Market-Specific Trade Costs and Firm Dynamics: Evaluation of the Integrated Cargo Containers Control Programme between Pakistan and the United States

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This version: November, 2016

First version: August 2015

Abstract

Using novel firm-level microdata that track the locations of firms' export processing stations and modes of shipments over time, this study examines the trade effect of the Integrated Cargo Container Control (IC3) programme, launched between Pakistan and the US in the wake of 9/11 to thwart the potential vulnerability of cargo containers to terrorist exploitations. Although primarily a security measure, IC3 affected the beyond-the-border and behind-the-border costs of exporting to the US. We exploit the exogenous nature of this shock and its specificity to one export market in the identification strategy. Using the EU as a counterfactual, the difference-in-difference estimates show that, after this intervention, Pakistan's exports to the US relative to the EU dropped by 15% on average. Exporting firms that were forced to switch from various export-processing stations to one specific seaport equipped with intrusive scanning and live monitoring technologies experienced the largest decline in their trade. The subsequent policy interventions aimed at facilitating the process moderated this effect to some extent. This security policy appears to have caused a loss of US market access amounting to $6 billion between 2007 and 2014. These findings have policy implications for the adoption of similar technologies aimed at ensuring the security of the supply chain together with facilitating trade in the wake of the emerging security situation in other parts of the world.

Keywords: Trade Costs, Supply Chain Security, Scanning, Integrated Cargo Container Control, 9/11 and Trade, Trade Diversion

JEL Codes: F1, F13, F14

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1 Introduction

In a world where the threats to national security are globalised, transportation networks have been recognised as a weak link that could be exploited to ship the technologies of terrorism internationally (Meade and Molander, 2006; OECD, 2005). The reliance on international trade on these same networks highlights an importance in understanding and quantifying the effects of any policy responses to counter this terrorist threat. The major difficulty to reliably providing such estimates is that countries do not alter or adopt new security policies randomly but rather do so in response to the actual or perceived threat of terrorism by and in its trading partners; confounding variables that can additionally affect trade flows directly or indirectly through numerous channels (Mirza and Verdier, 2008). To confront this issue, in this paper, we exploit part of the counter-terrorism policy response to the events of 9/11 by the US that affected the costs of trade with Pakistan and detailed transaction-level trade data.

In the period following the 9/11 terrorist attacks the US administration conducted a number of reviews of national security policy.[2] That containerised cargo could be used as a conduit to smuggle radioactive or nuclear materials into the US featured heavily in this analysis. The policy responses were numerous[3] and affected trade with Pakistan in particular when the US Congress passed a mandatory screening and scanning law for all US-bound containers entitled the Integrated Cargo Container Contro (IC3). Starting in 2007 the program involved the live monitoring of the scanning of containers for radioactive and contraband items in Pakistan by the National Targeting Centre (NTC) in Washington DC via a video link (Government Accountability Office, 2008). Once security clearance was given by Washington, the container was allowed loading on a vessel for shipment and enter the US without further checks. The scanning technology was made available by the US to the Pakistan authorities for use at Qasim Port (located in Karachi, Pakistan) only. In the year prior to IC3 Port Qasim accounted for around 35% of Pakistan-US freight.[4]

For US-bound freight, IC3 represented a reduction in expected beyond-the-border trade costs compared to the pre-IC3 period and compared to non-US bound freight, which were subject to random interception and diversion to ports in Sri Lanka, Hong Kong or Oman for scanning.[5] At- and behind-the-border trade costs rose as a consequence of IC3 however. Most obviously they rose because of the time taken to complete the 100% scanning requirement compared to the probabilistic stop and search approach used

[2] These include the National Commission on Terrorist Attacks on the United states (also known as the 9/11 Commission) as well as Meade and Molander (2006).
[3] These include the Aviation and Transportation Security Act (2001), the Homeland Security Act (2002) and the Maritime Transportation Security Act (2002).
[4] Explain the cessation of the program and where
[5] The exception to this were less than full loads that could continue to be shipped through non-Qasim ports such as Karachi Port. For these routes beyond-the-border trade costs rose because of the mandatory scanning requirement as a transhipment port.

previously. They also rose because of the congestion caused by technology being available only at a single outbound port. For freight previously routed through other ports in Pakistan, exporters had the choice to transfer cargo through Port Qasim or continue to use other ports. For those that switched beyond-the-border trade costs rose due to the longer domestic journey times. These higher costs were ameliorated to some extent by scanning and port-infrastructure expansions in 2011. For those that continued to use ports other than Qasim shipping times rose owing to the longer distances involved with transhipment via and scanning at a foreign port. Behind and at-the-border costs were however unchanged in this case. An open empirical question is whether the change in beyond-the-border trade costs caused by the IC3 program were larger or smaller than the changes in at- and behind-the-border costs and how these differed across firms depending on their pre-IC3 use of ports and over time.

In the next section of the paper we lay out in more detail how the motivation, design, introduction and the equipment used for this change in counter-terrorism policy might be viewed from the perspective of Pakistan's exporters as exogenous, and how it affected trade costs with the US but not other international markets. We use the insights from this section as a motivation to study the trade effects of the IC3 programme as a quasi-natural experiment, using Pakistan's trade with EU countries as a counterfactual.[6] By design the application of a difference-in-differences (DID) framework helps to remove the direct and indirect effects (for example changes in uncertainty) on trade flows that are explained by any changes in the perception that Pakistan was a source of terrorism, particularly from its neighbour Afghanistan. It also allows us to control for the effects of improvements in technology, infrastructure and other institutional changes that could have affected trade flows to both destinations in this period.

Initial evidence that IC3 had a negative effect on Pakistan's exports relative to the counterfactual is shown in Figure 1, which compares the volume of Pakistan's exports to the US versus the EU countries over time. Exports to the US and EU countries had been growing along similar trends up until 2007 and then diverge markedly after this point. This is consistent with an interpretation that IC3 raised trade costs for Pakistan exporters. Formal analysis confirms that change in exports relative to the counterfactual is statistically significant. The magnitude of this effect is sensitive to the inclusion of controls for time invariant firm-destination effects in the estimation, halving in magnitude compared a regression without these controls. This strongly suggests the selection of better performing exporters into serving the US versus the EU countries Union and the importance of removing the effects of this selection bias from the results. The sensitivity of the main findings to the inclusion of firm-destination

[6] Its timing was also difficult to anticipate owing to delays in funding (The World Trade Review, 2007). It was also viewed ex-ante as trade promoting by the Pakistan government as it meant shipments of the export cargo containers to the US market would no longer need to be diverted to Sri Lanka, Hong Kong or Oman for scanning. "The implementation of the IC3 will reduce the cost of country's exports to the US. Presently, all cargoes destined for US from Pakistan are trans-shipped to Hong Kong, Colombo and Salalah for scanning, resulting in delay and extra financial cost to the exporters. The facility will also help exporters save time and money." The World Trade Review (2007).

fixed effects helps to demonstrate the value of using highly disaggregated trade data compared to standard data on bilateral trade flows to answer the question of the effects of IC3.[7]

These results are robust to the addition of various combinations of controls for firms, destinations, products and years. We also provide evidence on the robustness of the main findings to the use of China as an alternative counterfactual and search for evidence that there may be trade diversion from the US to the EU markets for firms that had previously served both markets. We find some evidence consistent with such an outcome, although the effects are relatively modest.

