

	Dependent variable is first-diff. in log import value at firm-HS6 product-origin country-year level							
	Clearance time measured in days - 2007-2012 period				*Clearance time measured in hours - 2010-2012 period*			
	IV estimation							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First-diff. in median clearance time	0.577**	0.573**	0.332	0.323	0.041***	0.042***	0.026*	0.028*
	(0.283)	(0.286)	(0.285)	(0.288)	(0.015)	(0.015)	(0.014)	(0.014)
First-diff. in median clearance time * Preferential trading partner dummy	-2.292***				-0.093***			
	(0.375)				(0.019)			
First-diff. in median clearance time * EU preferential trading partner dummy		-2.466***				-0.098***		
		(0.388)				(0.020)		
First-diff. in median clearance time * CEFTA preferential trading partner or Turkey dummy		-1.091*				-0.068**		
		(0.661)				(0.031)		
First-diff. in median clearance time * High-income country dummy			-1.997***				-0.076***	
			(0.367)				(0.018)	
First-diff. in median clearance time * High-income EU country dummy				-2.152***				-0.084***
				(0.376)				(0.019)
First-diff. in median clearance time * High-income non-EU country dummy				-0.173				0.000
				(0.746)				(0.037)
Firm*year fixed effects	Yes	Yes	Yes	Yes	Yes		Yes	Yes
HS6 product*origin country*year fixed effects	Yes	Yes	Yes	Yes	Yes		Yes	Yes
Observations	200,281	200,281	200,281	200,281	84,298	84,298	84,298	84,298
R-squared	0.229	0.212	0.256	0.243	0.321	0.312	0.355	0.337
F-statistic from first-stage regression	206	138	203	138	134	90	134	89
First-stage coefficient on first-difference in median allocation to red channel	0.085***	0.085***	0.073***	0.073***	2.211***	2.211***	2.095***	2.095***
	(0.007)	(0.007)	(0.006)	(0.006)	(0.217)	(0.217)	(0.199)	(0.199)
First-stage coefficient on first-diff. in median allocation to red channel * Corresponding dummy	-0.021	-0.021	-0.004	-0.007	-0.323	-0.341	-0.168	-0.196
	(0.008)	(0.008)	(0.007)	(0.007)	(0.258)	(0.264)	(0.247)	(0.250)
First-stage coefficient on first-diff. in median allocation to red channel * Corresponding other dummy		-0.018		0.040		-0.202		0.205
		(0.013)		(0.019)		(0.451)		(0.601)
Proportion of observations with first country dummy=1	75.4%	63.8%	68.0%	61.7%	73.1%	61.79%	66.6%	59.6%
Proportion of observations with second country dummy=1		11.6%		6.3%		11.28%		6.9%

Notes: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% confidence levels, respectively.

6.2 Heterogeneity across Product Type

Next, we allow the effect of changes in customs clearance time on import growth to differ across products depending on their sensitivity to time in transit either because of physical depreciation (e.g., fresh agricultural and food products with a short shelf-life before they are rotten) or because of their use as inputs in production processes that may or may not be part of global supply chains (e.g., cloth needed for apparel manufacturing). We consider five key measures of time-sensitivity used in the recent trade literature as variable Z: the measure used by Freund, Djankov, and Pham (2010) that encompasses products with short shelf-life and products identified as parts and components by Hummels (2001), and its two sub-components separately, as well as the measure

used by Hummels and Schaur (2013) that encompasses fresh and frozen products and products that are parts and components and the fresh and frozen products category by itself.

The results from estimating by 2SLS-IV Eqs. (4)-(5) with the interactions with the time-sensitivity of products are presented in Table 8. The estimates show a generally insignificant difference in the effects for time-sensitive products, relative to the average product. Also, the first-stage regressions in Table 8 show no significant difference in the link between inspections and time for time-sensitive products relative to the average product. The only significant coefficients are of the expected negative sign, indicating stronger import growth of time-sensitive products in response to reductions in customs delays, but they may actually be econometric anomalies given the tiny number of observations used to identify those coefficients in columns (3) and (8).[54] The broad lack of difference in the link between customs clearance time and imports for time-sensitive goods may be simply due to the fact that Albania imports few fresh products and is not heavily involved in global supply chains, as seen in the small share of the sample at the firm-product-country-year level that consists of imports of time-sensitive products in any column.

[54] Unreported results show a substantially larger decline in conditional inspection rates over the sample period for time-sensitive goods only when these are defined as in column (3) and (8) of Table 8.

