IDB WORKING PAPER SERIES Nº IDB-WP-703

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Integration and Trade Sector

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Cataloging-in-Publication data provided by the
Inter-American Development Bank
Felipe Herrera Library

Carballo, Jerónimo.
Trust no one?: security and international trade / Jerónimo Carballo, Georg Schaur, Christian Volpe Martincus.
p. cm. — (IDB Working Paper Series ; 703)
Includes bibliographic references.
1. Ports of entry-Security measures-Economic aspects-Mexico. 2. Customs administration-Mexico. 3. Exports-Mexico. 4. Mexico-Commerce. I. Schaur, Georg. II. Volpe Martincus, Christian. III. Inter-American Development Bank. Integration and Trade Sector. IV. Title. V. Series.
IDB-WP-703

http://www.iadb.org

Trust No One?
Security and International Trade♦

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This version: March 2016

Abstract

Security concerns in a context of increasingly segmented supply chains have led to stricter border control measures, which may potentially negatively affect international trade. Customs around the world have therefore implemented security-motivated certification programs to facilitate licit trade. These programs offer trustworthy trading firms, i.e., Authorized Economic Operators (AEOs), several advantages in the administrative processing of their shipments including less frequent physical inspections and expedited customs clearance. In this study we focus on Mexico's AEO Program NEEC. In particular, we evaluate the impact of this program by primarily carrying out differences-in-differences estimations on highly disaggregated firm-level data that cover the entire universe of export and import transactions of the country over the period 2009-2014. Estimation results suggest that NEEC has been associated with less physical inspections and shorter clearance times and has thereby favored increased firms' exports. Effects seem to be stronger on the frequency of shipments and on consumer goods, industrial inputs, and capital goods.

Keyword: Security, Authorized Economic Operator, Trade, Mexico
JEL-Code: F10, F13, F14

♦ We would like to thank Federico Bennett and Carlos Salamanca Malagón for their excellent research assistance and Leticia Contreras Sánchez, Sandra Corcuera Santamaría, María de Lourdes Rosas Landa Flores, María Elena Sierra Galindo, and Francisco Tapia Pérez for helping us build the dataset used in this paper. We are also grateful to Bruce Blonigen, Juan José Bravo, Leticia Contrera Sánchez, Sandra Corcuera Santamaría, Alejandro Graziano, Anna Maria Mayda, María Elena Sierra Galindo, Elizabeth Tritt, and participants at the IDB Workshop on Trade Facilitation (Washington), the IDB Regional Workshop on Authorized Economic Operators Program in Latin America and the Caribbean (Washington), the ELSNIT Conference on Trade Facilitation (Kiel), and the IDB-WCO-FMI VIII Annual Donor Working Group Meeting for Latin America and the Caribbean (Washington) for helpful comments and suggestions. The views and interpretations in this paper are strictly those of the authors and should not be attributed to the Inter-American Development Bank, its executive directors, its member countries, or Mexico's SAT. Other usual disclaimers also apply.
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1 Introduction

The growth of trade has been remarkable in recent decades. Its share in global output quadrupled relative to the early 1950s (see Saito et al., 2013). To a significant extent, such development has been driven by increasing vertical specialization and the consequent emergence of supply chains that involve multiple border crossings and several economic agents spread across different jurisdictions (see Hummels et al., 2001).[1] The complexity of this network of international trade transactions has profound security implications. In particular, specific actions by individual actors became less visible; the potential for security breaches associated with terrorism or in the form of drug and contraband smuggling is potentially higher; and as the attacks on the United States in September 2001 made everybody aware of, the consequences could be dramatic.

Agencies tasked with border controls have reacted to these increased security threats by introducing tighter border control measures. Given that these measures could create additional costs and thereby negatively affect firms' trade, various initiatives were also implemented to facilitate licit trade in this new context (see Mirza and Verdier, 2014). Supply chain security-motivated programs for "trustworthy firms" or simply Authorized Economic Operators (AEO) stand out in this group of initiatives. AEO are firms certified by (or on behalf of) the national customs as complying with relevant supply chain security standards based on an exhaustive scrutiny of their plants and their tax and customs behavior. As such, these firms are entitled to trade facilitation benefits primarily consisting of access to express processing lanes, less frequent physical inspections and, when their shipments are subject to these inspections, reduced clearance times. These programs, covered in the 2013 WTO Agreement on Trade Facilitation, are conceived as cooperative arrangements between public border agencies and private sector firms that seek to extend controls up and down the supply chain by focusing on (the *ex ante* evaluation of) firms' premises, practices, procedures, and documentation instead of focusing on (checking) their individual shipments. Whether this kind of programs actually makes a difference in terms of foreign trade is completely unknown. In this paper, we shed light on this issue by assessing the impact of Mexico's AEO program NEEC (*Nuevo Esquema de Empresas Certificadas* – New Scheme of Certified Firms) on their firms' trade by exploiting a unique database that includes transaction-level export and import data over the period 2009-2014 and information on the firms' certification status with both the NEEC and other customs' certification programs.

[1] De Backer and Miroudot (2014) and Miroudot and Nordström (2015) show that the length of supply chains increased in recent decades both in terms of the number of production stages and the implied sourcing distance, the latter at an average pace of 40 kilometers a year.

In the old days, the buyers would board a ship and travel overseas, identify the goods they were looking for, pay for them, load the goods into the ship, return to their home country aboard the ship with their goods, unload the goods, pay the customs duties, and sell them in the domestic market (see Hesketh, 2010). Nowadays international trade transactions are far more complex. The number of actors and operations is substantially larger. Importantly, given that these transactions spread across multiple jurisdictions, there are several concurrent (national and international) security regimes, which resembles the preferential trade agreements' spaghetti bowl (see Grainger, 2007). Further along these lines, the seller, who knows exactly what is being shipped, is outside the jurisdiction of the importing country's border agencies, so these agencies generally turn to the carrier, whose information is not always accurate, and hold the importers legally accountable for goods they have probably never seen (see Hesketh, 2010). In this context, the scope for security breaches is high and part of the importer's challenge is to find foreign suppliers that are trustworthy.

In the aftermath of the September 11, 2001 terrorist attacks on the United States, this and other countries around the globe begun to recognize the need to address these potential vulnerabilities associated with the configuration of supply chains by means of tighter security measures while facilitating licit trade (see Aigner, 2010; and Altemöller, 2011). International efforts resulted in the WCO's SAFE Framework of Standards to Secure and Facilitate Global Trade in 2005. The SAFE Framework provides customs administrations with a procedure model to facilitate the movement of goods through secure international trade supply chains based on the establishment of cooperative arrangements between the border agencies and between these agencies and the private sector (see Tweddle, 2008; and Aigner, 2010). It encompasses four main elements: harmonization of information requirements; use of consistent risk management approach; carrying out outbound inspection of high risk cargos ideally with non-intrusive methods upon request from receiving nations (with comparable risk targeting methodology); and granting of (customs') benefits to firms that meet certain supply chain security standards (see WCO, 2012). Precisely, in 2007 this framework incorporated detailed provisions for AEO programs. These streamlined and consolidated multiple national initiatives starting with the United States' C-TPAT (Customs-Trade Partnership Against Terrorism) launched in 2002 and followed by the European Union's AEO with the amendment of the Community Customs Code in 2005 (see Laden 2007; and Altemöller, 2011).[2]

AEO is a voluntary security certification program. In order to get certified, firms have to apply with customs administrations and are subject to an exhaustive auditing process. In general, eligibility criteria include: record of compliance with customs requirements; satisfactory system of managing commercial

[2] Other United States' leading initiative was the Container Security Initiative (CSI). The CSI provides for the identification of high-risk containers, a non-intrusive inspection (X-Ray) of suspicious containers, and the use of security devices that make it possible for customs officers to determine whether the containers were opened while in transit and its load manipulated (see Altemöller, 2011).

records and, whenever applicable, transport records which allow for appropriate customs control; proven financial solvency; and adequate security and safety standards. Firms satisfying these criteria are considered reliable and can become AEO. From this point of view, this is equivalent to the US international passengers' program *Global Entry* for international trade.

AEO firms are entitled to a number of trade facilitation advantages. Among others, these advantages consist of: less frequent physical and documentary customs' inspections as they are assigned a lower risk score in the customs' risk management system; expedited processing and release of shipments, which specifically involves priority treatment when selected for inspection as well as priority during periods of elevated threat conditions or in post-incident resumptions; streamlined administrative compliance procedures, which encompass the use of simplified customs declaration forms. All these advantages translate into shorter clearance times at the border, lower per shipment costs and generally trade costs, and thereby increased shipping flexibility. This is likely to provide certified exporters with a competitive edge.

In addition, AEO certification could be a "quality" mark whereby it serves as a signaling mechanism that reduces information barriers. More specifically, AEO security and safety status indicates that the firm, apart from being reliable in the traditional customs and financial terms, is also compliant in respect of security and safety standards and can therefore be considered a "secure" trader and thus a reliable trading partner (see Tweddle, 2008). If importers are concerned with long-term supply chain relationships and compliance with local regulations, then they will value these exporters' characteristics.

However, obtaining AEO status is not free. The cost of certification varies across firms, depending primarily on the improvements they have to introduce to meet the safety and security eligibility criteria and the size of their facilities, among others. According to a recent survey conducted by the IDB among approximately 140 Latin American AEO firms, the certification costs range from less than 5,000 US dollars to more than 1 million US dollars, with a median value of 22,500 US dollars (see Corcuera Santamaria and Garcia Navarrete, 2014). As with any certification, keeping the status also involves costs (e.g., security personnel, maintenance costs of security devices such as cameras, annual membership fees when applicable such as in Mexico, etc.). The same survey revealed that these costs could be as low as 2,000 US dollars and as much as 100,000 US dollars with a median value of 10,000 US dollars (see Corcuera Santamaria and Garcia Navarrete, 2014). From a theoretical point of view, AEO firms can then be considered to incur a fixed cost to obtain a certificate which gives them access to a trade technology that is associated with lower variable (and per shipment) trade costs. Broadly speaking, this is similar to how firms' technology upgrading is modeled. In that case, firms pay a fixed cost to adopt a new production technology that implies reduced variable production costs (see, e.g., Bustos, 2011).

In recent years there has been literally an avalanche of supply chain security-motivated schemes (see Grainger, 2007). As shown in Figure 1, worldwide there are 64 AEO active programs (28 in Europe) and 16 additional ones are to be launched (see WCO, 2015).

While the number of certified firms varied widely across countries (see WCO, 2015), these firms generally account for a substantial share of their countries' trade. Thus, in the United States there are more than 4,200 C-TPAT certified trading firms that jointly represent roughly 54% of the country's total import value, while in the European Union, the involvement of the more than 7,500 certified firms in the supply chain exceeds 50% as measured in terms of their share in the total number of customs' declarations (see AEO Network Group, 2013; and EC Taxation and Customs Union, 2016).[3] Japan has roughly 250 AEO exporters and 100 AEO importers and China has certified 1,600 companies. In Mexico, more than 400 firms obtained the NEEC certification. These generally large firms only account for 1.4% of the total number of exporters but are responsible for more than 40% of Mexico's total exports. Despite the coverage of these programs in terms of traded values in most large trading nations and the involvement of multiple global firms, so far there is no evidence on whether and, if so, how AEO schemes affect trade.