We further use the richness of the international trade data available to us by separating the effects of IC3 into the adjustments that occur for firms that used Port Qasim prior to the introduction of IC3 versus those that had previously used other ports. We show that the mandatory scanning requirement and concentration of the scanning equipment at Port Qasim led many firms to switch away from their previous port of shipment. Using information on their pre-IC3 use of Port Qasim versus alternative ports, including dry-ports, we are able to show that the negative effects of IC3 were confined to the non-Qasim users. For firms that had used Port Qasim pre-IC3 we find no evidence of a significant drop in trade relative to the counterfactual. This evidence indicates that the introduction of scanning equipment at domestic ports as a counter-terrorism policy had no effect effects on trade, but its availability as only a single outbound domestic port had a large negative effect. The drop in trade for firms that did not use Port Qasim in the pre-IC3 period is greatest for initial four years of the programme, from 2007 to 2011. The port expansions in 2011 offset these negative effects to some extent, although their effects remain negative.

This research extends the narrow stream of literature on trade and security issues (European Commission [EC], 2009; GAO, 2008; Mirza & Verdier, 2008; World Customs Organization [WCO], 2009). Mirza and Verdier (2008), in a general analytical framework, describe the existing relationships between terrorism, counter-terrorism actions and trade and argue that terrorism affects trade flows primarily through two channels: reducing the willingness to do business with insecure countries and the trade-restrictive effect of counter-terrorism policies. Our paper, provides empirical evidence of these channels related to firm-level exports. Similarly, the EC (2009), WCO (2009) and GAO (2008) argue against the feasibility of 100% scanning of US-bound exports owing to the high costs associated with the internal movement of cargo, congestion at ports and associated infrastructural constraints. Although these studies found the scanning operations to be highly cost-intensive and trade-restrictive, they did not perform quantitative assessments of the magnitude of the trade-restricting impact due to data limitations. We bridge this gap by using an administrative dataset to estimate the trade effect of IC3 and examine its heterogeneity along multiple dimensions at a micro level.

[7] We show in the paper evidence on an effect on Pakistani exports when using COMTRADE data that is of a similar magnitude to that found when using Pakistani customs data and a regression with no firm-destination fixed effects.

Our findings add to four distinct strands of literature on technology and trade, economic sanctions, trade costs and trade diversion. First, the recent literature on technology and trade examines the effect of containerisation (Bernhofen, El-Sahli, & Kneller, 2016) and maritime transport (Hummels, 2007; Pascali, 2014), whereas this paper explores the effect of intrusive scanning technology, which is increasingly being adopted for security and trade facilitation purposes. Second, we add to the literature on economic sanctions by generating evidence concerning the trade-restricting effect of disguised sanctions. The existing studies in this stream mainly focus on income effects; however, a few studies also find a negative trade effect (e.g. Afesorgbor & Mahadevan, 2016; Caruso, 2003; Cooper, 1989; Khan, 1988; Yang, Askari, Forrer, & Zhu, 2009).

Third, the trade diversion literature primarily examines the changes in importing countries' trade patterns in the context of preferential trade agreements (PTAs) and free trade agreements (FTAs) (e.g. Carrère, 2006), whereas we explore the effect on the exporting country's trade flows due to the cost-raising effect of the security policy. This trade diversion effect of behind-the-border costs speaks to the vast literature on trade costs (Anderson & Van Wincoop, 2003, 2004; Arkolakis, 2010; Baier & Bergstrand, 2007; Donaldson, forthcoming; Feyrer, 2009). In contrast to these studies, we isolate the effect of this shock from other potentially omitted variables influencing exports during this period by finding a suitable counterfactual group.

The remainder of the paper is structured as follows. The next section introduces the data and estimation methodology. Section 3 presents the main estimation results and robustness checks. Section 4 concludes by highlighting the policy implications of the study. A short note on the background to the IC3 programme is contained in the Appendix.

2 Data and Estimation Framework

2.1 Data

The study uses transaction-level data on international trade from Pakistan Customs. This dataset contains transaction level information, including standard information on sellers and their buyers, on product codes, prices and quantities at an 8-digit level of the Harmonised System (HS), in addition to the identities of export processing stations and modes of shipment. It includes all product categories in manufacturing and the agricultural sector, and covers the universe of firms shipping from through dry ports, airports or seaports to 215 trading partners of Pakistan. From this larger dataset we focus on Pakistan's exports to the US and EU markets.

The cleaned dataset of Pakistan's exports to the EU and US contain 6.1 million transactions (3.8 million for the EU and 2.3 million for the US) for 24,174 firms, of which 20,297 exported to the EU and 11,737 to the US during the period 2002–2014. This long-time span covers five years prior to and seven years

after the launch of IC3. For ease of estimations, we collapse the data to the firm-product-market-year level. The final dataset therefore covers 606,531 observations, of which 464,479 pertain to the EU and 149,630 to the US. We test the integrity and accuracy of the data by performing aggregation tests and comparing the results to the same information retrieved from the UN Comtrade dataset. The remaining information on other economic variables have been retrieved from the open data sources of the World Trade Organization (WTO) and the World Bank.

2.2 Estimation Framework

To quantify the magnitude of the trade effect of the first intervention at the firm level, we use the standard difference-in-difference regression framework:

$$ln(X_{ijkt}) = \beta_0 + \beta_1 US_j + \beta_2 TIME_t + \beta_3 IC3_{jt} + \varepsilon_{ijkt} \quad (1)$$

where *i* denotes the exporting firm, *j* the trading partner, *k* the product and *t* the time (year). $ln(X_{ijkt})$, the dependent variable, is the value of exports (in logs) of firm *i* to market *j* for product *k* at a time *t*. Export values are measured in PKR millions. *US* is a dummy variable equal to 1 if an observation relates to exports to the US and is recorded as a 0 for exports to an EU country and therefore identifies treated trade flows. Exports to the EU countries are the counterfactual in the regression, for which we provide further justification for below. *TIME* captures the time-period in which the treatment occurs: it is a dummy variable equal to 1 for the period 2007–2014 and 0 otherwise. Our regressor of interest is the term *IC3*, which is interaction of US_j and $TIME_t$. A negative significant coefficient for this regressor, β_3, would suggest that exports to the treatment group (US) relative to the control group (EU) have dropped in following the introduction of the IC3 programme in 2007. ε_{ijkt} is an idiosyncratic error term. Throughout standard errors are clustered at the firm-market-year level as trade flows between markets tend to be highly persistent over time.

To this specification we add a series of control variables that account for time invariant firm-destination country characteristics, products and common year-specific effects. This forms the baseline model that we use in much of the analysis. In the main results table we further test the robustness of the key results to the addition of firm-year, product-year and firm-destination-product effects.

2.3 Description of IC3

The validity of the difference-in-difference design relies on the allocation of the treatment, the use of the IC3 program for US trade, to be randomly assigned from the perspective of Pakistan's exporters. To understand whether this assumption holds in the current context requires further background information on the IC3 program.