Table 8. Effect of customs clearance time on imports by time-sensitivity

	Dependent variable is first-diff. in log import value at firm-HS6 product-origin country-year level									
	Clearance time measured in days - 2007-2012 period					*Clearance time measured in hours - 2010-2012 period*				
	Freund et al. (2010) measure parts & short shelf-life	Freund et al. (2010) measure just parts	Freund et al. (2010) measure just short shelf-life	Hummels and Schauer (2013) measure parts & fresh & frozen	Hummels and Schauer (2013) measure just fresh & frozen	Freund et al. (2010) measure parts & short shelf-life	Freund et al. (2010) measure just parts	Freund et al. (2010) measure just short shelf-life	Hummels and Schauer (2013) measure parts & fresh & frozen	Hummels and Schauer (2013) measure just fresh & frozen
	IV estimation									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
First diff. in median clearance time	-1.003***	-1.039***	-0.967***	-0.984***	-0.970***	-0.024***	-0.025***	-0.023***	-0.023***	-0.023***
	(0.159)	(0.160)	(0.174)	(0.154)	(0.150)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
First diff. in median clearance time * Time sensitive dummy	0.242	0.519	-63.675**	0.183	-0.026	0.003	0.010	-1.891**	-0.002	0.008
	(0.438)	(0.431)	(26.262)	(0.846)	(1.223)	(0.019)	(0.019)	(0.896)	(0.030)	(0.052)
Firm-year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HS6-country--year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200,281	200,281	200,281	200,281	200,281	84,298	84,298	84,298	84,298	84,298
R-squared	0.371	0.368	0.139	0.371	0.371	0.44	0.439	0.423	0.44	0.44
F-stat from 1st stage regression	203	203	204	207	203	134	134	134	135	133
First-stage coefficient on first-diff. in median allocation to red channel	0.070***	0.070***	0.070***	0.073***	0.070***	1.969***	1.963***	1.992***	2.053***	1.987***
	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.130)	(0.130)	(0.122)	(0.128)	(0.122)
First-stage coefficient on first-diff. in median allocation to red channel * Time sensitive dummy	-0.004	-0.001	-0.055	-0.029	-0.005	0.127	0.175	-1.674	-0.600	0.038
	(0.009)	(0.010)	(0.043)	(0.010)	(0.025)	(0.324)	(0.327)	(1.995)	(0.357)	(0.882)
Proportion of observations with time sensitive dummy=1	11.7%	10.9%	0.8%	10.8%	1.9%	11.7%	11.1%	0.6%	10.7%	1.8%

Notes: Robust standard errors in parentheses. *** and ** indicate significance at 1% and 5% confidence levels, respectively.

6.3 Heterogeneity across Firm Size

Finally, we examine the differential effects of reductions in customs clearance time on import growth for firms of different size in the importing market. While it is likely that risk-based controls offer positive benefits to all firms that comply with import regulations, it is an open question whether reduced inspections arising from risk-based controls are relatively more favorable for firms that engage in more or less trade. On the one hand, compliant firms that are large/frequent traders might be more likely to receive favorable treatment in the risk models (and to do so sooner) because they have more opportunities to demonstrate their compliance.[55] On the other hand, less frequent traders might be less able to handle unexpected disruptions associated with random inspections.[56]

[55] These firms may also have more to lose from a non-compliant shipment, if the shipment were to cause the level of inspection on subsequent shipments to ratchet upwards. Understanding this, customs might undertake lower levels of inspection on the larger firms.

[56] It may be for example, that infrequent traders are less likely to be able to meet demand through warehouse stock that has already been cleared through customs. Smaller infrequent traders might also bear larger time costs because the capital costs of goods in transit are higher because their options for external financing are less advantageous than those for larger more frequent traders. Our IV strategy is designed to circumvent such issues.

Table 9 shows results from estimating by 2SLS-IV Eqs. (4)-(5) with the variable *Z* being an indicator for small importing firms. Firm size is defined by the firm's total imports in a year (across all HS 6-digit products and origin countries).[57] Small importing firms are those whose total imports are smaller than the median total imports that year in columns (1) and (3) and are those whose total imports are smaller than the 75th percentile of the distribution of total imports that year in columns (2) and (4).[58] The estimates are very clear in showing no significant difference in the link between inspections and customs clearance time and between time and import growth for small firms relative to the average firm. Also, the first-stage regressions show no significant difference in the effect on inspections on customs clearance time for small firms.[59]

Table 9. Estimated effect of customs clearance time on imports by firm size

	Dependent variable is first-diff. in log import value at firm-HS6 product-origin country-year level			
	Clearance time measured in days - 2007-2012 period		*Clearance time measured in hours - 2010-2012 period*	
	IV estimation			
	(1)	(2)	(3)	(4)
First-diff. in median clearance time	-0.981***	-0.980***	-0.020**	-0.026***
	(0.153)	(0.163)	(0.009)	(0.008)
First-diff. in median clearance time * Small firm (imports below median) dummy	0.276		-0.213	
	(0.689)		(0.131)	
First-diff. in median clearance time * Small firm (imports below 75th percentile) dummy		0.048		0.016
		(0.382)		(0.021)
Firm*year fixed effects	Yes	Yes	Yes	Yes
HS6 product*origin country*year fixed effects	Yes	Yes	Yes	Yes
Observations	200,281	200,281	84,298	84,298
R-squared	0.371	0.371	0.298	0.439
F-statistic from first-stage regression	204	203	135	133
First-stage coefficient on First-diff. in median allocation to red channel	0.069***	0.071***	2.020***	1.998***
	(0.004)	(0.004)	(0.124)	(0.133)
First-stage coefficient on First-diff. in median allocation to red channel* Small firm dummy	0.025	-0.007	-1.006	-0.062
	(0.018)	(0.009)	(0.679)	(0.322)
Proportion of observations with small firm dummy=1	8.0%	26.6%	7.8%	25.2%

Notes: Robust standard errors in parentheses. *** and ** indicate significance at 1% and 5% confidence levels, respectively.

[57] We are defining large and small firms according to their import value, which may or may not accord with conventional measures of firm size, such as employment, gross output or value added, measures for which we lack data.