Our paper precisely addresses two main questions: First, to what extent do security-motivated supply chain programs such as the NEEC facilitate trade? Second, what are the effects of the associated customs' security certification on firms' export outcomes such as quantities, prices, and shipping frequencies? To answer these questions, we first carry out differences-in-differences estimations on a unique dataset that includes all export transactions originated in Mexico over the period 2009-2014 and, as a novelty, informs which of these transactions correspond to NEEC firms. In addition, we examine the channels through which effects arise and investigate whether these effects are heterogeneous across groups of products and destinations.

To preview our main findings, we find that NEEC certification has been associated with increased firms' exports. This positive impact originates from both lower rates of physical inspection and shorter customs clearance times, which allows for decreased export costs and more frequent shipments. Our findings also suggest that the program increases trade above and beyond the effect working through lead time delays on the export side. This additional effect can be attributed to reductions in information asymmetries thanks to quality signaling and greater flexibility. Further, the impact we identify is largest for industrial inputs. This highlights the importance of these types of trade facilitation measures for trade in intermediate inputs and global value chains in general.

Our identification strategy faces the challenge that firms may self-select into the certification program. In particular, fast growing firms with promising export opportunities may be more likely to

[3] C-TPAT is available for importers, carriers, customs brokers, port operators, freight consolidators, third part logistic providers, and foreign firms (Mexican and Canadian) manufacturers (see Irish, 2009). When all these categories are considered, the total number of certified companies reaches 10,832.

join. To address this issue, we exploit the timing of the certification. More specifically, given that firms can become certified during a calendar year, there are generally firm-product-destination export flows under different certification status (certified and non-certified) for a given firm within a given year.[4] This allows for introducing a firm-year fixed effect that accounts for all time-varying firm-level factors which may be correlated with both the certification status –notice that all eligibility criteria are firm-specific- and trade outcomes, including firms' productivity.

On top of this, we carry out several robustness checks. First, we restrict the sample to firms that get their security certification with no more than one year of difference. Since the certification process can take up to one year, we are primarily comparing exports from firms that already applied and are about to be certified and those of firms that are already certified, thereby accounting for systematic differences in the probability to participate in the program, which could be associated, for instance, with differences in the managerial teams (e.g., in terms of their knowledge of public programs and their pro-activeness). Second, we conduct a falsification exercise whereby we artificially assume that firms obtained their certification one or two years before the actual certification year. Third, it can still be argued that firms may decide to get a certification based on specific exports, i.e., large exports of given products to given destinations. We therefore alternatively limit the sample to those importing countries whose shares in Mexico's or firms' total exports in the pre-certification period (2009-2011) do not belong to the top 10% or the top 25% of the respective distribution across destinations, with the consequence that only those with shares below 2.5% in these aggregate are actually considered. All these robustness checks corroborate the baseline results.

In addition, we account for general equilibrium effects. The measurement of NEEC's contribution to Mexican exports associated with our estimation approach can be potentially threatened by economy-wide effects in the form of market stealing across firms or changes in intermediation such that AEO firms become channels for other firms' foreign sales. More precisely, observed impacts could not only reflect net additional exports but also their redistribution across firms. Given their different economic implications, which one prevails make a substantial difference for the assessment of the policy under consideration. In order to disentangle actual aggregate changes from reallocation of exports, we estimate separate equations comparing "treated" and "untreated" observations and "treated" and "residual" observations and allow for different effects on sectors with low and high intermediation-intensity.[5] These estimates reveal that the certification program has had a net positive effect on exports.

Our paper is related to the current economic literature. First, we contribute to a number of papers that explore how terrorist activities (and the counteracting security measures enacted) affect international trade (see, e.g., Nitsch and Schumacher, 2004; Fratianni and Kang, 2006; Globerman and Storer, 2009a,

[4] Needless to say, this would not apply to firms whose certificates are granted towards the end of the year.
[5] See Redding and Turner (2014) for an explanation in relationship to the evaluation of infrastructure projects.

2009b; Mirza and Verdier, 2008, 2014; and Egger and Gassebner, 2015). Second, we investigate whether and how a public policy can influence exports primarily from large firms that account for substantial shares of their countries' total foreign sales (see, e.g., Freund and Pierola, 2015; Bernard et al., 2015). Third, we examine the trade implications of using different customs' inspection technologies that parallel those associated with the so-called American and Japanese supplier subcontracting models relying either on inspections or the benefits of relationships to motivate compliance with safety standards (see, e.g., Taylor and Wiggings, 1997; and Pierce et al., 2015). Fourth, our analysis is also linked to a set of recent analyses of the value of reputation and trust in international trade (e.g., Antras and Foley, 2014; Macchiavello, 2010; and Macchiavello and Morjaria, 2015). Fifth, we add to a series of studies that assess the impact of different types of certifications on firm-level trade (see, e.g., Volpe Martincus et al., 2010; Dragusanu and Nunn, 2014). Sixth, we show that the supply chain effects of the AEO program has led to increased trade volatility passing on United States' demand shocks to Mexican firms at higher frequency. This complements previous evidence according to which United States' outsourcing activities with Mexico transmits United States' demand volatility to Mexican employment variation amplified by changes in the extensive margin of outsourced products (see Bergin et al., 2009). Finally, by rigorously assessing the impacts of a security-motivated public certification program on customs' processing of certified firms' shipments and these firms' exports, we provide a trade value measure of trustworthiness as defined according to objective conditions established by the public sector in terms of regulatory compliance and security standards, and inform developing countries' ongoing and upcoming work on one key initiative covered by the WTO Agreement on Trade Facilitation (see WTO, 2014).

The remainder of this paper is organized as follows. Section 2 introduces the dataset. Section 3 describes the Mexican AEO program and presents basic statistics and preliminary evidence. Section 4 explains the empirical strategy. Section 5 discusses the estimation results, and Section 6 concludes.

2 Data

Our main dataset consists of two databases that were kindly provided by the Mexican customs SAT (*Secretaría de Administración Tributaria)*. The first database includes transaction-level export and import data from 2005 to 2014. Specifically, each record comprises a firm's ID, the product code (10-digit HS), the customs office (port/airport/land border) through which the shipment exits/enters Mexico, the destination/origin country, the export and import values in US dollars, the quantities (weight) in kilograms, the channel through which the transaction was processed (either green or red), the date in which the customs-processing of the shipment was requested (channel request), the date in which the shipment was authorized to leave the customs (release date), i.e., the customs clearance times, and an

indicator that reports whether the shipment had an irregularity and whether this irregularity was minor or important (see Volpe Martincus et al., 2015).

The second database informs whether each specific shipment was made by a firm that at the time in question was certified with the SAT. The data allow for distinguishing two groups of certified firms: NEEC and other SAT´s certification programs, with the latter primarily referring to CC (*Compañía Certificada* – Certified Company).

3 The Mexican Authorized Economic Operator Program NEEC

In 2002 the Mexican SAT launched the CC program to provide trade facilitation benefits to trustworthy firms with certain characteristics that meet specific criteria in terms of their import activities. Currently, eligible firms for the CC program include: firms that imported more than 300 million of Mexican pesos (roughly 20 million of US dollars) the previous semester; IMMEX firms that imported more than 200 million of Mexican pesos (approximately 13 million of US dollars) the previous semester; IMMEX firms that do not meet the former criterion but are approved by the customs; and courier (messaging and packaging) firms.[6] Critically, the CC program do not include security requirements among eligibility conditions and provides participating firms with a limited set of trade facilitation advantages, including less frequent physical inspections and prioritized customs clearance.

In response to the adoption of the WCO SAFE Framework in 2005 and the approval of its complement with provisions on AEO programs in 2007, the SAT started to design its own AEO program to incorporate the security dimension, the NEEC, in 2009; published its general rules in 2011; and formally launched it in 2012. The NEEC aims to strengthen the security of the trade logistic chain through the implementation of minimum standards for safety that are internationally recognized in cooperation with the private sector and thereby favor the competitiveness of Mexican firms and their foreign trade (see Clavijo, 2013).

In order to be eligible for NEEC certification, firms must be trustworthy. They have to meet tax, customs, and security requirements. Regarding tax and customs requirements, firms must prove a record of trade activities (and hence of interactions with the customs) for the past three years, have a good tax compliance track record, and have a digital invoicing system. Security requirements depend on the type

[6] The IMMEX is a program that allows for temporarily importing goods that will be used in an industrial or service process intended to produce, transform, and repair foreign goods imported temporarily for its subsequent export or provision of export services, without being subject to the payment of the general tax for imports, the value added tax, and, where applicable, the countervailing duties. In order to get a CC certification IMMEX firms that imported less than 200 million Mexican pesos the previous semester have to submit a copy of the annual electronic report of total sales and exports for the preceding years; a copy of a document showing that the firm has more than 100 employees registered with the IMSS (*Instituto Mexicano de Seguridad Social* – Mexican Institute for Social Security); and a copy of a document proving that the firm has fixed assets in the form of machinery and equipment that are worth more than 250,000 US dollars. If the value of these assets exceeds 10 million US dollars, firms do not need to submit proof of the number of employees (see SAT, 2015).

of operator (e.g., importer, exporter, etc.), but generally refer to safety of trucks and containers, personnel safety, process security and security planning in the supply chain, physical security including access control, commercial partners, information and document security, security training and awareness, and incident management and investigation. Importantly, from the point of view of our estimations, all these criteria can be mapped into time-varying firm-level characteristics.

As for the certification process, firms must submit a complete application form and a company's profile and pay a fee of approximately 1,650 US dollars. The customs administration assesses the application, the company's profile, and reviews its tax and customs compliance. Then the agency carries out visits to the firm's premises to observe and validate the information provided in the application and to inspect the systems and security measures in place. Finally, the customs agency takes a decision about granting (or not) the NEEC certification. The certification process may take from six months to one year (see Figure 2).

Certification is valid for one year (and renewable) and is associated with a number of advantages, which primarily consist of reduced physical inspections and expedited customs clearance, in both cases to a significantly larger extent to those granted to CC firms. These advantages also include access to express/fast track lanes wherever available; administrative simplifications; and personalized attention through a designated account official (see SAT, 2015).

NEEC was implemented in early 2012. The first certification was granted on March, 2012. The total number of certified firms grew from 88 in 2012 to more than 400 in 2014 (see Figure 3).

Tables 1 and 2 show the relative importance of all certified firms and NEEC-certified firms in Mexican exports and relevant exporter characteristics, respectively. In particular, Table 1 reports the country's total exports and key aggregate extensive margin indicators (upper panel) along with the share accounted for certified (CC and NEEC) firms from 2009 to 2014 (second to fourth panels). Around 33,000 exporters sold about 9,500 products in more than 200 destinations for almost 400 billion US dollars in 2014. Approximately, 3.5% of the exporters are certified. These firms jointly represent three quarters of Mexican aggregate exports. The products and destinations in which they register foreign sales correspond to 63% and 90% of those of the country as whole, respectively. In particular, foreign sales by NEEC firms amounted to 40% of Mexico's total exports, 43% of the total number of products, and 81% of the total number of destinations in 2014. It is worth noting herein that most firms that became NEEC did so after being certified as CC. This can be seen by comparing the evolutions of the share of CC and NEEC firms in both total Mexican exports and number of exporting firms (see panels three and four of Table 1).[7]

Table 2 characterizes both the overall average Mexican exporter and the average CC and NEEC exporters in terms of their total foreign sales, number of exported products, and number of reached

[7] Roughly 97% of NEEC firms were previously CC firms.

destinations in these years. On average, in 2014 exporting firms sold 11 products to 2.5 countries for approximately 11 million US dollars. The average certified exporter is larger along these dimensions. This firm exported 91 products to 9 destinations for 285 million US dollars. In particular, the average NEEC firm registered total exports for 334 million US dollars being active in 89 products and 8.6 destinations, whereas the CC counterpart did so for 180 million US dollars with 70 products and 7.5 destinations.