The integrated cargo containers control (IC3) program is part of the Secure Freight Initiative (SFI) run by the US Department of Homeland Security.[8] IC3 built on the Container Security Initiative and the Mega Ports Initiative, both started in 2001. The Container Security Initiative required the stationing of US Customs and Border Protection officials at foreign ports to scan containers based on risk assessment, whereas the Mega Ports Initiative aimed at scanning as many containers as possible at high-volume ports. As a part of the earlier Container Security Initiative Prior to IC3 US-bound commercial cargo containers could be randomly intercepted and diverted to Sri Lanka, Hong Kong or Oman for security scanning (European Commission, 2009).[9]

IC3 began in April 2007 (MarineLog, 2008). Its key feature is the mandatory requirement for all Pakistan-US exports to undergo security scanning before their arrival in the US.[10] The scheme was a partnership between Pakistan Customs and the US Customs and Border Protection. In Pakistan, the scanning technology to complete the 100% scanning requirement was made available at Qasim Port in Karachi, but was also available at ports in Sri Lanka, Hong Kong or Oman.[11] Scanning could be completed at port Qasim or one of these foreign ports. The funds for land acquisition[12] at Port Qasim were provided by the Government of Pakistan, whereas the US authorities provided the X-ray scanners, Radio Portal Monitors (RPMs), communication systems and supporting technical assistance to Pakistan Customs.[13] Once cleared through intrusive scanning at Port Qasim, the cargo was placed on a secured site before being shipped. It was not subject to re-examination upon arrival at a US port, provided that the security seals on the container remained intact. Scanning Shipments sent via foreign ports took between two to six days longer to reach the US, depending on the destination port, compared to shipments sent directly through Port Qaim (see Table 1). These arrangements and port capacity were left unaltered until 2011, when the scanning yard at Port Qasim was expanded to double its capacity and an off-dock terminal was developed near Karachi Port to collect US-bound export cargo containers and arrange their further transportation to, and processing at, Qasim Port.

[8] This was separate to the 100% scanning requirement imposed on all inbound-US trade signed by President Bush on 3rd August 2007 under the 9/11 Commission Act of 2007. This required a 100% scanning requirement for all countries by 2012. It was also separate to the SAFE Ports Act of 2006. Three pilot ports were selected for the scheme Southampton (United Kingdom), Port Qasim (Pakistan) and Puerto Cortés (Honduras). A limited implementation was agreed for four additional ports (Singapore, Busan in South Korea, Salalah in Oman and Hong Kong in S.A.R. China). The insights from pilot schemes operated under the SAFE ports Act were supposed to inform the provisions for freight scanning under the 9/11 Act, but that act was signed before the pilot schemes had begun (European Commission, 2009).

[9] These were in addition to standard domestic border clearance procedures such as random physical inspections by Pakistan Customs and drug checks by the anti-narcotics force.

[10] The agreement for IC3 was signed following a visit to Pakistan by President Bush in March 2006 and was due to open by December of the same year. However this was delayed by around three months owing to late release of funds by the federal government (The World Trade Review, 2007).

[11] As mega-ports these owned scanning equipment as part of their standard security arrangements.

[12] 10 acres of land were used for IC3.

[13] Its building cost reached US$ 8 million (European Commission, 2009).

From the perspective of Pakistan's exporters, the introduction of the IC3 program might reasonably be regarded as exogenous. The project was established as a result of the 9/11 attacks in the US and was imposed by the US in the wake of prevailing broader international security situation, in particular with respect to Pakistan's neighbour Afghanistan. The Pakistan authorities had no influence over the design of the policy, no exemptions were offered for particular sectors and industries and Pakistan was not required to make investment in equipment or infrastructure beyond supplying the necessary land.

2.4 Selection of a Control Group and Tests for Parallel Trends

The scope and implementation of IC3 differs from many trade-related port or infrastructure projects, such as the construction of a new port or improvement in existing trade-processing infrastructure, in that it effects are destination market specific. IC3 influenced the processing of Pakistan's exports to the US (treatment group) only, whereas those to all other markets remained unaffected. Exports to non-US markets continued to be handled by ports across Pakistan, including inland (also known as dry-ports), and the security arrangements were unaltered. Trade between Pakistan and other countries was potentially affected by concerns about the threat of global terrorism in this period however, in particular that emanating from its neighbour Afghanistan. The most obvious example of this followed the attacks in London in July 2007. The counterfactual therefore controls for these common shocks to the demand for Pakistani produced goods.

The major destinations of Pakistan exports include China, the EU and the United Arab Emirates (UAE). Although the volume of exports to these markets is comparable to that destined for the US, the structure of exports varies (**Table** 2). In terms of the nature of products, the EU is closer to the US as these economies are key destinations for Pakistan's textiles and other finished goods.[14] Textiles constitute around 75% of the Pakistan export basket to these markets (Figure 2).The production process of these goods uses the same raw materials, machinery and equipment.[15] Given this we use exports to the EU countries as the counterfactual.

Before proceeding to developing a formal estimation strategy, we test the key identifying assumption of parallel trends in the evolution of the control and treatment groups in the pre-treatment period. The following graphical and statistical analysis indicates that this assumption holds. Figure 1 plots Pakistan's total exports to the EU and US, the control and treatment groups respectively. The chart

[14] For comparison: exports to China mainly comprise raw materials and semi-processed goods, whereas those to the US are higher value finished products. The UAE market attracts all kinds of products but exports to the UAE are not necessarily absorbed in that market, but may transit through its ports to other destinations.

[15] The trade flow to the EU has not directly been affected by the introduction of IC3, although it may be indirectly affected if there is destination substitution. We address this potential concern in detail in the robustness analysis by decomposing the trade effect across single- and multiple-market firms, as well as by using China as an alternative control on the assumption that export diversion to China, as a lower income country, is more difficult. We control for the differences in product quality across markets in the estimations.

suggests that the evolution of exports to both markets was similar before the launch of IC3 but differed afterwards. The evidence from Table 4, which presents the results of two sample t-tests on an annual basis, shows that the difference in trade in this year, or indeed any other year, does not differ significantly between US and EU countries prior to IC3. We infer form this evidence that the assumption of parallel trends is satisfied and the EU represents a valid counterfactual group.

3 Estimation Results

In this section of the paper we present evidence on the effects of the IC3 program using the difference-in-differences model set out in section 2.2. We then test the robustness of these results, before moving on to consider the effects of the 2011 port expansion and the use of different ports in section #.#.

3.1 Baseline Estimations

The introduction of IC3 meant a change in the pattern of trade costs for Pakistan's exporters. The evidence presented in Figure 1 suggests that the effect was to reduce exports to the US market. Using data for the value of exports from 1999 to 2014 to the US, EU and in total (all normalised to 1 in 1999) **Figure 4** show a similar pattern in the growth of trade prior to the launch of IC3 and a marked deviation between the US and EU in the period after that. After 2007 the value of exports remains largely unchanged until the end of the period, whereas exports to the EU continue to rise. This evidence is consistent with an interpretation of rising trade costs.

Regression 1 in Table 5, where we present the estimation results the simplest form of the difference-in-difference, confirms that this drop is statistically significant at standard levels. According to the results from this regression the introduction of the IC3 program policy in 2007 led to a fall in US trade relative to the counterfactual of 21% ($1-\exp^{-0.241}$). Instead of facilitating exports, the IC3 counter-terrorism security policy appears to have impeded Pakistan's ability to export.