[58] The proportion of HS 6-digit product-origin country-year observations belonging to small firms is always very small.

[59] Unreported results show a somewhat larger decline in conditional inspection rates over the sample period for small firms, particularly when these are defined relative to the median total imports, i.e., as in columns (1)-(2) of Table 9.

7. Effects of Customs Clearance Time on Other Import-Related Outcomes and Effects of Uncertainty in Customs Clearance Time

7.1 Decomposing the Import Intensive Margin Effect

To better understand the compositional effects of time on imports we re-estimate by 2SLS-IV Eqs. (2)-(3) using the same IV strategy but having as dependent variable either the first-difference in log import quantity or the first-difference in the log import unit price (defined as the ratio of the value to the quantity) and present the results in columns (1)-(2) and (5)-(6) of Table 10. The estimates suggest that most of the effect on import values in Table 5 originates from an increase in import quantities as customs time decreases. For the 2007-2012 period when customs clearance time is measured in days (column (2)) there is also a significant positive response from unit prices to declines in customs clearance time.[60] The most plausible interpretation of a negative effect of clearance times on import prices is that reduced time in customs is associated with an increase in the quality of the imported goods, with higher quality reflected in higher prices.

A margin of trade that has received attention recently in the empirical trade literature is the frequency of shipments. Kropf and Saure (2014) and Hornok and Koren (2014) provide evidence suggesting that firms face a trade-off between shipment size and shipment frequency. Cross-sectional evidence in Hornok and Koren indicates that countries with larger measures of per shipment costs see larger, less frequent shipments for a given volume of trade. In the context of the Albanian reforms, those results would suggest that the average value of shipments should fall as inspections are reduced. In order to investigate this issue, we decompose the effect of customs clearance time on import value into the effect on average import value per shipment and the effect on average number of import shipments for a given HS 6-digit product from an origin country by a firm in a year, again re-estimating by 2SLS-IV Eqs. (2)-(3) using the corresponding first-differences as dependent variables. The results in columns (3)-(4) and (7)-(8) of Table 10 suggest that reduced time in customs influence the firms' shipping choices in terms of how many shipments to make - if clearance time declines they make a significantly higher number of shipments – but the effects on average value per shipment are not significant. The absence of the hypothesized effects on shipment sizes may be because our estimation procedure requires a contemporaneous

[60] Our result for import unit prices differs from the absence of an effect of customs time on export unit prices in Volpe Martincus *et al.* (2014).

impact of inspection activity on shipment sizes. Hornok and Koren's cross-sectional evidence implies longer-run adjustment possibilities.[61]

Table 10. Estimated effect of customs clearance time on other import-related outcomes

	Dependent variable is first-diff. at firm-HS6 product-origin country-year level in:							
	log import quantity	log import unit price	log import value per shipment	log number of import shipments	log import quantity	log import unit price	log import value per shipment	log number of import shipments
	Clearance time measured in days - 2007-2012 period				*Clearance time measured in hours - 2010-2012 period*			
	IV estimation							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First-diff. in median clearance time	-0.738***	-0.235***	-0.079	-0.891***	-0.017**	-0.006	0.006	-0.029***
	(0.154)	(0.083)	(0.109)	(0.089)	(0.008)	(0.005)	(0.006)	(0.004)
Firm*year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HS6 product*origin country*year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	200,255	200,255	200,281	200,281	84,293	84,293	84,298	84,298
R-squared	0.416	0.435	0.446	0.257	0.445	0.449	0.44	0.377
F-statistic from first-stage regression	407	407	405	405	267	267	267	267
First-stage coefficient on first-diff. in median allocation to red channel	0.070***	0.070***	0.070***	0.070***	1.987***	1.987***	1.987***	1.987***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.122)	(0.122)	(0.122)	(0.122)

Notes: Robust standard errors in parentheses. *** and ** indicate significance at 1% and 5% confidence levels, respectively.

7.2 Effects on the Extensive Margin of Imports

Our baseline results in Table 5 refer to the intensive margin of trade, that is, growth in imports for an existing firm-product-country. But another important dimension to consider is the effect of the customs reforms and the ensuing reduction in physical inspections on the extensive margin of trade. We define the extensive margin of trade flexibly, calculating (i) the number of importing firms per HS 6-digit product-origin country pair, (ii) the number of origin countries per firm-HS 6-digit product pair, and (iii) the number of HS 6-digit products per firm-origin country pair,. For this purpose we use the data aggregated respectively, to the HS 6-digit product-origin country-year level, the importing firm-HS 6-digit product-year level, and the importing firm-origin country-year level and we define correspondingly the median red channel allocation and time in customs. We apply the same 2SLS-IV strategy as before considering each of the three definitions of the extensive margin in turn and defining each specification appropriately. To illustrate our approach, consider the example of the two-stage specification for the number of importing firms per HS 6-digit- origin country pair that is given by the equations below:

[61] Another explanation might be that the Hornok and Koren estimates rely on the Doing Business data tracking costs of shipment. These are survey data and thus subject to endogeneity concerns. Traders in countries that routinely receive smaller shipments might be expected to report higher levels of cost per shipment.