4 Empirical Methodology

We seek to assess the impact of NEEC certification on Mexican firms' exports. In defining the evaluation approach, two main considerations are worth taking into account. First, as suggested by the evidence presented in Section 3, NEEC firms are substantially different from the average regular exporter but relatively similar and thus most comparable with CC firms. Hence, our baseline estimating sample will exclusively consist of exports from NEEC and CC firms. Second, as shown in the left panel of Figure 4, these firms can and in fact do obtain such certification at different dates within a year. Depending on when during the year the firms export a given product to a given destination, this creates variation in the NEEC certification status under which exports are made across product-destination combinations within firms in the year in question. This can be clearly seen in the right panel of Figure 4, which is a kernel density estimate of the share of firm-product-destination combinations (with at least one export under NEEC) for firms that were certified as NEEC in each year of the period 2012-2014.[8] In the estimations below we exploit that variation in NEEC status across firm-product-destinations within a given year along with that within firm-product-destinations over time to identify the impact of interest. More specifically, we postulate the following empirical model of exports:

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

where f denotes firm, p stands for product at the HS-10 digit-level, c indicates country, and t indexes year (i.e., transaction-level data are aggregated by year). The main variables are X and $NEEC$. The former represents export value. The latter is a binary indicator that takes the value of 1 if firm f exports product p to destination c as NEEC in year t and 0 otherwise. The coefficient on *NEEC*, α, is then our parameter of interest. If $\alpha > 0$ ($\alpha = 0$), then certification has a positive (no) impact on exports. The remaining terms of Equation (1) correspond to control variables. Thus, λ_{fpc} is a set of firm-product-destination fixed effects that captures, for instance, the firm's knowledge of the market for a given product in a given country; δ_{ft} is a set of firm-year fixed effects that accounts for time-varying firm characteristics (e.g., size), competences (e.g., delivery of goods according to the specifications agreed upon), overall performance

[8] Defining the treatment at the firm-year level would imply classifying as NEEC a relative large number of firm-product-destination-year observations that are actually non-NEEC. The share of these observations would be on average 26% over our sample period and almost 50% in 2012.

(e.g., productivity), and firm-level public policies (e.g., export promotion) as well as the companies' changing abilities to comply with customs' and other border agencies' regulations and specifically their propensities to apply for security certification and meet the NEEC eligibility criteria; ρ_{pct} is a set of product-destination-year fixed effects that controls for product-destination shocks such as changes in international transport costs across products and importing countries and fluctuations in demand for goods across markets; and for time-varying trade costs associated with customs and other administrative procedures in the various destinations; and ε is the error term.

In estimating Equation (1), we use first-differencing to eliminate the firm-product-destination fixed effects. Note that, as typically the case when using this strategy to evaluate programs on more than two periods, the *NEEC* indicator has to be differenced along all other covariates (see Wooldridge, 2002).[9] We therefore estimate the following baseline equation:

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

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

We use this same estimation strategy when investigating the sources, the channels, and the mechanisms of the NEEC effects on exports. First, Volpe Martincus et al. (2015) show that less frequent physical inspections and accordingly reduced times in customs are associated with increased firms' exports. As explained above, NEEC firms are allegedly entitled to two primary trade facilitation advantages: their shipments experience less frequent material verifications or red channels and these shipments are cleared faster. We assess whether and to what extent the certification program delivers these promises by estimating equations similar to the baseline but whose dependent variables are the aforementioned trade facilitation indicators along with their relationship with exports as follows:

$$\Delta RC_{fpct} = \beta \Delta NEEC_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpct} \quad (3)$$

$$\Delta lnD_{fpct} = \gamma \Delta NEEC_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpct} \quad (4)$$

$$\Delta lnD_{fpct} = \theta \Delta RC_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpct} \quad (5)$$

$$\Delta lnX_{fpct} = \sigma \Delta lnD_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpct} \quad (6)$$

where RC represents allocation to the red channel and D is the median customs delays (see Volpe Martincus et al., 2015).[10]

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

[10] We consider that a given firm-product-destination-year flow is assigned to the red channel if all customs declarations (*pedimentos*) it consists of have at least one specific shipment subject to physical inspection. This is slightly different from what Volpe Martincus et al. (2015) do. The reason is twofold. First, unlike in Uruguay, a customs declaration can encompass several products, which can be sequentially withdrawn from customs facilities and accordingly be allocated to different verification channels. It is therefore very likely that a declaration has at least one of its multiple specific shipments inspected. In other words, by being liberal in defining a flow as red channeled, we would be overstating the actual relative importance of physical inspections and washing out the variation in this regard across exports. Second, a 100% share of red channel maximizes the F-statistics of a regression of customs delays on measures of allocation to material verification. In short, it can be seen as the most accurate source of variation in these delays.

Second, we disentangle the channels of the effects based on the following variants of the baseline equation:

$$\Delta lnZ_{fpct} = \alpha_Z \Delta NEEC_{fpct} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpct} \quad (7)$$

where Z stands for quantity (weight), unit value, number of shipment, average export value per shipment, and average quantity per shipment.

Third, the baseline equation assumes that the effect of NEEC certification on exports is symmetric across firms, products, and destinations. There are, however, reasons to believe that these effects may differ among groups of companies, goods, and countries, in which case such a restriction would not hold. Thus, for instance, impacts can be larger on intermediate inputs or more complex products. Hence, we also generalize this equation to explore the existence of heterogeneous effects across those groups as follows:

$$\Delta lnX_{fpct} = \sum_{i=1}^{I} \alpha_i \Theta_i \Delta NEEC_{ft} + \delta'_{ft} + \rho'_{pct} + \varepsilon'_{fpc} \quad (8)$$

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

Note that all previous equations include fixed effects that account for systematic differences across firms and product-destination shocks, thus substantially reducing the risk of omitted variable biases and particularly of heterogeneity in export dynamics. Moreover, in our baseline estimation, we cluster standard errors by firms because the certification status is firm-specific and, hence, exports may be correlated across (groups of) product-destinations for given firms.

5 Estimation Results

5.1 Baseline Results

The first row of the upper panel of Table 3 presents OLS estimates of Equation (2) for our main estimating sample: exports from NEEC and CC firms. According to this baseline specification which controls for time-varying firm and product-destination factors, certification has been associated with 73.1% higher export growth. The sample average (logarithm) annual growth rate of firm-product-destination exports in 2014 was 3.8%, so this would imply that those from security-certified firms would have a growth rate 2.8 percentage points higher than those from counterparts lacking such certification.[12]

Having said that, we should mention that results are robust to using the median assignment to the red channel as in Volpe Martincus et al. (2015). These alternative results are available from the authors upon request

[11] The non-conditional effects of the variables that form the interaction terms are already accounted for by the sets of fixed effects.

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

This estimated impact primarily corresponds to that of the first use of the regime. This can be seen by estimating Equation (2) on the "First NEEC" subsample. This latter subsample creates a common "before treatment" period for both "treated" and "control" observations. Thus, for each year, we include all exports registered as associated with a CC firm the previous year, that is, we are strictly comparing exports for which a change in the firms' certification status to NEEC is observed in a certain year and accordingly in the trade facilitation benefits their shipments have access to and exports with no change in their firms' certification status and henceforth in the trade facilitation benefits (i.e., they continue as CC) in the same year, conditional on both having taken place under the same certification status and subject to the same customs treatment in the past.[13] Estimates of Equation (2) based on this sample, which are reported in the second column of Table 3, are virtually identical to those obtained from the whole sample.[14] In the second row, we show that estimation results remain similar when we include exports from all firms instead of restricting the sample to those from CC and NEEC firms.[15]

Given that the NEEC certification is granted to firms (see Section 3), we use standard errors clustered by firm in making inferences. It might be the case, though that exports are correlated across other dimensions, e.g., across firms in given products or destinations. Hence, we have also re-estimated Equation (2) using alternative clustered errors to account for these potential correlations. More specifically, we also consider standard errors clustered at the (10 digit- and 2 digit-) product- and destination-levels as well as their combinations with each other and with firm-level. Results are robust to these alternative clusterings.[16]

5.2 Robustness

Our baseline estimations can be potentially affected by various issues including granularity, zeroes, omitted variable bias, non-parallel previous trends, self-selection of firms into the certification program, and general equilibrium effects, among others. In this subsection, we go through several robustness check exercises that address each of these issues.

[13] Thus, for 2013 we only include exports that were not processed as NEEC in 2012 and for 2014 we consider exports that were not processed as NEEC in 2012 and 2013. The number of observations accordingly differs between the first columns (entire sample) and the second column (first NEEC) of Table 3.

[14] All estimation results reported hereafter are similar to those obtained when considering all firms. A set of tables paralleling these results with the complete sample is available from the authors upon request.

[15] As explained in Section 3, NEEC aims to facilitate trade for trustworthy firms. One can assess how well the program is doing in identifying this kind of firms by exploiting information on the existence and severity of irregularities at the transactional level kindly provided by the SAT. In particular, we estimate a modified version of Equation (1) over the period 2009-2011 where the dependent variable is a binary indicator that takes the value of one if at least one irregularity (a serious irregularity) was detected in a given firm-product-destination-year quadruple and zero otherwise and the explanatory variables are a binary indicator that takes the value of one if the firm in question was later certified as NEEC and zero otherwise and product-destination fixed effects. Estimates of this equation suggest that NEEC firms do indeed have a better past customs compliance record. These estimates are available from the authors upon request.

[16] These alternative estimates are available from the authors upon request.

5.2.1 *Granularity*

While we are primarily considering exports from large firms, their specific product-destination flows are likely to be heavy-tailed (see, e.g., Eaton et al., 2012; di Giovanni and Levchenko, 2013; Gaubert and Itskhoki, 2015; Freund and Pierola, 2015; and Bernard et al., 2015). In particular, our estimated average effect could be largely driven by a majority of small export flows with significantly higher export growth rate responses than their more decisive large counterparts and thus not be representative for that of the economy as a whole. In order to assess whether this is affecting our results we re-estimate Equation (2) by WLS using the value of the export flows in the first, pre-NEEC sample year (i.e., 2011) as weights. The estimates are presented in the third column of Table 3. Although smaller than the baseline, the estimated impact remains economically important. Following the same reasoning as before, the growth rate of exports from NEEC firms would have been 1.8 percentage points higher than those from comparable non-NEEC firms. A back-of-the-envelope calculation based on this estimate suggests that total Mexican exports would have been on average about 6% smaller than they actually were over the period 2012-2014 in the absence of the NEEC.