In the next remaining columns of the table we determine the robustness of this outcome to the addition of various combinations of firm, destination, product and time effects that explain micro-level trade flows and might also be correlated with the response to the IC3 program. Of particular concern are the effects of selection bias caused by the presence of unobservable firm, product and time effects that determine who and the type of products that are exported to the US market compared to the EU. In turn we add a full set of dummy variables for firm-destinations (regression 2), firms-destination and products (regression 3), firm-destinations, products and time (regression 4), firm-time, firm-destination and

product (regression 5), product-time and firm-destinations (regression 6) and firm-destination-product and year effects, where the products are measured at the HS8 level.[16]

The results in regression 2 indicate that the types of firms that export to the US market may differ in their time --invariant characteristics such as managerial ability from those that export to the various EU markets. From the results, the suggestion is that firms that export to the US are typically better than those who export to EU markets and this serves to bias upwards the estimated effect of the IC3 program. Using the within-firm-destination variation within the data, the results show that trade fell by an estimated 11% as a consequence of the IC3 program.

As already noted the types of products that Pakistan exports to the US and EU is similar. It is then perhaps of little surprise that controlling for product characteristics, even at the HS8 digit level, in regression 3 has relatively little effect on the estimated effect of the IC3 program. Again the estimated effect of IC3 is close to 10%. In regression 4 we account for the presence of shocks to world trade that year-specific but are common across the US and EU as export markets from Pakistan. In the post-IC3 time period most obviously this captures the effects of shocks to world trade associated with the global financial crisis and falling world demand. It may also capture common movements in the demand for exports from Pakistan owing to changes in its perceived terrorist threat. These are included along with firm-destination and product fixed effects. Again we find that this has some modest effect on the estimated effect of the IC3 program on Pakistan's exports to the US relative to a counterfactual, although the effect remains negative and statistically significant at conventional levels.

In regressions 5 we consider the possibility of omitted variable bias at the level of the firm further by controlling for time-varying changes to firms that may affect trade (alongside products effects). These firm-time effects could include unobservable changes to the management and organisation of the firm that affect all exports by that firm, shocks to their productivity or heterogeneity in the effects of the global financial crisis across firms. In this regression (regression 5) the effects of IC3 are identified from the within firm-year and firm-destination variation in the data. Despite the rather demanding nature of this regression specification we continue to find evidence that trade from Pakistan to the US was negatively affected by the introduction of the IC3 program, where the estimated effect is if anything slightly larger than in regression 4.

In regression 6 we control for differences in the response of different products to common shocks by adding product-year dummies. Again despite the large number of dummy variables that are added to the regression in this model the effects of IC3 are found to be negative and the magnitude of the effect is similar to that already reported. Finally, in regression 7 we control for any observable or unobservable time-invariant differences in the types of products that are exported by a given firm to the various US

[16] To estimate the model with high dimensional fixed effects, we use the Stata command 'reghdfe', as suggested in Guimaraes and Portugal (2010).

and EU markets by adding firm—destination-product fixed effects. In this regression we lose many observations, as we cannot estimate the firm-destination-product effects for those firm-product combinations that appear only once in the data. The evidence from this regression suggests that the introduction of IC3 reduced exports from Pakistan to the US by a little under 9%.

3.2 Robustness

In this section we consider some further issues around the robustness of the baseline results in Table 4. Of the various regressions in Table 4 we use regression 4 as the baseline, controlling for firm-destination, product and year effects reduces the magnitude of the coefficient noticeably compared to regression 1, but it remains robust to the inclusion of other combinations of control variables.

The first-difference estimator is often proposed as part of the robustness tests for the difference in difference estimator as it relies on weaker exogeneity assumptions and is more efficient when the error term is serially correlated (Baier and Bergstrand, 2007). Demir and Javorcik (2014) adopt a similar approach in firm-level estimations in order to account for any difference in pre-shock trends. Moreover, the first-differencing of data takes into account the specific firm-product time-invariant factors, such as firms' experience of exporting a product to a given destination, and addresses any concerns regarding the non-stationarity of the series. We report the results from the first difference model as regression 8 in Table 5. The results in Table 5 provide support for our baseline findings as the coefficients of interest bear the expected signs and are statistically significant at the 1% level. The magnitude of the drop in trade explained by IC3 is larger than the baseline estimation at 11% but in the range of estimates found in Table 4.

As part of the robustness of difference-in-difference estimates Betrand, Duflo, and Mullainathan (2004) also recommend collapsing the time series data to a single pre- and post-treatment period to account for the problem of serial correlation when there are repeated observations. We report the results from this as regression 9 in Table 5. Our findings again appear robust to this point and if anything the magnitude of the effect IC3 program increases compared to Table 4.

In Table 4 we controlled for the possibility that firms were affected by shocks differently using firm-time effect in regression 5, and that products had different product-cycles by introducing product-time effects in regression 6. We did not however allow for the possibility that the timing of shocks, such as the financial crisis, led to different policy responses and the differential rates of recovery across the EU and US. That is shocks had a market specific dimension. To address this concern, we control for the import demand[17] to the regression. The coefficient of interest in this regression (reported as regression

[17] Which is total import of these products by the EU and US less their imports from Pakistan.

10 in Table 5) remains negative and statistically significant at the 1% level, while the import demand variable has a significant and positive effect as expected.

Next we consider the role of the counterfactual in the regression. From the description of the IC3 program a first concern is that the counterfactual may itself be contaminated by the introduction of IC3 because some exporters diverted efforts to serving the EU market. If this occurs then this would tend to exacerbate the difference in trade to the US and EU markets and increase the magnitude of the trade effects of IC3 in our regressions. To consider the plausibility of this argument we separate firms that exported just to a EU country or the US (single destination exporters) from those that served both the US and EU, on the assumption that if there are fixed or sunk costs of exporting we would expect that the single-destination exporters should be less able to divert trade across destination. That is we would expect the effects of the IC3 program to be smaller when we consider single destination exporters together in the same regression rather than firms that serve both markets. We report the results for single-destination exports in regression 11 and exporters who serve both the US and EU markets in regression 12. We find the expected outcome, the effect of IC3 is larger for firms that had the greatest possibility of diverting trade from the affected US market to the EU market. However, in both cases the effect of IC3 remains negative and statistically significant, and reassuringly, the magnitude of the decline in trade for the single destination exporters is not dissimilar to the baseline regressions. Trade by firms serving just the US market or an EU country fell relative to firms serving just the EU market by 12%, whereas for firms serving both US and EU markets trade fell by 7% in the post-IC3 time period.

In regression 13 we explore the use of an alternative counterfactual for US trade. As IC3 exclusively targeted Pakistan's US-bound exports whereas those to other markets, including China, were not subjected to screening. Using China as an alternative counterfactual offers two additional advantages. First, exports to China were not affected by the conclusion of ATC in 2005, which might have influenced textiles exports to the EU market due to the removal of the quota under ATC. Second, the demand for Pakistani exports into the US and China are likely to be different such that the scope for exporting firms to switch markets is therefore much more limited than in the EU case. Concerns about spillovers on the counterfactual are therefore less likely to occur. Regression 13 in Table 5 indicates that trade between Pakistan trade with the US fell by even more than trade with the EU when using trade with China as the counterfactual. In the post-treatment period, Pakistan's US-bound exports relative to China drop by 19% on average.