$$\Delta T_{jct} = \beta_1 \Delta Red\_channel_{jct} + \gamma_{ct} + \gamma_{jt} + v_{jct} \quad (6)$$

$$\Delta \log Nb\_firms_{jct} = \beta_2 \Delta \hat{T}_{jct} + \gamma_{ct} + \gamma_{jt} + \epsilon_{jct} \quad (7)$$

where Nb_firms_{jct} is the number of importing firms in an HS 6-digit product-country-year cell, first-differences are calculated with respect to the HS 6-digit product-origin country and the subscripts are as before.[62] The use of first-differences again implies that the effects of inspections on time and of time on the extensive margin of trade are identified based on within variation. The HS 6-digit product-year and the origin country fixed effects that are included account for trade policy, transport costs, and demand shocks that might also have influenced the extensive margin of trade. Equations that are parallel to Eq. (6)-(7) are defined for the number of origin countries per firm-HS 6-digit product pair ($\Delta \log Nb\_countries_{ijt}$) and for the number of HS 6-digit products per firm-origin country pair ($\Delta \log Nb\_products_{ict}$), with a corresponding adjustment to the fixed effects included.[63]

Columns (1)-(2) of Table 11 present the 2SLS-IV estimates of Eqs. (6)-(7) that show a significant positive effect of reductions in customs clearance time on the number of importing firms. Combining the first- and second-stage estimates in column (1), we can see that a reduction in the median assignment to the red channel saw an approximate 4 percent increase in the number of firms importing that product-country pair.[64] Column (2) reports the impacts from the shorter sample that has continuous time measures available. These estimates suggest impacts of a similar magnitude, approximately 6.3 percent growth in the number of trading firms among product-country pairs that saw a reduction in the median allocation to the red channel. Columns (3)-(4) show that the number of countries per firm-product pair also increased significantly as a result of the reductions in inspections and resulting reductions in customs clearance time. Combining the first- and second-stage estimates in column (3) implies that a reduction in the median assignment to the red channel resulted in an increase of 1.7 percent in the number of origin countries from

[62] The median allocation to the red channel is in this case defined as equal to 1 if more than 50% of import declarations of an HS 6-digit product-origin country in a year are inspected and the median time in customs is calculated based on all import declarations for an HS 6-digit product-origin country in a year.

[63] Also the definition of the median allocation to the red channel and of the median time in customs are adjusted in each case. For the number of HS 6-digit products per firm-origin country pair, the median allocation to the red channel is equal to 1 if more than 50% of import declarations of a firm-origin country in a year are inspected and the median time in customs is calculated based on all import declarations for a firm-origin country in a year. For the number of origin countries per firm-HS 6-digit product pair the median allocation to the red channel is equal to 1 if more than 50% of import declarations of a firm-HS 6-digit product in a year are inspected and the median time in customs is calculated based on all import declarations for a firm-HS 6-digit product in a year.

[64] This magnitude is calculated as ($e^{(-0.587*0.066)}$-1) = 0.040.

which that firm-product pair imports.[65] The effects of reductions in customs clearance time on the number of imported products are insignificant in column (5). The estimates in column (6) suggest a close to 4.6 percent growth in the number of products among firm-country pairs that saw a reduction in the median allocation to the red channel.[66]

Table 11. Estimated effect of customs clearance time on the numbers of importing firms, imported products and origin countries

	Dependent variable is first-difference in log number of importing firms at HS6 product-origin country-year level		Dependent variable is first-difference in log number of origin countries at importing firm-HS6 product-year level		Dependent variable is first-difference in log number of HS6 products at importing firm-origin country-year level	
	Clearance time measured in days - 2007-2012 period	*Clearance time measured in hours - 2010-2012 period*	*Clearance time measured in days - 2007-2012 period*	*Clearance time measured in hours - 2010-2012 period*	*Clearance time measured in days - 2007-2012 period*	*Clearance time measured in hours - 2010-2012 period*
	IV estimation		IV estimation		IV estimation	
	(1)	(2)	(3)	(4)	(5)	(6)
First-diff. in median clearance time	-0.587***	-0.022***	-0.195***	-0.011***	-0.072	-0.013***
	(0.077)	(0.003)	(0.027)	(0.002)	(0.071)	(0.005)
HS6 product*year fixed effects	Yes	Yes	Yes	Yes		
Origin country*year fixed effects	Yes	Yes			Yes	Yes
Firm*year fixed effects			Yes	Yes	Yes	Yes
Observations	94,872	39,709	186,900	77,269	56,890	24,187
R-squared	-0.258	-0.16	0.145	0.083	0.516	0.449
F-statistic from first-stage regression	154	196	491	286	191	102
First-stage coefficient on first-diff. in median allocation to red channel	0.066***	2.760***	0.084***	2.245***	0.135***	3.429***
	(0.005)	(0.197)	(0.004)	(0.133)	(0.010)	(0.340)

Notes: Robust standard errors in parentheses. *** indicates significance at 1% confidence level. The first-difference in median allocation to the red channel and in median clearance time is defined differently across columns: in columns (1)-(2) it is a first-difference with respect to HS 6-digit product-origin country, in columns (3)-(4) it is a first-difference with respect to importing firm-HS 6-digit product, and in columns (5)-(6) it is a first-difference with respect to importing firm-origin country.