5.2.2 *Zeroes*

So far the analysis has focused on continuing firm-product-destination export flows, i.e., on the intensive margin. It is well known that that zeroes are pervasive in international trade, especially at this level of aggregation. We investigate the robustness of our results to including these zeroes by estimating a variant of Equation (2) in which the dependent variable is the mid-point growth rate. Estimates of this equation are shown in the upper panel of Table 4. These alternative estimates convey exactly the same message as the baseline estimates do.

5.2.3 *Omitted Variable Bias*

Our baseline specification includes sets of fixed effects that allow us to control for unobserved time-varying firm-level and product-destination shocks. Nevertheless, there might be other factors that could have affected firms' exports over our sample period. Thus, NEEC firms may have received support from Mexico's trade promotion organization, PROMEXICO, to sell abroad specific (groups of) products or in specific (group of) destinations. If it was effective, this support could confound our estimated impact and specifically result in its overestimation. Further, firm-product-destination exports under NEEC might have export growth rates different from those of their non-NEEC counterparts even in the absence of any

security-certification. We have therefore also estimated alternative specifications of Equation (2) in which firm-product-year or firm-destination-year fixed effects are included instead of merely firm-year fixed effects or firm-product-destination fixed effects are added. In addition, we have exploited our transaction-level data and estimated another variant of Equation (2) that incorporates firm-product-destination-year fixed effects to control for idiosyncratic firm-specific market developments that are correlated with NEEC on semester-frequency data. In this case, we also include semester-year fixed effects to account for seasonality. Estimates of these alternative specifications along with those not including fixed effects are reported in the lower panel of Table 4.[17] These estimates essentially confirm our initial findings.

Up to this point we are not controlling for previous trade activities. As mentioned in Section 3, firms are eligible to become NEEC as long as they have traded and thus have interacted with the customs the three previous years. In Column 1 of Table 5 we restrict the sample to firms that meet this criterion. The estimating sample does not experience a noticeable change because CC (as well as NEEC) firms are large and have registered trade operations consistently over time. Unsurprisingly, estimation results are fully in line with the baseline.[18]

While going a long way in isolating a large number of possible unobserved time-varying heterogeneity sources, unfortunately, previous estimations do not make it possible to entirely rule out of potential confounding factors are contaminating our estimates. This is particularly the case in our analysis because firms can have access to similar or complementary trade facilitation benefits in the framework of other programs either at home or abroad. Thus, in Mexico firms can operate under the *maquiladora* regime (IMMEX) and thereby import inputs under very favorable conditions (see Section 3). Some NEEC firms can also be IMMEX and, specifically, IMMEX firms may be overrepresented among NEEC firms relative to CC firms. In fact, more than half of the NEEC firms are IMMEX. Similarly, Mexican exporting firms can get certified as C-TPAT by the US customs (see Section 1). Again, more than half of NEEC firms are also C-TPAT. Further in this sense, the US is by far the most important destination for Mexican exports. Over our sample period, the US accounted for roughly 80% of total Mexican foreign sales. This also holds for NEEC firms. On average, more than 83% of their exports had the US as destination. The question naturally arises of whether it is the NEEC or either the IMMEX or the C-TPAT what is behind the observed superior export outcomes. In order to shed light on this issue, we exploit information on IMMEX and C-TPAT status kindly provided by the SAT and estimate a variant of

[17] On the other hand, larger set of fixed effects impose larger restrictions on the estimation sample. However, this does not seem to drive our results. Estimates based on specifications that do not include fixed effects or only include firm or product-destination fixed effects confirm that the certification program has had a significant positive impact on export growth (see Columns 1-3 in the first panel of Table 4). Alternative specifications that just include firm(-year) fixed effects, product(-year) fixed effects, destination(-year) effects or their alternative pairwise combination at a time yield similar results. These alternative results are available from the authors upon request.

[18] Only 6 firms did not renew their NEEC certification. Results do not change when we remove the respective observations from the estimating sample. These results are available from the authors upon request.

Equation (8) that allows for different effects of NEEC on exports depending on whether or not the NEEC certified firms are also IMMEX or C-TPAT. Alternatively, we re-estimate Equation (2) on a sample that excludes exports to the US.[19] Estimates of these equations are shown in Columns 2-4 Table 5. These estimates reveal that effects are larger for NEEC firms that are also IMMEX and C-TPAT and on sales to the US, which might be indicative of the additional benefits associated with combining programs. Most importantly, whereas it is relatively smaller, the impact of NEEC on remaining firms' exports is still positive and significant. Moreover, the effect of this certification on sales to destinations other than the US is virtually indistinguishable from the baseline. Hence, NEEC appears to have a strong independent effect on exports.

5.2.4 Non-Parallel Previous Trends

One key assumption in our difference-in-differences-type of estimation is that NEEC exports and their CC counterparts have had parallel trends before the adoption of NEEC, i.e., the NEEC should not cause any gap in exports in previous periods. In order to assess the plausibility of this assumption, we carry out alternative placebo tests which imply regressing current export changes in future changes in certification status and accordingly in customs treatment. More precisely, we artificially assume that the first NEEC has taken place one or two years before it actually occurs and re-estimate Equation (2) on the sample of firm-product-destination-year exports without NEEC certification. These placebo estimates are presented in the lower panel of Table 5 along with those for the respective real first NEEC underneath as obtained from the same firm-product-destination combinations. Reassuringly, none of the former estimated coefficients are significantly different from zero, but the latter are, which points to the inexistence of pre-NEEC differences in export trajectories.

5.2.5 The Timing of Certification

Using high frequency data from Peru, Bernard et al (2014) show that the month of entry into foreign markets has important consequences for estimates related to the level and growth of trade flows of new exporters when computed at the annual level. While this is not directly an identification problem here, because our sample primarily consists of large firms with continuous export flows, it suggests that timing is likely to matter for treatment effects of trade policies and in such a way that can contribute to inform causality.

[19] It is worth noting in this regard that, on average, the US accounted for 83% and 85% of IMMEX and C-TPAT firms' exports in 2012-2014, respectively.

Firms can obtain the NEEC certification at different points in time (see Section 4). The earlier in the year firms become NEEC, the larger will be the share of their respective firm-product-destination flows that will be processed under the advantageous conditions associated with such status. Accordingly, the impact of NEEC can be expected to incrementally accumulate over months within a year. In particular, assuming that everything else is equal after controlling for unobserved time-varying firm and product-destination factors through the baseline sets of fixed effects, if our hypothesis is right, then the NEEC impact should be larger for firm-product-destination flows that turn NEEC early in the year compared to those late in the year. In order to explore this, we exploit our transaction-level data and estimate a variant of Equation (8) that allows for different effects across firm-product-destination combinations depending on the month in which they were first exported as NEEC. As shown in Figure 5, NEEC export effects decrease as the number of months under certification declines and, specifically, become non-significant when certification kicks in over the last quarter of the year. [20]

5.2.6 Self-Selection of Firms into NEEC

As explained in Section 3, all NEEC eligibility criteria are specified in relationship to the firms as a whole. The same holds for the decision to apply for certification and so are taken the decisions to grant (or not) the NEEC certification. In our context, a primary evaluation concern is that firm-specific factors that determine the propensity to be certified cannot only affect the participation in the certification program but also directly exports. This could be particularly the case with the security measures that make it possible to reduce inventory losses and the attributes of the managerial teams (i.e., trade expertise and pro-activeness). Our firm-year fixed effects are precisely meant to account for these potentially confounding time-varying firm-level factors.

To further reduce the scope for unobserved firm heterogeneity to play a role, we make use of the information on the timing of NEEC certification along with the fact that the certification process may take up to one year (see Section 3) and re-estimate Equation (2) on the sample of exports from firms whose NEEC certification dates are at most one year apart, thereby comparing foreign sales from firms that are just NEEC certified with those from peers about to become NEEC. These alternative estimates of Equation (2) are presented in Columns 1 and 2 of Table 6 and are in line with the baseline.

These results along with those of our placebo tests already convey the message that self-selection does not appear to be a severe problem. However, the previous evidence could be considered not sufficient to completely rule it out as firms might arguably opt for NEEC based on prospects of exports to

[20] Results are qualitatively the same if the specification additionally includes month fixed effects. Consistently, the estimated effect is similar to the baseline when we restrict the NEEC group to those firm-product-destination-year observations with more than 50% of the respective shipments as NEEC (and drop the remaining NEEC observations from the estimating sample). These results are available from the authors upon request.

certain important destinations. A natural way to assess whether this is an issue is to estimate the impact of NEEC on sales to non-large markets, which are less likely to justify certification. In so doing, we classify as such importing countries that are not among the top 10% or the top 25% in terms of their average shares in either Mexico's or the firm's total exports in the pre-NEEC period (2009-2011). These turn out to be countries whose share does not exceed 1% in the first total and whose median shares are below 2.5% in the second total. Estimates of a variant of Equation (8) which distinguishes between these destinations and their respective complements, are reported in Columns 3 to 10 of Table 6 and indicate that the effect of NEEC remains positive and significant for non-relevant markets, which are exactly those that can hardly drive firms' decision to obtain certification.[21]

5.2.7 General Equilibrium Effects: Net Export Increase vs. Export Redistribution

Admittedly, there are two possible interpretations of our estimates which are associated with different implications for country-level trade. These estimates are consistent with both increases in certified firms' foreign sales without affecting those of non-certified firms and larger exports from NEEC firms at least partially at the expense of those from peers that are not NEEC. In the former case, the estimated results clearly correspond to a net expansion of aggregate exports, whereas in the latter they would partially or entirely reflect a redistribution of exports across firms with smaller or no changes in total exports. In order to determine whether and to what extent NEEC actually redounded in additional foreign sales for the country as a whole, these potential general equilibrium effects need to be isolated. Assuming that, if present, the negative cross-firm externalities are specific to foreign sales of given product-destination combinations, we do so by estimating our differenced Equation (2) on alternative subsamples that involve comparisons between exports from NEEC firms ("treated") and their non-NEEC counterparts in the same products as defined above to the same destinations ("untreated") and between the former ("treated") exports and those other firms without changes in their certification status exporting in other product-destination combinations ("residual").[22] Estimates of these equations, which are presented in the upper panel of Table 7, point to no significant differences between "untreated" and "residual" relative to "treated" export flows.[23] Keeping in mind that these robustness exercises depend on the assumptions made on the nature of the spillovers and that they should accordingly be seen as

[21] A similar message comes out from a series of estimations that allows for different effects for the (two, three, four, or five) most important destinations and the remaining destinations. These estimation results are available from the authors upon request.
[22] Products at the HS 2-, HS 4-, and HS 6-digit levels are considered to allow for potential substitutability across finely defined HS 10- digit products belonging to each of these categories.
[23] See Girma et al. (2015) for an alternative strategy to estimate the direct and indirect effects of a given treatment.

indicative, their results suggest that certification seems to have had a net positive effect on Mexico's exports.[24]

General equilibrium effects are not certainly restricted to those associated with potential market stealing. A certification program such as NEEC, which provides participating firms with exclusive trade facilitation advantages such as reduced physical inspection and expedited customs clearance, might induce non-certified firms to use certified peers as intermediaries to export (at least part of) their products to gain access to these advantages. If this was the case, we would observe that NEEC has a stronger impact on exports from firms belonging to sectors that are naturally more intermediation-intensive. We therefore evaluate whether induced intermediation is driving our results by estimating a version of Equation (8) in which we allow for different effects on exports across groups of products (i.e., HS 2, HS 4, and HS 6) depending on whether their share of intermediaries (wholesalers and retailers) is above or at or below the median across these groups of products as reported in Ahn et al. (2011).[25] Estimates of this equation do not differ across these two groups, which would indicate that, if any at all, the market restructuring phenomenon would be limited in scale (see lower panel of Table 7).