As a final exercise in this section we conduct a placebo test where we consider trade between India, the US and the EU. By so doing we seek to test whether the difference in the pattern of trade we observe between Pakistan-US and Pakistan-EU in the post-IC3 period might be explained by a more general difference in trade into the US and EU markets. To conduct this test, we use product level international trade data from the UN Comtrade database, where products are now measured at the HS6 digit level.

While this exercise also allows us to test the robustness of our findings to the use of an alternative data source, their disadvantage is that they do not allow us to control for time-invariant differences in the type of firms exporting to the US and EU markets. The results from regression 2 suggest that this was an important difference for the magnitude of estimates of the effects of IC3.

In regression 14 we first show the robustness of our results for Pakistan to the use of the UN Comtrade data. The difference in the difference estimates show that relative to the counterfactual of EU exports, Pakistan's exports to the US dropped by 24% on average. This difference is statistically significant at the 1% level. That the effect is larger than those reported in regression 4 in Table 4 is expected given the absence of firm specific information in the UN Comtrade data and it is close to the estimates in regression 1 where we also did not control for time invariant unobservable firm-destination characteristics. This differs from the pattern found Indian exports to the same markets over this time period reported in regression 15. Indian exports to the US were unaffected by the introduction of IC3 in India compared to the counterfactual. Also important, the magnitude of the treatment effect in regression 15 is very close to zero in its overall magnitude, indicating that it is not that the treatment effect of IC3 is poorly identified in the data.

3.3 Extensions

The results in Table 4 and Table 5 assume that the effects of the IC3 were homogenous across firms and across the post-IC3 period Compared to the pre-IC3 system of randomly intercepting freight and diverting it to a foreign port, expected beyond-the-border time costs fell for freight sent via Port Qasim following the introduction of IC3; freight was now sent direct to the US with certainty once it had cleared Pakistan customs. The documentation on IC3 prior to its introduction describes the programme as consistent therefore with the idea of trade facilitation.[18] At- and behind-the-border costs rose however because of the time spent in scanning and because of congestion at the port gates due to the concentration of scanning operations at a single location.[19] These latter costs were alleviated to some degree by the 2011 port expansion.

[18] Documents of the national customs authorities, as well as the Pakistan Trade Policy Review (WTO, 2007), describe it as a step towards facilitating trade by curtailing vessel sailing time to the US, eliminating transhipment requirements at intermediary ports for scanning and simplifying procedural formalities at the port of origin and destinations, in addition to ensuring the security of the supply chain.

[19] Qasim Port is relatively poorly connected with the hinterland compared to Karachi Port, which is the main sea port of Pakistan. Karachi Port also has better port infrastructure and handling facilities. Moreover, the major support services, such as shipping agents and freight forwarders, are located near Karachi Port. The IC3 scanning yard at Qasim Port is located outside the main port terminal. This means there is a need for unloading, handling and internal transportation, which further increases the costs, in addition to causing delays. As Qasim Port is connected to the main road network through Karachi, cargo vehicles have to wait in the daytime to ply through the mega city of 22 million people. To avoid traffic congestion heavy traffic is allowed to cross the city only after 11 pm.

For freight that had previously used non-Qasim ports trade costs rose as a consequence of IC3. For those that continued to use ports other than Qasim, beyond-the-border trade costs rose compared to the pre-IC3 scheme because of their required diversion onto a foreign transfer port for scanning. This can be measured both in terms of time delays for a longer route and the time spent at the foreign port for scanning. For freight routed this way, at- and behind-the-border trade costs were unaltered. In comparison, for freight that had previously been routed through an alternative port but was now switched to using Port Qasim, behind-the-border trade costs rose as exporters faced the further distance and therefore additional cost of transferring their cargo to Port Qasim rather than their previous choice.

A natural question that follows from this description is how much trade continued to use other ports in Pakistan and how much switched to using Port Qasim? The percentage of the total value of exports to the US using of Port Qasim versus the alternative ports, including Karachi Port, dry-ports and airfreight for 2005 to 2014 is shown in **Figure** 3. Port Qasim accounted for about 50% of the total value of exports in 2005 but this had fallen to about 35% in the year in which IC3 begins (2007). In this year Karachi Port is the most frequently used port for US-bound freight. Karachi port is generally regarded as having a better developed port infrastructure and cargo handling facilities than Port Qasim and most major support services, such as shipping agents and freight forwarders, are located near this port.

Immediately following the introduction of IC3 the percentage of export value using Karachi Port falls, although this appears to be driven by a rise in the use of dry-ports and airfreight rather than to Port Qasim. This is consistent with evidence from a European Commission report into the US scanning of freight globally, including the project in Pakistan, which noted little immediate evidence of switching of freight to Port Qasim. Freight transferred through dry-ports required security clearance from the US, but this could be done at Port Qasim or elsewhere. The share of trade using Port Qasim rises more quickly in the years 2009 and 2010, such that by 2011 it accounts for over 65% of total exported cargo to the US. After 2011 the trend continues upwards but at a noticeably slower rate.

In an extension to the empirical analysis we study the trade effects separately for those firms that had used Qasim as well as non-Qasim ports prior to introduction of IC3. For this we create two sets of firms according to their values in the 2006 data; those that previously used Port Qasim exclusively; and those that had previously used Karachi Port, dryports and airfreight.

In Table 6 we group firms according to their use of Port Qasim or another port to export to the US or EU market prior to the start of the IC3 program in 2006 and separate the time period into the years up to 2011 and 2011 to 2014. In these regressions the variable *IC3_2007* is a dummy variable equal to 1 for the period 2007–2014 and 0 otherwise and *IC3_2011* is also a dummy variable equal to 1 for the period 2011–2014 and 0 otherwise. This variable therefore captures the additional effect of changes in the post-2011 time period.

Regressions 16 to 19 in Table 6 report regressions where both the treatment and the control group used Port Qasim to export exclusively prior to the start of IC3, while regressions 20 to 23 include only observations where the firm exported through ports other than Port Qasim. From the description in section 3 we anticipate that the change in trade costs is likely to be larger for this latter group, because of the mandatory scanning requirement but limited availability of the scanning technology domestically. Regressions 17 and 19 allow for the further possibility that the effects differ across time, where we anticipate that the post-2011 expansion served to lower trade costs. In regression 18-19 and 22-23 we further disentangle these effects on the value of exports into changes in the quantity versus price.

The results suggest a marked difference in the effects of IC3 on those who used Port Qasim prior to IC3, versus those who did not. For exporters that used Port-Qasim pre-IC3 we find that IC3 had no effect on the value of trade compared to a counterfactual of exporters to the EU using the same port pre-IC3 (regression 16). It would appear that for this group of firms the consolidated scanning and clearance to the US in a single step compensated for any increase in the time required to transfer through Port Qasim such that there was on average no statistically significant effects for the average firm, although we note that the coefficient is large in this regression. It would also appear there were no significant effect for this group from the 2011 changes, although in regression 18 and 19 we note that this occurred because increases in the physical quantity of goods exported were exactly offset by reductions in the price.