7.3 Effects of Dispersion in Customs Clearance Time on Import Values

The focus on changes in median customs clearance time obscures the effects that reductions in physical inspections may have had on the dispersion of customs clearance time and the potential ensuing effects on import growth. The recent study by Clark *et al.* (2013) focuses on uncertainty as a trade barrier, and the uncertainty about the time needed to clear customs is likely to be an important dimension of uncertainty. To address this issue we calculate the interquartile range in customs clearance time for each firm-HS 6-digit product-origin country within each year.[67] We then take its first difference at the firm-HS 6-digit product-origin country level and include that

[65] This magnitude is calculated as $(e^{(-0.195*0.084)}-1) = 0.017$.

[66] This magnitude is calculated as $(e^{(-0.013*3.429)}-1) = 0.045$.

[67] Our choice of interquartile range instead of the standard deviation is aimed at minimizing the influence of transactions with more extreme delays at customs for a given firm-HS 6-digit product-origin country in a given year. It is also preferred, relative to statistics derived from the second moment, because the functional forms that derive those statistics contain the number of shipments in the denominator, and the number of shipments also affects the left-hand-side variable.

measure instead of ΔT_{ijct} as the dependent variable in Eq. (2) and the corresponding predicted value is then used in Eq. (3) in our 2SLS-IV estimation. The results are shown in columns (1)-(2) of Table 12 and suggest that reform-induced reductions in physical inspections led to significantly lower dispersion in customs clearance time and in turn this resulted in significant import growth at the firm-product-country intensive margin. Unfortunately, we are unable to estimate joint impacts of changes in the median and the interquartile range of time in customs because we have a single instrument, changes in the pseudo-random assignment to the red channel of inspection.[68] We do show in columns (3)-(4) of Table 12 the (admittedly flawed, nevertheless informative) results from re-estimating Eqs. (2)-(3) by 2SLS-IV with the interquartile range of clearance time as the endogenous variable instrumented by changes in the median allocation to the red channel, but also including median clearance time as a control variable. The finding that reductions in the probability of inspection reduce dispersion in customs clearance times, and that reduced dispersion increases imports is qualitatively maintained.

Finally, we allow for longer-term effects of the dispersion in customs clearance time on import values by limiting the sample to observations in 2007 and 2012 that occur in both years and re-estimating by 2SLS-IV Eqs. (2)-(3) focusing on long-differences in the interquartile range of customs clearance time as the dependent variable in the first-stage regression. This exercise does for dispersion of clearance times what Table 6 does for median clearance times. Column (5) of Table 12 includes only HS 6-digit product-country fixed effects while column (6) of Table 12 includes firm fixed effects in addition to product-country fixed effects. Our estimates show that, in contrast to what was shown in Table 6 for median clearance time, when the interquartile range of customs clearance time is used the long-run effects are clear-cut and do not depend on the type of fixed effects included: reductions in physical inspections between 2007 and 2012 significantly reduce the dispersion in customs clearance time, and this in turn leads to significant import growth over the longer term.

[68] Because the distribution of clearance times is strongly right-skewed, it is likely that the reductions in the median time in customs and in the interquartile range are related. Indeed the correlation across those two measures (calculated at the firm-product-country-year level) across the 2007-2012 period is 0.26 and statistically significant.

Table 12. Effect of dispersion in customs clearance time on imports

	Dependent variable is first-difference in log import value at firm-HS6 product-origin country-year level				Dependent variable is long-difference in log import value at firm-HS6 product-origin country level	
	Clearance time measured in days - 2007-2012 period	*Clearance time measured in hours - 2010-2012 period*	*Clearance time measured in days - 2007-2012 period*	*Clearance time measured in hours - 2010-2012 period*	*Clearance time measured in days - 2007-2012 period*	
	IV estimation		IV estimation		IV estimation	
	(1)	(2)	(3)	(4)	(5)	(6)
First-diff. in interquartile range of clearance time	-1.327***	-0.027***	-1.907***	-0.030**		
	(0.239)	(0.009)	(0.434)	(0.013)		
First-diff. in median clearance time (not instrumented)			0.424***	0.003		
			(0.115)	(0.003)		
Long-diff. in interquartile range of clearance time					-3.278***	-3.893*
					(1.255)	(2.189)
Firm*year fixed effects	Yes	Yes	Yes	Yes		
HS6 product*origin country*year fixed effects	Yes	Yes	Yes	Yes		
Firm fixed effects					No	Yes
HS6 product*origin country fixed effects					Yes	Yes
Observations	200,281	84,298	200,281	84,298	14,556	14,556
R-squared	0.132	0.379	-0.164	0.36	-0.948	-0.621
F-statistic from first-stage regression	170	165	5,874	2,461	18	10
First-stage coefficient on first-diff. in median allocation to red channel	0.051***	1.725***	0.033***	1.218***		
	(0.004)	(0.134)	(0.004)	(0.131)		
First-stage coefficient on first-diff. in median clearance time (not instrumented)			0.264***	0.255***		
			(0.002)	(0.004)		
First-stage coefficient on long-diff. in median allocation to red channel					0.055***	0.046***
					(0.013)	(0.015)

Notes: Robust standard errors in parentheses. ***, **, and * indicate significance at 1%, 5%, and 10% confidence levels, respectively.

8. Conclusion

One of the rare successes so far of the Doha "development" round of WTO negotiations is a recently concluded comprehensive agreement on trade facilitation. Most of the reform activities that will take place as a result of this agreement will occur in developing countries. Yet little is known, formally, about the impacts of such reforms. Albania's reforms - which are already well under way because of the demands of its prospective EU accession - offer important evidence on the effects of trade facilitation measures in a middle-income country. In this study we use a dramatic reduction in physical inspection of imported goods by the Albanian customs authority to estimate the impact of inspections on time and of time on import value. An important feature of the Albanian inspection regime is that it employs risk-based selection procedures. These procedures underpin the reduction in inspections we observe, and they are central to our strategy for econometric identification.