5.3 Sources

Evidence hitherto consistently point out that the NEEC appears to have favored increased Mexican firms' exports. Such better export performance could be due to the trade facilitation advantages that the program officially provides participating firms (see Section 3). More specifically, shipments from NEEC firms enjoy a lower rate of physical inspection and shorter times in customs, which in turn can positively affect firms' foreign sales (see Volpe Martincus et al., 2015). We next explore whether this is actually the case by estimating Equations (3)-(6). Results from these estimations are reported in the upper panel of Table 8. In consonance with the program's stated provisions, NEEC firms' export shipments are significantly less likely to be subject to material verification and their customs delays are substantially shorter. Moreover, consistent with estimates presented in Volpe Martincus et al. (2015), these shorter delays can be at least partially traced back to the less frequent assignments to the red channel and are associated with larger firms' exports.[26]

[24] Moreover, certification might have directly affected the survival of similar exports coming CC firms. In order to investigate whether such crowding out took place, we estimate a linear probability model on the sample of firm-product-destinations flows existing in 2011 for "untreated" and "residual" observations, whereby the dependent variable is a binary indicator taking the value of one if the export flow is present in 2012, 2013 or 2014 and zero otherwise and the main explanatory variable is a binary indicator that takes the value of one if there is at least an export flow with certification and zero otherwise (or their number) along with firm and product-destination fixed effects. Again, there is no evidence that security certification has benefited some export flows at the price of pushing others out of international markets. These results are available from the authors upon request.

[25] Results are similar if we distinguish between the two groups of products using data from Bernard et al. (2010) on the relative importance of intermediation in their trade.

[26] In contrast, express lanes in specific customs, another of the trade facilitation benefits to which NEEC firms have access, do not seem to make a significant difference. More precisely, the effects of NEEC on firms' foreign sales is similar in customs with and

As discussed in the Introduction, NEEC certification could also serve as a quality signaling mechanism thereby reducing information barriers with potential buyers and, as such, could have an influence on firms' exports separate from that linked to customs treatment.[27] To investigate whether NEEC signals quality, we estimate a combination of Equations (2) and (6) in which we include as explanatory variables both the median time in customs and the NEEC indicator. Estimates of this equation are shown in Column 5 of the upper panel of Table 8. These estimates confirm that NEEC has an independent positive impact on firms' exports on top of that derived from reduced customs delays, thus helping firm expand their foreign sales not only by facilitating border crossings but also by addressing information asymmetries.[28] This is further supported by the evidence on heterogeneous effects across destinations presented in the second panel of Table 8.[29] According to these results, the positive response of exports to NEEC is stronger in more distant and so less familiar destinations and in importing countries where there is an AEO program in place and thus buyers are more likely to be aware of the program and what certification stands for.[30]

The NEEC also provides participating firms with a more favorable customs treatment when importing, -i.e., their import shipments are less frequently assigned to physical inspections and spend less time in customs- and by facilitating their imports could have allowed for increased exports. Thus, at least part of the effects identified above could be due to improved customs clearance conditions for imports. We assess whether this is the case by estimating Equations (2)-(6) using import data and by additionally estimating a version of Equation (8) that allows for different effects across groups of products depending on how heavily their production relies on imported inputs as determined based on the national input-output matrix (see Blyde, 2014). Estimates of this equation, which are presented in the third and fourth panels of Table 8, confirm that NEEC firms have experienced higher import growth and that this has been associated with less intrusive controls and shorter customs delays. Furthermore, estimation results highlight that the impact of NEEC is similarly positive and significant on both exports

without express lanes regardless of we estimate Equation (2) on data at the firm-product-destination-year level using the main customs at that level to discriminate across these flows or on data at the firm-product-destination-customs-year level and allow for different effects across groups of customs with and without express lanes. These estimation results are available from the authors upon request.

[27] This would be in line with the ISO certification effect reported in Volpe Martincus et al. (2010).

[28] These results remain the same when we instrument observed delays with the (median) allocation to physical inspection as in Volpe Martincus et al. (2015). These alternative results are available from the authors upon request.

[29] Estimated impacts are similar on sales to destinations with high and low levels of terrorist activities as determined based on the either the count of serious incidents or that of all incidents reported in the Global Terrorist Database (GTD). These estimates are available from the authors upon request.

[30] These results also hold when imposing common products across destinations and when excluding the US as a destination. In this regard, it worth recalling that Mexican firms can get certified as C-TPAT in the US and mentioning that Mexico did not have active AEO Mutual Recognition Agreements with partners during our sample period. Of course, an alternative explanation could be that buyers are certified as AEO in their countries. Unfortunately, we do not have data to explore this possibility.

of products in which imported inputs are used intensively and those of their counterparts that do not depend that much on these inputs.[31]

Note that lower frequency of physical inspections and shorter customs delays release customs resources. Taking into account the total annual number of export and import shipments subject to those inspections in recent years; that, on average, two men are needed for each of such inspections; and that the average annual compensation of inspectors is 11,811 US dollars, the reduction in the inspection rate and the length of the time-in-customs associated with NEEC amounts to gross savings of approximately 520,000 US dollars for the Mexican customs administration. On the other hand, the NEEC certification process entails its own costs. The assessment of each application typically takes almost two net working weeks (spread in several months, as this involved both documentary review and visits to the firm's facilities) and is carried out by five officials whose average annual compensation is 18,280 US dollars.[32] Assuming that the number of certified firms corresponds to the average of the period 2012-2014, the total costs of these certifications as measured by the overall compensation of the intervening agents is roughly 422,000 US dollars. Hence, without counting the effect of the program on firms' exports, switching the focus of inspection from individual shipments to firms generates a net saving of almost 100,000 US dollars for the public sector per year.

5.4 Channels

In this subsection we explore the channels through which NEEC affects firms' exports. In disentangling these channels, we estimate the effects of certification on the quantity (weight) shipped, the unit values, the number of shipments, and the average value and quantity per shipment, based on Equation (7). Estimation results are presented in the first column of Table 9. These results reveal that the certification scheme has mainly affected the number of shipments and thereby the quantity shipped. Thus, NEEC has led to an increase in the number of shipments by 46.7%. Interestingly, participation in the program seems to have been associated with a reduction in unit values. Given the results presented above, this can be traced back to the shorter customs delays and thereby reduced trade costs.

In the second column of Table 9, we report estimates of a variant of Equation (7) whereby the dependent variable is the standard deviation of the outcome variables listed above across months within a year. The estimated effects indicate that NEEC has been associated with larger export variability. This may reflect an increased pass-through of foreign demand volatility, possibly due to participation in production chains through outsourced activities. More specifically, NEEC has made it possible for firms

[31] The number of observation is slightly smaller than that in the baseline estimation because data on imported input intensity is not available for a set of products.
[32] We assume a working week of 40 hours (i.e., 8 hours x 5 days).

to better respond to time-specific demands from foreign buyers by shipping more just-in-time and therefore to export more, but this has raised shipment volatility in terms of frequency and size. This complements evidence reported by Bergin et al. (2009), who show that Mexican (maquiladora) industries that are linked to US offshoring experience changes in employment that are twice as volatile as their US peers.

In short, NEEC has allowed for expanded firms' exports and at the same time has increase shipping variability.

5.5 Other Heterogeneous Effects and the Extensive Margin

We next investigate additional underlying mechanisms of the effects. In particular, we examine the existence of heterogeneous effects across products. Estimates of Equation (8) presented in the upper panel Table 10 reveal that the effects have been larger on exports of textiles, industrial supplies, and capital and consumer goods, most of which can be generally considered time-sensitive.[33] This is consistent with the larger estimated impacts on exports are air-shipped reported in the lower panel of this table.

The previous subsection primarily provides estimates of the effect of NEEC on the export intensive margin. NEEC could have also helped firms expand their foreign sales by making it easier to reach new export markets. We assess whether security certification has had an impact on the export destination margin by estimating a variant of Equation (2) on data at the firm-product-year level where the dependent variable is the change in the (natural logarithm of the) number of destinations and the main explanatory variable is the change in the NEEC status indicator along with firm-year and product-year fixed effects. According to the estimates of this equation, NEEC has had a significant positive effect on the destination extensive margin.[34] In other worlds, NEEC appears to have helped firm reach new export markets.[35]

6 Concluding Remarks

Security concerns in a context of increasingly segmented supply chains and expanding trade has led to a generalization of security-motivated certification programs around the world that seek to facilitate

[33] We do not find significant differences in the estimated effects on exports of differentiated and non-differentiated products as identified based on the classification proposed by Rauch (1999) or between complex or non-complex goods as defined based on how diversified in terms of inputs are their production processes as suggested by Levchenko (2007). A possible explanation could be that most NEEC are specialized in exports of differentiated and complex goods. In fact, they accounted on average for more than 85% and 90% of NEEC firms' total exports over our sample period, respectively. These estimation results are available from the authors upon request.

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

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

trade for trustworthy firms or AEOs. These programs provide participants with several advantages in the administrative processing of their shipments including less frequent physical inspections and expedited customs clearance. In this study, we assess the impact of Mexico's AEO Program NEEC on firms' exports. In so doing, we use a rich database that covers the entire universe of export and import transactions for this country over the period 2009-2014 and informs for each of these transactions whether they correspond to a certified (CC or NEEC) firm and the customs processing channel and clearance times.

Our difference-in-differences estimates suggest that NEEC has resulted in increased firms' exports. This positive effect can be traced back to lower rates of physical inspections and thereby shorter times in customs for their shipments and, to a certain extent, to reduced information barriers due to the quality signaling associated with certification. Importantly, this effect does not come at the expense of non-certified exporters, so that the program appears to have positively affected country-level exports.

The evidence further indicates that the NEEC has favored an expansion of foreign sales along both the destination intensive margin -NEEC firms registered an increased number of shipments to already served importing countries- and the destination extensive margin. Finally, the effects seem to have been stronger on time-sensitive products such as textiles and consumer goods and industrial inputs.

The rise of global production chains and the associated trade in inputs emphasizes the costs associated with moving goods between firms across borders. Research focuses on lean inventory management, timely delivery, and fast processing of trade flows. Our results show that AEO programs are consistent with these expected benefits. In addition, we provide evidence that AEO programs raise trade above and beyond the cost savings associated with shorter lead times. Explanations for these benefits include reductions of information asymmetry, signaling exporter "quality", and greater flexibility. These findings imply that these are important frictions in international trade that can be effectively addressed by trade policy.