In contrast, the large negative effects found previously appear to be exclusively borne by those firms that did not use Port Qasim prior to the introduction of IC3. As a reminder many of these firms switched to using Port Qasim by the end of the time period, with an initial increase in the use of dry-ports. Post-IC3 these firms had the choice of switching to using Port Qasim, in which case they faced additional domestic freight costs but lower beyond-the-border costs, or remaining at their pre-IC3 port and having to transfer through a foreign port for scanning with a longer shipping time to the US. For these firms, trade fell by over 16% between 2007 and 2011 compared to the counterfactual of firms exporting to the EU market through non-Qasim ports. These negative effects were offset to some extent by the 2011 port expansions, although not fully. In the period 2011 to 2014 the negative effects of IC3 on trade were an estimated 7%. Seperating these effects into price and quantity changes we note that in the period between 2007 and 2011 there were declines in both price and the quantity of goods sold to foreign buyers compared to the counterfactual. Following the 2011 port expansions there were further declines in price, consistent with the changes for those using Port Qasim prior to IC3, although these were smaller for this group of firms, such that following an increase in the quantity of goods sold the value of exports rose.

4 Findings and Policy Implications

This study finds that the integrated cargo containers control (IC3) programme has restricted trade flows rather than facilitating them. Although it reduced beyond-the-border trade costs by allowing direct shipments of cargo containers to the US market and eliminating transhipment requirements in various transiting countries, the unintended increase in behind- and at-the-border costs offsets these trade facilitation effects. These costs increased due to the concentration of the intrusive scanning and live monitoring operations of all US-bound containers at one specific port, leading to a massive diversion of exports at the domestic level. The duplication of some border clearance procedures and the relatively under-developed port infrastructure and trade-related services at the Qasim Port compounded this effect further.

Since the changes in the security policy, Pakistan's exports to the US market relative to the EU have suffered a decline to the tune of 9% on average. Back-of-the-envelope calculations show a loss of access to the US market to the tune of $6 billion. This is quantitatively meaningful for a developing economy struggling to grow its exports. Some partial adjustment to the shock took place around five years after the introduction of IC3 owing to another intervention designed to facilitate US-bound shipments. The trade-impeding effect is heterogeneous across firms. The firms that were forced to switch their export-processing operations to the port equipped with the screening and live monitoring facilities experienced the largest decline in exports.

The findings have policy implications for the ongoing drive to deploy similar technologies aimed at facilitating trade as well as ensuring the security of the supply chain. They show how adding another layer of security on already very thick national borders can influence the behaviour of exporting firms and disrupt existing trade flows. In the wake of the emerging security situation in other parts of the world, the implementation of similar arrangements might present a serious blow to the market access of affected economies. This implies that policymakers need to focus on domestic constraints and the potential unintended effects of internal trade diversion, which can offset the effect of improvements at and beyond the borders.

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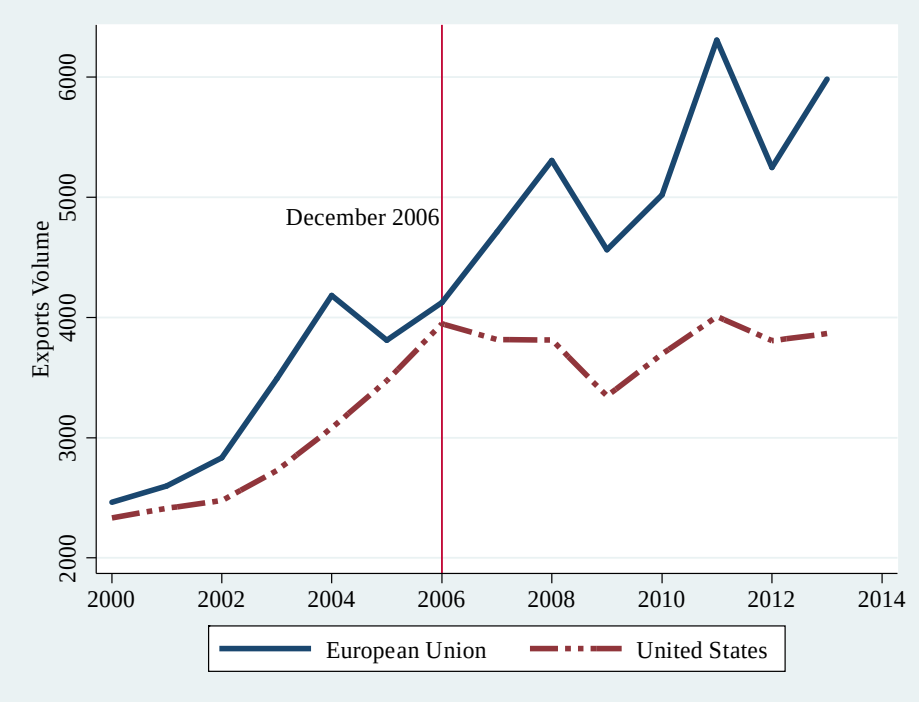
- Representatives of shipping lines (Maersk, Safemarine, UASC and APL) at Port Qasim, Karachi

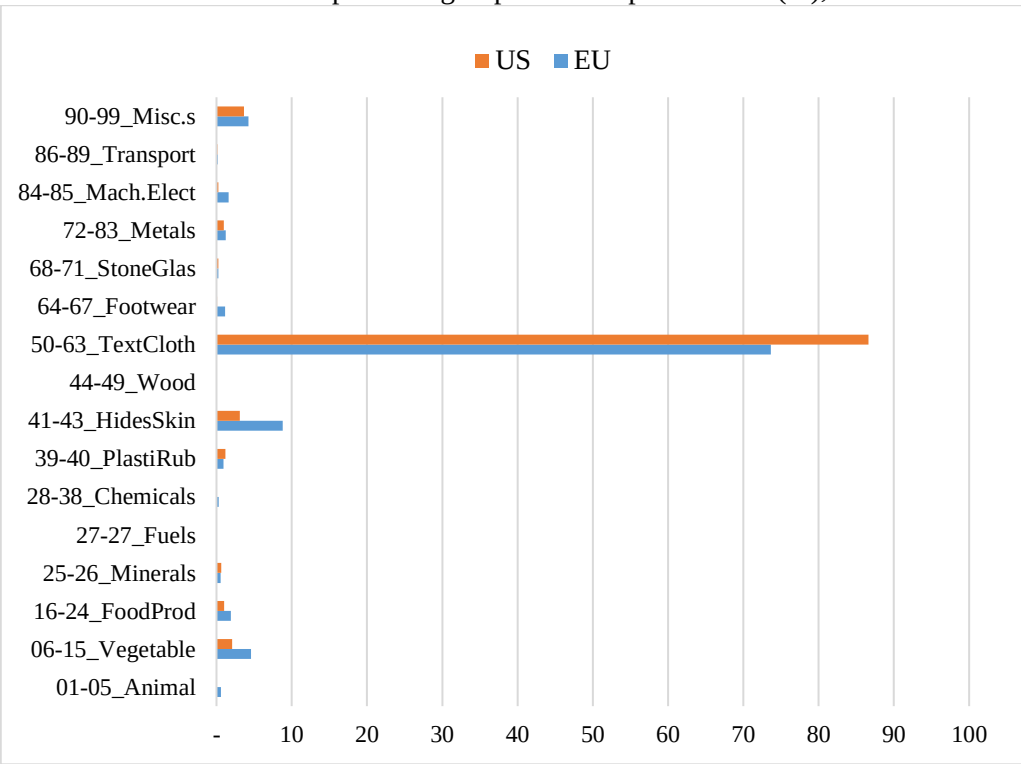
6 Figures and Tables

Figure 1: Pre- and Post-Treatment Trends for the Control (US) and Treatment (EU) Groups, 2000–2013