Our estimates show that conditional reductions in physical inspection rates lead to significantly lower delays in customs for Albanian imports. In turn, the reduction in median days in customs

leads to a significant increase in imports at the firm-HS 6-digit product-origin country level. The reform has a disproportionate impact on imports from the EU, and this appears to be due to those imports' greater sensitivity to reduced time at the border. We also show that the intensive margin effects on imports of reduced clearance time are driven by an important increase in quantities (accompanied by a more modest increase in unit values) and by an increase in the average number of shipments (whereas imports per shipment do not change). Reduced delays in customs also increase imports at the extensive margin in terms of the number of importing firms. Reduced inspections also reduce the variability of time spent under customs control and this also increases trade. It appears that there are no differential effects operating through clearance times for time-sensitive products or for small firms.

Some rough calculations using our estimates are useful for putting the customs reforms in an economic context. Our unit of analysis is the importing firm-HS 6-digit product-origin country-year, and the probability that this unit saw more than half of its shipments subjected to physical inspection fell by 21 percentage points during the period of our sample. We estimate that units that saw inspection rates fall from half or more to less than half of shipments saw contemporaneous growth in imports that was 7 percent higher than those that did not. Under an assumed response of import growth to trade costs, this is consistent with a 1.8 percent reduction on the affected observations, and 0.36 percent ad valorem if the estimated effects were applied proportionally to all shipments. Applying this estimate to the value of Albania's non-oil imports in 2012 suggests that reversing the reform would have increased Albanian trade costs in 2012 by approximately 12 million US dollars.

The reforms to Albanian customs that drove the variation used in our analysis are similar in nature to that which would be required of a country that was newly integrating risk management into its customs agency. A related reform that has not yet been fully implemented in Albania (and in many other countries) is the adoption of risk management techniques by other technical agencies that operate at national borders, including those that certify compliance with food safety, animal health or environmental protection standards. The estimates in this paper are most suited to an understanding of the effects of such reforms in a customs environment. Evaluation of reforms in other agencies remains a question for future research.

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Appendix A: Distribution of time in customs

Figure A1. Box plots for time to clear customs for Albanian imports

Note: the box plots show the distribution of the number of days to clear customs for the observations taking more than 1 day to clear customs.

Appendix B: Conditional Exogeneity of Allocation to Red Channel

Our econometric model estimates the impact of customs clearance time at the firm-HS 6-digit product-origin country-year level on the corresponding firm-HS 6-digit product-origin country-year import values (and other import-related outcomes) accounting for firm-HS 6-digit product-origin country unobserved heterogeneity and conditioning on product-origin country combinations each year and on firms each year. These fixed effects control for variables that are likely to be important for the risk model the Albanian customs agency uses to select transactions for targeted red channel inspections.

A fundamental assumption that lies behind this strategy is that the allocation to the red channel for physical inspections is random, conditional on the vector of fixed effects included in our econometric model. Random allocation is an important component of the automated allocation decisions that are based on the potential risk factors considered by the Albanian customs agency in following risk management principles. In Section 3 we show that the automated system is responsible for allocation to the red channel in the vast majority of cases.[69] At issue then, is simply whether or not our fixed effects are sufficient to isolate random variation of the kind that drives red channel allocations by the automated system.

The statistical risk model of the Albanian customs agency is confidential, so we are unable to reproduce it ourselves. The technical customs literature documents that it should combine information on different shipment characteristics to produce a 'risk score' for the shipment.[70] Conditional on its risk score the allocation of a shipment to the red channel for physical inspections

[69] We refer here to the evidence in Table 3 that there are relatively few cases in which the inspection of documents leads an agent to override the automated system's allocation to the yellow channel and decide that the goods should be subject to physical inspection in the red channel.

[70] Geourjon *et al.* (2013) describe how simple statistical scoring techniques exploiting shipment characteristics are being used by the customs agency in Senegal to assess risk and thus effectively limit physical inspections. Also using Senegalese customs data, where the focus of risk management is improved revenue collection, Laporte (2011) compares several simple statistical targeting models, demonstrating that the effectiveness of targeting is not overly sensitive to functional form.

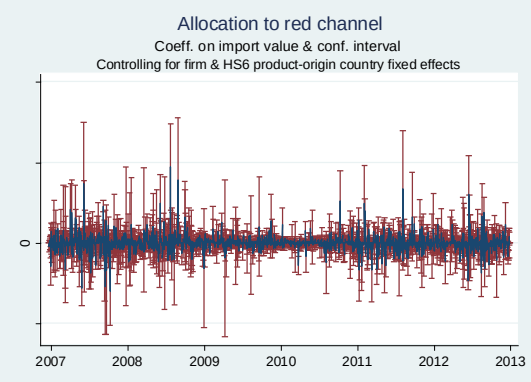
should be random. That literature along with our discussions with customs experts suggest that the importing firm, the product, and the origin country are important shipment characteristics influencing the risk of the shipment. [71]