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Table 1

Aggregate Export Indicators and CC and NEEC Programs				
Year	**Total Exports**			
	Exports*	**Firms**	**Products**	**Destinations**
2009	230,110	33,118	9,142	210
2010	290,638	33,498	9,134	203
2011	346,124	33,563	9,191	209
2012	363,321	33,691	9,657	208
2013	369,753	32,826	9,456	204
2014	390,611	33,712	9,426	203
Year	**All Certified Firms (Percentage Shares)**			
	Exports	**Firms**	**Products**	**Destinations**
2009	70.510	3.992	57.810	87.143
2010	75.735	3.129	58.966	90.148
2011	74.836	3.346	60.603	89.474
2012	75.812	3.283	64.389	91.827
2013	75.644	3.080	62.035	89.216
2014	74.463	3.026	62.168	89.163
Year	**CC Firms (Percentage Shares)**			
	Exports	**Firms**	**Products**	**Destinations**
2009	70.510	3.992	57.810	87.143
2010	75.735	3.129	58.966	90.148
2011	74.836	3.346	60.603	89.474
2012	60.911	3.274	63.757	91.346
2013	39.371	2.839	57.942	86.275
2014	34.198	2.213	55.082	80.296
Year	**NEEC Firms (Percentage Shares)**			
	Exports	**Firms**	**Products**	**Destinations**
2009	N/A	N/A	N/A	N/A
2010	N/A	N/A	N/A	N/A
2011	N/A	N/A	N/A	N/A
2012	14.901	0.321	20.669	53.846
2013	36.272	1.021	38.166	73.039
2014	40.265	1.397	43.497	82.759

Source: Authors' calculations based on data from SAT.
Export values are expressed in millions of US dollars.

Table 2

Average Exporters: All, CC and NEEC Firms			
Year	**Total Exports**		
	Exports*	**Products**	**Destinations**
2009	6.948	8.360	2.230
2010	8.676	8.391	2.313
2011	10.313	8.818	2.351
2012	10.784	10.797	2.434
2013	11.264	11.189	2.494
2014	11.587	11.040	2.464
Year	**Certified Firms**		
	Exports*	**Products**	**Destinations**
2009	122.731	43.196	6.398
2010	210.032	55.894	8.531
2011	230.653	58.703	8.533
2012	249.044	89.618	9.295
2013	276.651	91.203	9.148
2014	285.158	91.654	8.984
Year	**CC Firms (Percentage Shares)**		
	Exports	**Products**	**Destinations**
2009	122.731	43.196	6.398
2010	210.032	55.894	8.531
2011	230.653	58.703	8.533
2012	200.637	85.077	9.019
2013	156.198	68.992	7.591
2014	179.065	70.225	7.452
Year	**NEEC Firms (Percentage Shares)**		
	Exports	**Products**	**Destinations**
2009	N/A	N/A	N/A
2010	N/A	N/A	N/A
2011	N/A	N/A	N/A
2012	501.293	67.926	8.444
2013	400.350	89.376	8.866
2014	333.925	88.794	8.592

Source: Authors' calculations based on data from SAT.
Export values are expressed in thousands of US dollars.

Table 3

The Impact of NEEC on Firms' Exports Baseline Estimates			
Sample\Program Participation	**All Observations**	**First NEEC**	**Weights 2011**
Only Certified Firms	0.549***	0.531***	0.365**
	(0.045)	(0.050)	(0.165)
All Firms	0.535***	0.513***	0.366***
	(0.040)	(0.042)	(0.138)
Firm-Year Fixed Effect	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes
Observations Including Only Certified Firms	265,080	225,080	185,677
Observations Including All Firms	743,705	703,093	506,048

Source: Authors' calculations based on data from SAT.

The table reports OLS estimates of Equation (2) for both all observation regardless the previous NEEC status and when restricting the sample to non-NEEC exports in the past, whereas the third column presents WLS estimates of Equation (2) using the value of the firm-product-destination flows in 2011 as weights. In the first row, the sample is restricted to firms that are either NEEC or CC, while in the second row all firms are considered. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. Firm-year fixed and product-destination-year effects are included (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 4

The Impact of NEEC on Firms' Exports
Alternative Specifications

Mid-Point Growth Rate

	Frequency							
	Year							Semester
NEEC	0.282***	0.907***	0.368***	0.836***	0.800***	0.813***	0.436***	0.273***
	(0.037)	(0.044)	(0.030)	(0.036)	(0.128)	(0.034)	(0.070)	(0.0258)
Firm-Year Fixed Effect	No	Yes	No	Yes	No	No	Yes	No
Firm-Product-Year Fixed Effect	No	No	No	No	Yes	No	No	No
Firm-Destination-Year Fixed Effect	No	No	No	No	No	Yes	No	No
Product-Destination-Year Fixed Effect	No	No	Yes	Yes	Yes	Yes	Yes	No
Firm-Product-Destination Fixed Effect	No	No	No	No	No	No	Yes	No
Firm-Product-Destination-Year Fixed Effect	No	No	No	No	No	No	No	Yes
Semester-Year Fixed Effect	No	No	No	No	No	No	No	Yes
Observations	464,065	464,065	464,065	464,065	464,065	464,065	464,065	675,796

Baseline

	Frequency							
	Year							Semester
NEEC	0.132***	0.500***	0.202***	0.549***	0.567***	0.530***	0.480***	0.136***
	(0.039)	(0.051)	(0.038)	(0.045)	(0.147)	(0.048)	(0.117)	(0.029)
Firm-Year Fixed Effect	No	Yes	No	Yes	No	No	Yes	No
Firm-Product-Year Fixed Effect	No	No	No	No	Yes	No	No	No
Firm-Destination-Year Fixed Effect	No	No	No	No	No	Yes	No	No
Product-Destination-Year Fixed Effect	No	No	Yes	Yes	Yes	Yes	Yes	No
Firm-Product-Destination Fixed Effect	No	No	No	No	No	No	Yes	No
Firm-Product-Destination-Year Fixed Effect	No	No	No	No	No	No	No	Yes
Semester-Year Fixed Effect	No	No	No	No	No	No	No	Yes
Observations	265,080	265,080	265,080	265,080	265,080	265,080	265,080	375,177

Source: Authors' calculations based on data from SAT.

The upper panel of the table report OLS estimates of variants of Equation (2) where the dependent variable is the mid-point growth rate, whereas the lower panel of the table presents OLS estimates of alternative specifications of Equations (2) where the dependent variable is the change in the natural logarithm of export value, both at the firm-product-destination-year level (Columns 1 to 7) and at the firm-product-destination-semester-year level (Column 8). The sample is restricted to firms that are either NEEC or CC. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. No fixed effects are included in the first column; firm-year fixed effects are included in the second column; product-destination-year fixed effects are included in the third column; firm-year fixed effects and product-destination-year fixed effects are included in the fourth column; firm-product-year fixed effects and product-destination-year fixed effects are included in the fifth column; firm-destination-year fixed effects and product-destination-year fixed effects are included in the sixth column; firm-year fixed effects, product-destination-year fixed effects, and firm-product-destination fixed effects are included in the seventh column; and firm-product-destination-year and semester-year fixed effects are included in the eight column (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 5

The Impact of NEEC on Firms' Exports Alternative Samples and Placebo Tests				
Alternative Samples				
	Trade Experience	**IMMEX vs. Non IMMEX**	**C-TPAT vs. Non C-TPAT**	**Non-US**
NEEC	0.552***			0.545***
	(0.045)			(0.085)
NEEC * IMMEX		0.599***		
		(0.049)		
NEEC * Non IMMEX		0.301**		
		(0.127)		
NEEC * C-TPAT			0.611***	
			(0.051)	
NEEC * Non C-TPAT			0.380***	
			(0.092)	
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes
Observations	257,840	265,080	265,080	118,317
Placebo Tests				
			Placebo 1 NEEC (t+1)	**Placebo 2 NEEC (t+2)**
NEEC			0.144	0.160
			(0.089)	(0.131)
Firm-Year Fixed Effect			Yes	Yes
Product-Destination-Year Fixed Effect			Yes	Yes
Observations			138,828	58,986
Baseline with the Same Observations				
NEEC			0.694***	0.601***
			(0.070)	-0.103
Firm-Year Fixed Effect			Yes	Yes
Product-Destination-Year Fixed Effect			Yes	Yes
Observations			138,828	58,986

Source: Authors' calculations based on data from SAT.

The upper panel of the table reports OLS estimates of Equation (2) when only considering firms that registered exports in all years of the period 2009-2011 (Column 1) and exports to destinations other than the US (Columns 4) as well as OLS estimates of a specification of Equation (8) that allows for different effects on exports depending on whether NEEC firms are or not also operating under the *maquiladora regime* (IMMEX) and are or not also certified as C-TPAT in the United States (Columns 2 and 3, respectively). The lower panel of the table presents OLS estimates of Equation (2) based on a placebo exercise whereby first time NEEC firm-product-destinations exports over the period 2012-2014 are assumed to have been NEEC one year before (Column 2) and two years before (Column 3). In so doing, we use export data for the period 2009-2011. Estimates immediately below correspond to our baseline but when the sample is limited to the same respective firm-product-destinations. In both cases the sample is restricted to firms that are either NEEC or CC. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. Firm-year fixed and product-destination-year effects are included (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 6

The Impact of NEEC on Firms' Exports
Addressing Self-Selection with Alternative Samples

	Firms Certified One Year Apart		Destinations in Mexico's Total Exports (in 2009-2011)				Destinations in Firm's Total Exports (in 2009-2011)			
	2012-2013	**2013-2014**	**Top 10%**	**Rest**	**Top 25%**	**Rest**	**Top 10%**	**Rest**	**Top 25%**	**Rest**
NEEC	0.107***	0.657***	0.555***	0.504***	0.551***	0.441**	0.542***	0.562***	0.531***	0.600***
	(0.216)	(0.118)	(0.049)	(0.119)	(0.045)	(0.200)	0.058	0.062	0.053	0.081
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,970	44,788	265,080		265,080		265,080		265,080	

Source: Authors' calculations based on data from SAT.

The left panel of the table reports OLS estimates of Equation (2) when only considering firms whose NEEC certification dates are one year or less apart from each other, while the center and right panels of the table presents OLS estimates of a specification of Equation (8) that allows for different effects on exports depending on whether the destination belong or not to the top 10% or the top 25% as determined based on its average share in total export value either at the country-level (center panel) or the firm-level (left panel) over the period 2009-2011. In both cases the sample is restricted to firms that are either NEEC or CC. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. Firm-year fixed and product-destination-year effects are included (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 7

The Impact of NEEC on Firms' Exports General Equilibrium Effects						
Market Stealing						
	Treated vs. Untreated			**Treated vs. Residual**		
	Same Destination and Same			**Different Destination and Different**		
	HS2	**HS4**	**HS6**	**HS2**	**HS4**	**HS6**
NEEC	0.549***	0.550***	0.550***	0.554***	0.554***	0.554***
	(0.044)	(0.044)	(0.043)	(0.051)	(0.052)	(0.052)
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	261,393	253,593	245,027	169,982	175,351	180,744
Market Restructuring						
	HS2 where the Presence of Intermediaries is		**HS4 where the Presence of Intermediaries is**		**HS6 where the Presence of Intermediaries is**	
	Low	**High**	**Low**	**High**	**Low**	**High**
NEEC	0.554***	0.538***	0.547***	0.553***	0.552***	0.546***
	(0.046)	(0.055)	(0.047)	(0.051)	(0.048)	(0.050)
Firm-Year Fixed Effect	Yes		Yes		Yes	
Product-Destination-Year Fixed Effect	Yes		Yes		Yes	
Observations	265,080		265,080		265,080	

Source: Authors' calculations based on data from SAT.