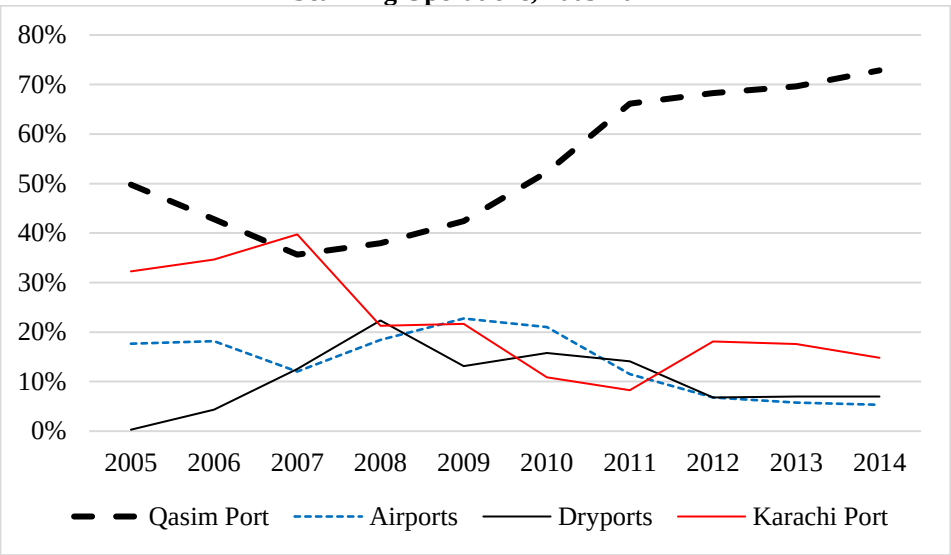
Note: Exports in millions of US dollars.
Source: Pakistan Customs.

Figure 2: Composition of Exports to the Control (EU) and Treatment (US) Groups
Share of various products groups in the export baskets (%), 2013



Source: Pakistan Customs.

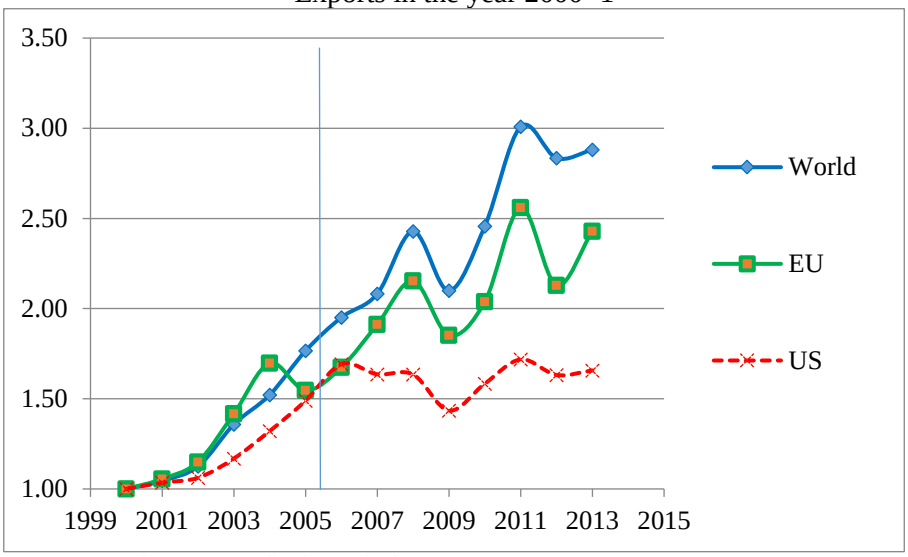
Figure 3: Internal Diversion of US-bound Export Cargo to Qasim Port due to Centralisation of the Scanning Operations, 2005-2014



Note. The values on the y-axis are the trade shares of various processing stations in the total US-bound exports.
Source: Pakistan Customs.

Figure 4**: Trend of Pakistan's Overall Export Volume, 2000-2013**

Exports in the year 2000=1



Note: Export values are normalized to '1' in the year 2000.

Source: Authors working using Pakistan Customs dataset.

Table 1: Maritime Distances and Vessel Sailing Time to the US in the Pre- and Post-IC3 Periods

A: Maritime Distance (Km)

Direct Shipments		Via Transhipment Ports					
		Sri Lanka		Hong Kong		Salalah (Oman)	
Destination	KM	KM	Diff. (%)	KM	Diff. (%)	KM	Diff. (%)
New York	14,812	18,424	-19.60	28,591	-	14,852	-0.27
Los Angles	19,564	19,756	-0.97	19,828	-1.33	21,754	-10.07

B: Vessel Sailing Time (days)

Direct Shipments		Via Transhipment Port					
		Sri Lanka		Hong Kong		Salalah (Oman)	
Destination	Days	Days	Diff. (%)	Days	Diff. (%)	Days	Diff. (%)
New York	24	30	-6	45	-	25	-1
Los Angles	31	32	-1	32	-1	35	-4

Source: http://www.searates.com/reference/portdistance/

Table 2: Value and Share of Pakistan's Exports to Selected Countries, 2013

Trading Partner	Exports (US$ M)	Share (%)
United States	3,746	14.91
China	2,652	10.56
United Arab Emirates	1,775	7.07
European Union (28)	5,932	23.01

Note: Share indicates the proportion of Pakistan's total exports.
Source: Pakistan Customs

Table 3: Parallel Trend Tests, 2002–2006

Δ Growth	Control	Treatment	Difference	t-statistic
(1)	(2)	(3)	(4)	(5)
2003	0.381	0.315	0.070	1.327
	(0.031)	(0.311)	(0.052)	
2004	0.390	0.316	0.073	1.388
	(0.031)	(0.041)	(0.052)	
2005	0.203	0.242	-0.0389	-0.782
	(0.029)	(0.039)	(0.048)	
2006	0.277	0.269	0.007	0.147
	(0.277)	(0.269)	(0.054)	

Note: Δ Growth indicates the annual growth rate of exports. Standard errors are in parentheses. The t-statistics in column (5) pertain to the difference in the means of the treatment and control groups in column (4).

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Table 4: Baseline Estimates of the Effect of IC3 on US-bound Exports

Regression number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Dependent variable	**log of exports per firm, by destination, by product and year**						
IC3	-0.241*** (0.019)	-0.116*** (0.018)	-0.101*** (0.017)	-0.089*** (0.017)	-0.122*** (0.025)	-0.097*** (0.017)	-0.086*** (0.029)
US	0.598*** (0.017)						
$TIME_{2007\text{-}2014}$	-0.273*** (0.010)	0.027*** (0.010)	0.004 (0.012)				
Additional Controls							
Firm-Destination effects		Y	Y	Y	Y	Y	
Product effects			Y	Y	Y		
Year effects				Y			Y
Firm-Year					Y		
Product-Year						Y	
Firm-Destination-Product							Y
R^2	0.009	0.473	0.547	0.561	0.607	0.575	0.792
Observations	606,351	606,351	589,486	589,486	570,065	580,713	334,333

Note: Robust standard errors are in parentheses. These coefficients were obtained using Stata 13 SE; * p < 0.10, ** p < 0.05, *** p < 0.01.