We follow Volpe Martincus *et al.* (2014) in conducting some exercises designed to demonstrate that, after controlling for a comprehensive vector of fixed effects, plausible sources of endogeneity in the allocation of declarations to the red channel appear to be absent in our data. This is important for motivating the first-stage regression of the IV strategy that links red channel allocations to the time spent in customs. To apply their approach to the Albanian customs agency's allocation of import shipments to the red channel, we estimate the equation below using data at the firm-HS6 product-origin country-day level:

$$Red\_channel_{ijcd} = \alpha^d M_{ijcd} + \gamma_i + \gamma_{jc} + u_{ijcd} \qquad \text{(B1)}$$

where d stands for a day (of a given month of a given year), the other subscripts are as in the description of Eq. (1), and u_{ijcd} is an i.i.d. error. $Red\_channel_{ijcd}$ is an indicator variable equal to 1 if more than 50% of import shipments of a firm-HS 6-digit product-origin country in a day are allocated to the red channel and zero otherwise, and M_{ijcd} is the import value summed across all shipments of the firm-HS 6-digit product-origin country in day d. Eq. (B1) is estimated by OLS separately for each day d in the period 2007-2012 obtaining the corresponding coefficients α^d.[72] Figure B1 shows the estimated α^d and their confidence intervals.[73] The estimated α^d are insignificantly different from 0 in all regressions. Hence, the evidence shows no systematic relationship between the import value of firm-HS 6-digit product-origin country in a day and its allocation to the red channel, after conditioning on firm and on HS 6-digit-origin country fixed effects.

Figure B1. Allocation to the red channel and import value



Note: the figure shows coefficients (the darker mass close to the horizontal line at 0) and the confidence intervals (the vertical bars) from each daily regression corresponding to Eq. (B1) with more than 20 degrees of freedom.

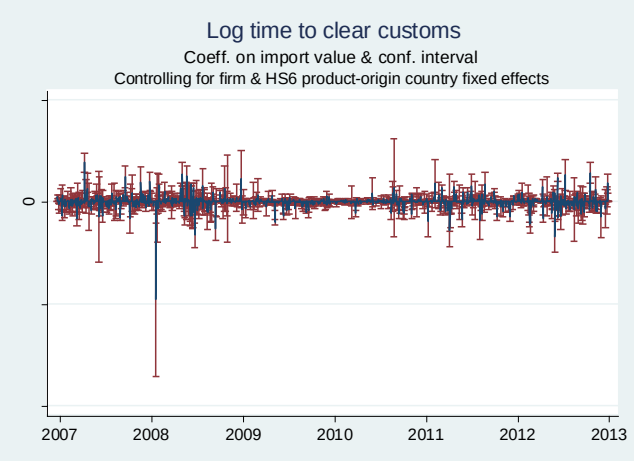
[71] We do not have information on the exporting firm (outside Albania), which is also likely to be a key input into the risk model. But because we conduct our econometric analysis at the importing firm-product-country-year level this is only problematic if importing firms source products from more than one firm in the same origin country and in the same year, and if those exporting firms enter differently into the risk profiles. In detailed Peruvian data Carballo *et al.* (2014) find that 90% of Peruvian importers import a given HS 10-digit product from a single exporting firm.

[72] Due to the large number of fixed effects and since we do not need to make predictions about red channel allocation we choose to estimate a linear probability model rather than a probit model for Eq. (A1).

[73] Figure B1 shows only the coefficients for the 1857 (out of 2196) daily regressions with more than 20 degrees of freedom.

We also estimate a variant of Eq. (B1) whose dependent variable is the median clearance time at the firm-HS 6-digit product-origin country level each day. Figure B2 shows that clearance time is also independent of the import value, after conditioning on firm and on HS 6-digit-origin country fixed effects.

Figure B2. Time to clear customs and import value



Note: the figure shows coefficients (the darker mass close to the horizontal line at 0) and the confidence intervals (the vertical bars) from each daily regression shown in Eq. (B1) (with time to clear customs as the dependent variable) with more than 20 degrees of freedom.

Another possible source of systematic variation in the inspection decisions that would not be controlled for by our fixed effects is serial correlation in the inspection decision. Risk management systems are designed to use information from prior inspections to inform current decisions. In particular, a firm that is non-compliant in one inspection will tend to face higher levels of scrutiny in the future. As we demonstrated in Section 3, the infraction data shows extremely low levels of non-compliance, at least when non-compliance is indicated by the existence of a penalty. Low levels of non-compliance indicate that serial correlation is not likely to be a large problem because, it would seem, there are relatively few cases that warrant significantly higher levels of subsequent scrutiny. In any case, the evidence in Section 3 can be buttressed by formal tests for serial correlation.