The upper panel of the table shows OLS estimates of Equation (2). The samples are defined to compare "treated" vs. "untreated" and "treated" vs. "residual". "Untreated" are defined as those firm-product-destination exports for which the relevant firm did not experience any change in its certification status and consist of the same HS2, HS4 or HS6 product-destination combinations as those of firms that became NEEC (Columns 1, 2, and 3, respectively), whereas "Residual" are defined as those firm-product-destination exports for which the relevant firm did not experience any change in its certification status and consist of HS2, HS4 or HS6 product-destination combinations different from those of firms that became NEEC (Columns 4, 5, and 6, respectively). The lower panel of the table presents estimates of a specification of Equation (8) that allows for different effects on exports depending on whether the share of intermediaries in HS2, HS4 or HS6 products' trade is above or at up to the median across the respective groups of products as reported in Ahn (2011). In all cases the sample is restricted to firms that are either NEEC or CC. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. Firm-year fixed and product-destination-year effects are included (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 8

The Impact of NEEC on Export and Import Facilitation					
NEEC and Export Facilitation					
Explanatory Variable\Dependent Variable	**RC**	**D**	**D**	**X**	**X**
NEEC	-0.026***		-0.026*		0.540***
	(0.005)		(0.015)		(0.044)
RC		0.409***			
		(0.013)			
D				-0.434***	-0.421***
				(0.066)	(0.067)
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	265,080	265,080	265,080	265,080	265,080
NEEC and Familiarity in Destinations					
		CD vs. DD		**AEO vs. NAEO**	
		CD	**DD**	**AEO**	**NAEO**
NEEC		0.540***	0.734***	0.559***	0.459***
		(0.044)	(0.132)	(0.048)	(0.109)
Firm-Year Fixed Effect		Yes		Yes	
Product-Destination-Year Fixed Effect		Yes		Yes	
Observations		265,080		265,080	
NEEC and Import Facilitation					
Explanatory Variable\Dependent Variable	**M**	**RC**	**D**	**D**	**M**
NEEC	0.459***	-0.011***	-0.010***		0.456***
	(0.019)	(0.003)	(0.003)		(0.018)
RC				0.424***	
				(0.011)	
D					-0.321***
					(0.021)
Firm-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	1,275,459	1,275,459	1,275,455	1,275,455	1,275,455
NEEC, Imports, and Exports					
			Products whose Dependence on Imported Inputs is		
			Low		**High**
NEEC			0.544***		0.554***
			(0.047)		(0.063)
Firm-Year Fixed Effect			Yes		
Product-Destination-Year Fixed Effect			Yes		
Observations			227,522		

Source: Authors' calculations based on data from SAT.

The first and third panels of the table show OLS estimates of Equations (3)-(6) and a combination of Equations (2) and (6). The dependent variables are the change in the natural logarithm of export (import) value at the firm-product-destination-year level (X/M), the change in the allocation to physical inspection (red channel-RC), the change in the natural logarithm of the time spent in customs (as measured in hours) (D) at the firm-product-destination-year level. The main explanatory variables are the change in a binary indicator taking the value of one if the firm ships the product to the destination in question as NEEC and zero otherwise (first and third columns); the change in the allocation to physical inspection (red channel-RC) at the firm-product-destination-year level (second column); the change in the natural logarithm of the time spent in customs (as measured in hours) at the firm-product-destination-year level (fourth column); and the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise and the change in the natural logarithm of the time spent in customs (as measured in hours) at the firm-product-destination-year level (fifth column). The second panel of the table reports OLS estimates of a specification of Equation (8) that allows for different effects on exports to different destinations: close destinations (CD) vs. distant destinations (DD) a determined based on whether the distance to the importing country is above or up yp the median of the respective distribution; and destinations with AEO programs (AEO) and destinations without AEO programs (NAEO). The fourth panel of the table estimates of a specification of Equation (8) that allows for different effects on exports depending on whether the reliance on imported inputs of the production process of the good in question in Mexico is above or up to the median across goods as computed in Blyde (2014). The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. In all cases the sample is restricted to firms that are either NEEC or CC. Firm-year fixed and product-destination-year effects are included (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 9

The Impact of AEO on Firms' Exports		
Channels		
Outcome	**Z**	**S.D. Z**
Export Value	0.549***	0.211***
	(0.045)	(0.018)
Export Quantity	0.671***	0.259***
	(0.060)	(0.019)
Unit Value	-0.121*	0.058***
	(0.066)	(0.004)
Number of Shipments	0.383***	0.311***
	(0.025)	(0.022)
Export Value per Shipment	0.167***	0.202***
	(0.035)	(0.017)
Export Quantity per Shipment	0.288***	0.230***
	(0.059)	(0.019)
Firm-Year Fixed Effect	Yes	Yes
Product-Destination-Year Fixed Effect	Yes	Yes
Observations	265,080	265,080

Source: Authors' calculations based on data from SAT.
The first column of the table reports OLS estimates of Equation (7), whereas the second column of the table presents OLS estimates of a variant of Equation (7). In the first column, the dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, the number of shipments, average export value per shipment, and average export quantity per shipment, all at the firm-product-destination-year level. In the second column, the dependent variables are the change in standard deviation of the natural logarithm of the variables listed previously. In all cases the sample is restricted to firms that are either NEEC or CC. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. Firm-year fixed and product-destination-year effects are included (not reported). Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Table 10

The Impact of NEEC on Firms' Exports
Heterogeneous Effects by Product Categories and Transport Mode

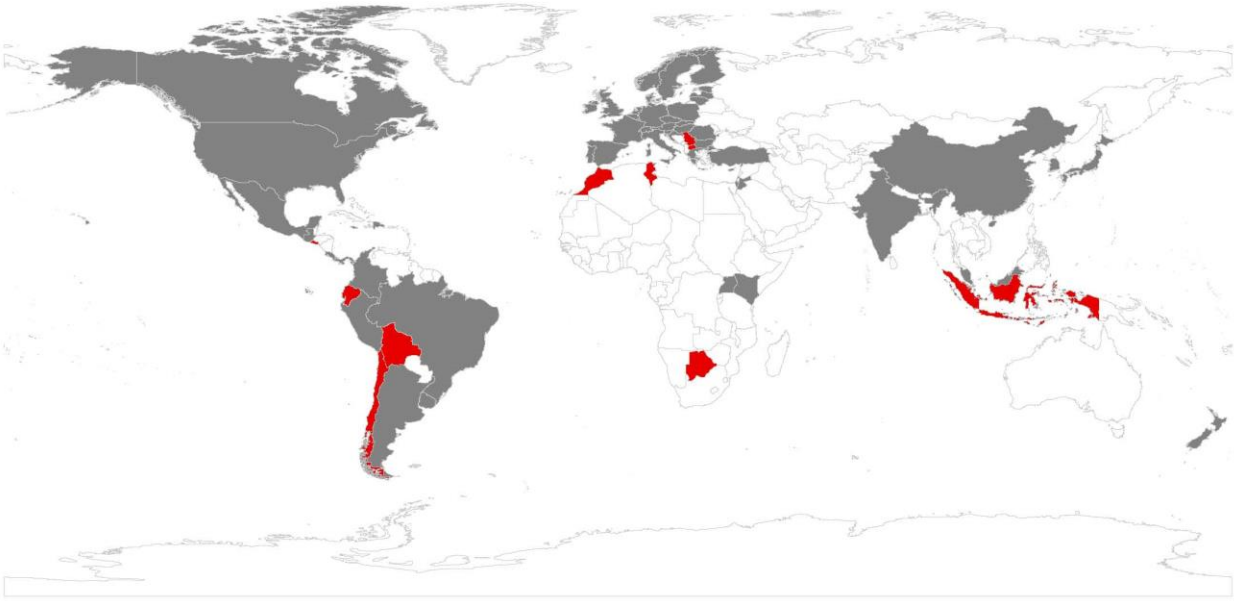
Heterogeneous Effects by Product Category							
	Food	**Textiles**	**Industrial Supplies**	**Capital Goods**	**Transport Equipment**	**Consumer Goods**	**Others**
Export Value	-0.118	0.573***	0.585***	0.544***	0.461***	0.570***	0.136
	(0.442)	(0.167)	(0.058)	(0.049)	(0.066)	(0.083)	(0.246)
Export Quantity	0.426	0.686***	0.674***	0.685***	0.591***	0.657***	0.439*
	(0.337)	(0.117)	(0.063)	(0.071)	(0.094)	(0.088)	(0.231)
Unit Value	-0.545	-0.113	-0.089***	-0.141***	-0.130	-0.087	-0.302
	(0.377)	(0.176)	(0.074)	(0.073)	(0.083)	(0.099)	(0.251)
Number of Shipments	0.215	0.309***	0.397***	0.386***	0.318***	0.396***	0.139
	(0.153)	(0.064)	(0.028)	(0.026)	(0.043)	(0.039)	(0.103)
Export Value per Shipment	-0.334	0.264*	0.188***	0.157***	0.142**	0.174**	-0.002
	(0.399)	(0.153)	(0.046)	(0.038)	(0.055)	(0.069)	(0.213)
Export Quantity per Shipment	0.211	0.377***	0.277***	0.299***	0.272***	0.261***	0.300*
	(0.323)	(0.104)	(0.060)	(0.067)	(0.080)	(0.081)	(0.182)
Firm-Year Fixed Effect				Yes			
Product-Destination-Year Fixed Effect				Yes			
Observations				265,080			

Heterogeneous Effects by Transport Mode						
	Air	**Sea**	**Land**	**Air**	**Sea**	**Land**
Export Value	0.842***	0.469***	0.520***	0.737***	0.502***	0.544***
	(0.095)	(0.069)	(0.053)	(0.107)	(0.070)	(0.057)
Export Quantity	0.848***	0.655***	0.669***	0.637***	0.756***	0.721***
	(0.124)	(0.123)	(0.085)	0.113)	(0.119)	(0.085)
Unit Value	-0.026	-0.186*	-0.149*	0.100	-0.255***	-0.176**
	(0.109)	(0.099)	(0.090)	(0.108)	(0.094)	(0.086)
Number of Shipments	0.474***	0.397***	0.376***	0.455***	0.383***	0.386***
	(0.048)	(0.056)	(0.039)	(0.050)	(0.060)	(0.038)
Export Value per Shipment	0.368***	0.072	0.144***	0.282***	0.119*	0.159***
	(0.065)	(0.058)	(0.044)	(0.074)	(0.067)	(0.046)
Export Quantity per Shipment	0.394***	0.258**	0.293***	0.182*	0.374***	0.335***
	(0.101)	(0.109)	(0.090)	(0.095)	(0.095)	(0.084)
Firm-Year Fixed Effect		Yes			Yes	
Product-Destination-Year Fixed Effect		Yes			Yes	
Transport Mode-Year Fixed Effect		No			Yes	
Observations		200,517			200,517	

Source: Authors' calculations based on data from SAT.