To check whether allocation to the red channel is serially uncorrelated we estimate the equation below again using data at the firm-HS6 product-origin country-day level:

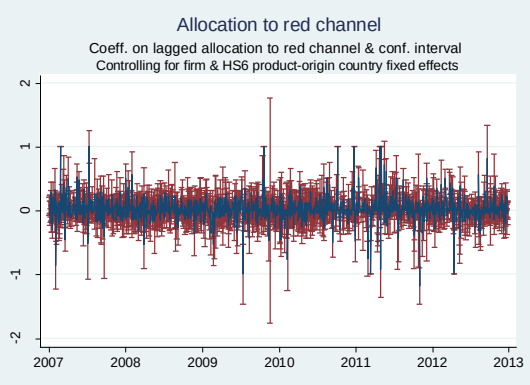
$$Red\_channel_{ijcd} = \pi^d Red\_channel_{ijcd_{lag}} + \gamma_i + \gamma_{jc} + u_{ijcd} \qquad \text{(B2)}$$

where d_{lag} stands for the previous day when an import was made by the same firm of the same HS 6-digit product from the same origin country, and all else is as above. Eq. (B2) is estimated by OLS separately for each day d in the period 2007-2012. The corresponding coefficients π^d and their confidence intervals are shown in Figure B3.[74] The estimated π^d is insignificantly different from 0 in all regressions. Hence, the fact that the majority of shipments of a firm-HS 6-digit product-origin country are allocated to the red channel at a given date provides no information on

[74] Figure B3 shows only the coefficients for the 1689 (out of 2188) daily regressions with more than 20 degrees of freedom.

whether similar shipments will be allocated to the red channel the next time they are imported, conditional on firm and on HS 6-digit-origin country fixed effects.

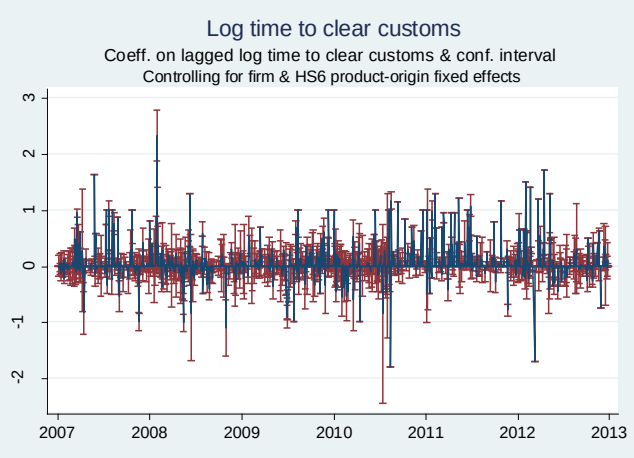
Figure B3. Allocation to the red channel and its lag



Note: the figure shows coefficients (the darker mass close to the horizontal line at 0) and the confidence intervals (the vertical bars) from each daily regression shown in Eq. (B2) with more than 20 degrees of freedom.

Finally, we also estimate a variant of Eq. (B2) whose dependent variable is the median time taken to clear customs by the shipments of a firm-HS 6-digit product-origin country in a day. Figure B4 shows that clearance time is also serially uncorrelated, conditional on firm and on HS 6-digit product-origin country fixed effects.

Figure B4. Time to clear customs and its lag



Note: the figure shows coefficients (the darker mass close to the horizontal line at 0) and the confidence intervals (the vertical bars) from each daily regression shown in Eq. (B2) (with time to clear customs as the dependent variable) with more than 20 degrees of freedom.

Appendix C: Conditional inspections by type of country

Table C1. Conditional change in inspections by type of country over the sample period

	Dependent variable is median allocation to red channel at firm-HS6 product-origin country-year level									
	Sample of imports from:									
	Preferential Trade Agreement countries	Non-Preferential Trade Agreement countries	Rich countries	Poor countries	Rich EU countries	Other rich countries	Poor countries	EU countries	CEFTA countries and Turkey	Other countries
	OLS estimation									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Year 2008	-0.035***	-0.051***	-0.039***	-0.038***	-0.036***	-0.069***	-0.038***	-0.037***	-0.022***	-0.051***
	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.010)	(0.005)	(0.003)	(0.007)	(0.005)
Year 2009	-0.124***	-0.089***	-0.121***	-0.108***	-0.118***	-0.152***	-0.108***	-0.123***	-0.135***	-0.089***
	(0.003)	(0.006)	(0.003)	(0.005)	(0.003)	(0.011)	(0.005)	(0.003)	(0.008)	(0.006)
Year 2010	-0.176***	-0.111***	-0.173***	-0.134***	-0.174***	-0.170***	-0.134***	-0.177***	-0.170***	-0.111***
	(0.003)	(0.006)	(0.003)	(0.005)	(0.003)	(0.011)	(0.005)	(0.003)	(0.008)	(0.006)
Year 2011	-0.216***	-0.143***	-0.213***	-0.168***	-0.214***	-0.208***	-0.168***	-0.218***	-0.206***	-0.143***
	(0.003)	(0.006)	(0.003)	(0.005)	(0.004)	(0.011)	(0.005)	(0.003)	(0.009)	(0.006)
Year 2012	-0.220***	-0.171***	-0.220***	-0.186***	-0.216***	-0.253***	-0.186***	-0.221***	-0.215***	-0.171***
	(0.003)	(0.006)	(0.004)	(0.005)	(0.004)	(0.012)	(0.005)	(0.004)	(0.009)	(0.006)
Year 2007 (constant)	0.421***	0.567***	0.413***	0.556***	0.410***	0.447***	0.556***	0.414***	0.459***	0.567***
	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)	(0.008)	(0.004)	(0.002)	(0.006)	(0.004)
Firm*HS8*country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	523,100	193,125	473,939	242,286	420,593	53,346	242,286	436,087	87,013	193,125
R-squared	0.749	0.82	0.749	0.807	0.742	0.805	0.807	0.744	0.773	0.82

Note: Standard errors in parentheses. *** indicates significance at the 1% confidence level.