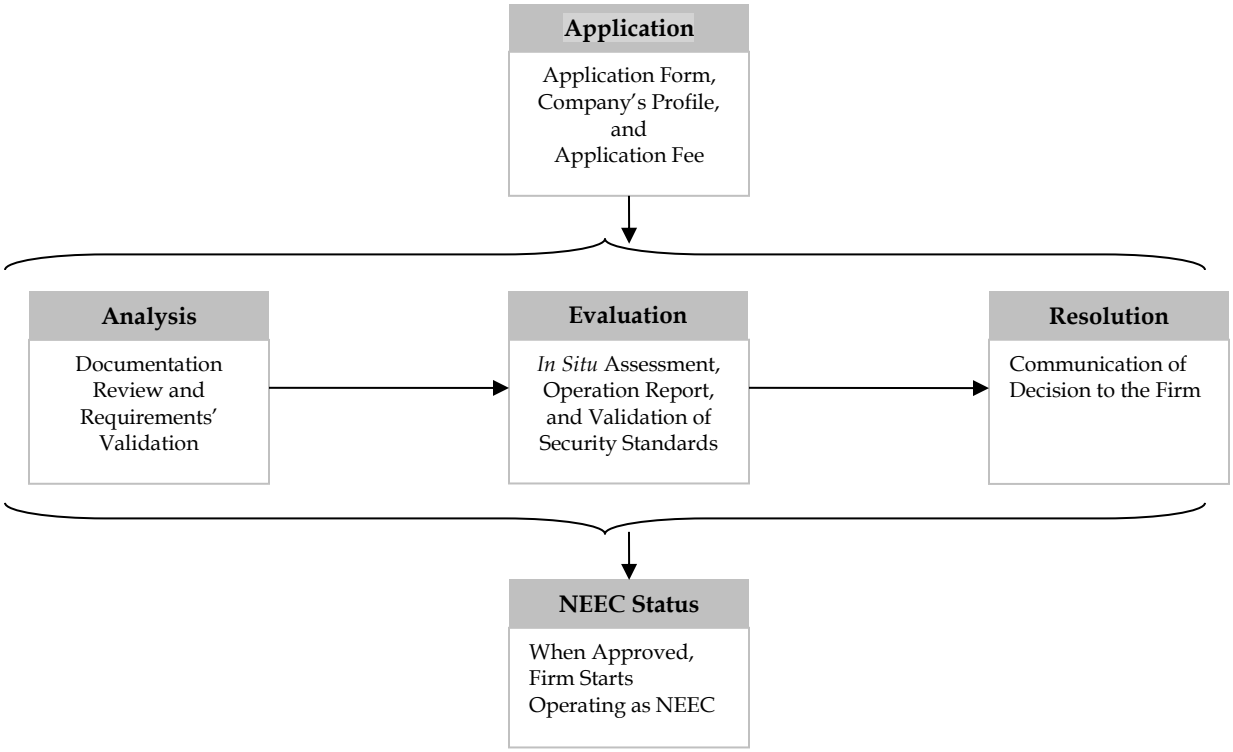
The upper panel of table reports OLS estimates of a specification of Equation (8) that allows for different effects on exports of different product categories: food products, textile products, industrial supplies, capital goods; transport equipment; consumer goods; and other goods. The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, the number of shipments, average export value per shipment, and average export quantity per shipment, all at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise. Firm-year fixed and product-destination-year effects are included (not reported). The lower panel of table presents OLS estimates of a specification of Equation (8) that allows for different effects on exports depending on the transport mode: air, sea, and land (the estimated effects on "others" are not reported). The dependent variables are the change in the natural logarithm of export value, quantity (weight) shipped, unit value, the number of shipments, average export value per shipment, and average export quantity per shipment, all at the firm-product-destination-transport mode-year level. The main explanatory variable is the change in a binary indicator taking the value of one if the firm ships the product to the destination through the transport mode in the year in question as NEEC and zero otherwise. Firm-year fixed effects and product-destination-year effects (Columns 1-3) and firm-year fixed effects, product-destination-year fixed effects, and transport mode-year fixed effects (Columns 4-6) are included (not reported). In all cases the sample is restricted to firms that are either NEEC or CC. Standard errors clustered by firm are reported in parentheses below the estimated coefficients. * significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

Figure 1
AEO Programs in the World



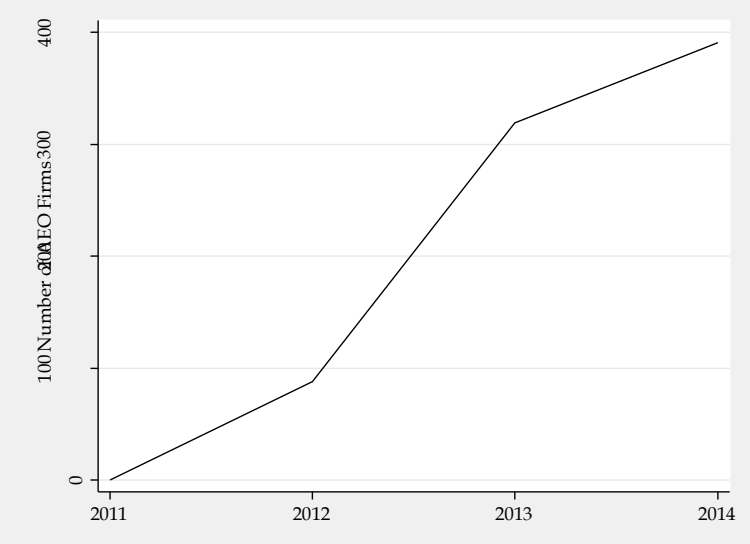
Source: Authors' preparation based on WCO (2015).
Countries colored in grey are those where the AEO program is currently active, whereas countries colored in red are those where the AEO program is about to be launched.

Figure 2
NEEC Certification Process
6-12 Months (at least 140 working days)



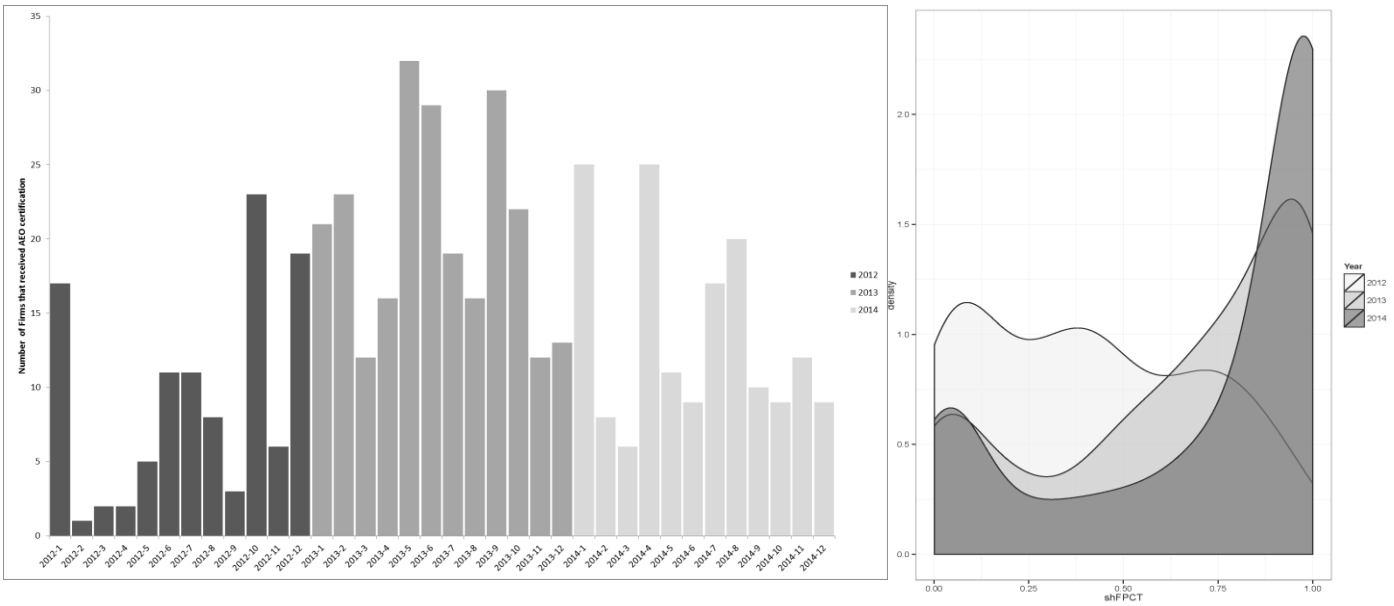
Source: Authors elaboration adapted from Clavijo (2013).
The figure illustrates the NEEC certification process.

Figure 3
NEEC Firms



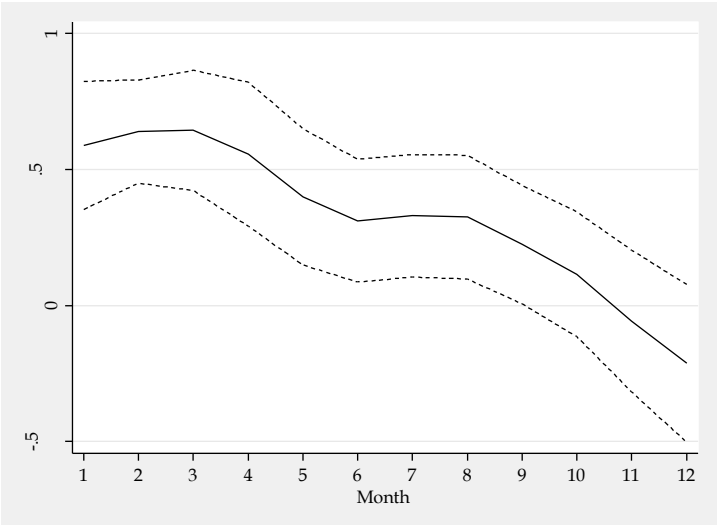
Source: Authors' calculations based on SAT.
The figure presents the total number of NEEC firms in each year of the period 2012-2014.

Figure 4
NEEC Firms: Months of Certification (left) and
Share of Product-Destination Observations under NEEC for Given Firms within a Year (right)



Source: Authors' calculations based on SAT.
The figure on the left reports the number of firms that became NEEC in each month of the period 2012-2014, whereas the figure on the right shows the distribution of the share of firms' product-destination exports as NEEC in their respective total number of product-destination exports within each year of the aforementioned period.

Figure 5
The Impact of NEEC on Firms' Exports by Month of Certification



Source: Authors' calculations based on data from SAT.
The figure shows OLS estimates of a variant of Equation (8) that allows for different effects across firm-product-destination combinations depending on the month in which they were first exported as NEEC along with the respective 95% confidence intervals. The dependent variable is the change in the natural logarithm of export value at the firm-product-destination-year level. The main explanatory variable is the change in a binary indicator that takes the value of one if the firm ships the product to the destination in the year in question as NEEC and zero otherwise interacted by a set of twelve binary indicators each of that take the value of one in one month of the year and zero otherwise. Firm-year and product-destination-year fixed are included (not reported). Standard errors are clustered by firm.