Table 5: Robustness of the Effects of IC3

Regression number	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Remark	**First-differenced**	**Single pre & post-IC3 period**	**Adding import demand**	**US or EU exports**	**US and EU exporters**	**China as Counterfactual**	**Comtrade data for Pakistan**	**Comtrade data for India**
Dependent variable	**log of exports per firm, by destination, by product and year**						**log of exports by destination, by product and year**	
IC3	-0.111***	-0.142***	-0.081***	-0.069**	-0.125***	-0.207***	-0.281***	0.003
	(0.027)	(0.021)	(0.019)	(0.030)	(0.022)	(0.066)	(0.036)	(0.037)
Import demand			0.047***					
			(0.005)					
Additional Controls								
Firm-Destination effects		Y	Y	Y	Y	Y		
Product effects		Y	Y	Y	Y	Y	Y	Y
Year effects			Y	Y	Y	Y	Y	Y
R^2	0.000	0.555	0.558	0.596	0.552	0.560	0.740	0.734
Observations	185,989	380,549	576,607	261,850	319,964	160,157	39,604	87,568

Note: Robust standard errors are in parentheses. These coefficients were obtained using Stata 13 SE; * p < 0.10, ** p < 0.05, *** p < 0.01. The coefficients for other regressors and fixed effects are not reported as they are not of direct interest. The 1st treatment indicates the effect of the initial shock and the 2nd treatment shows the effect of subsequent remedial measures. Y indicates the inclusion of fixed effects.

Incumbents exported from Qasim Port before and after IC3, while switchers exported from Karachi Port and dry ports in the pre-IC3 period and from Qasim Port in the post_IC3 period. Y indicates the inclusion of fixed effects. The number of observations varies across columns as Stata drops singletons in column (2) and (3). Y indicates the inclusion of fixed effects. The estimations control for import demand in both markets to account for the differential effect of the financial crisis on the EU and US markets. The import variable captures total importations of the EU and US from the world less their imports from Pakistan.

Table 6: Heterogeneity of the IC3 Effect across pre-IC3 users of Port Qasim Users and other ports

Regression number	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**
Remark	**Pre-IC3 Port Qasim exporter**				**Pre-IC3 other port exporter**			
Dependent variable	**Value**	**Value**	**Quantity**	**Price**	**Value**	**Value**	**Quantity**	**Price**
IC3_2007-2014	-0.204	-0.205	-0.125	-0.081	-0.128***	-0.157***	-0.083***	-0.074***
	(0.129)	(0.130)	(0.121)	(0.110)	(0.025)	(0.025)	(0.025)	(0.016)
IC3_2011-2014		0.001	0.112***	-0.104***		0.085***	0.120***	-0.030**
		(0.030)	(0.030)	(0.025)		(0.018)	(0.019)	(0.013)
Additional Controls								
Firm-Destination effects	Y	Y	Y	Y	Y	Y	Y	Y
Product effects	Y	Y	Y	Y	Y	Y	Y	Y
Year effects	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.631	0.631	0.733	0.723	0.532	0.532	0.607	0.603
N	147,449	147,449	145,722	145,722	374,060	374,060	371,968	371,968

Robust standard errors are in parentheses. These coefficients were obtained using stata 13SE

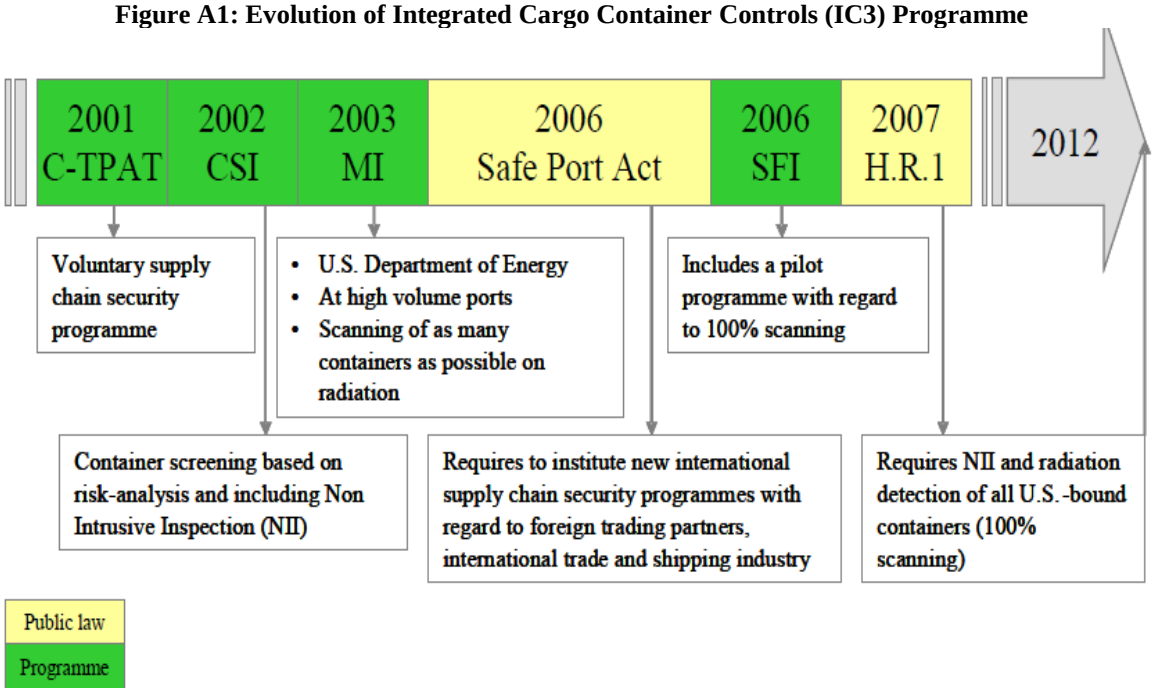
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The estimations contain fixed effects for firms, products and time.

7 Appendix

Annex A: IC3 Programme in Brief

The integrated cargo containers control (IC3) program is a part of the Secure Freight Initiative (SFI), a Department of Homeland Security (DHS) programme. It builds on two similar arrangements launched after 9/11 in 2001: the Container Security Initiative (CSI) and the Mega Ports Initiative (MPI). CSI required the stationing of US Customs and Border Protection (CBP) officials at foreign ports to scan containers based on risk assessment, whereas the MPI aimed at scanning as many containers as possible at high-volume ports. The SFI begin in April 2007 (MarineLog, 2008) with the launch of an International Container Security pilot at Qasim Port (QP) in Karachi, Pakistan. However, the "100% scanning" law, or House Resolution 1 (H.R. 1) required the extension of scanning operations to all US-bound cargo of all trading partners by July 2012 (Figure A1).

Figure A1: Evolution of Integrated Cargo Container Controls (IC3) Programme



Source: European Commission (2009).

The "100% scanning" law, or House Resolution 1 (H.R. 1), that IC3 forms part of, required the extension of scanning operations to all US-bound cargo of all trading partners by July 2012 (Figure A1). The practicability of the 100% scanning of US-bound cargo originating from other trading partners and its potential trade-inhibiting effect have been the subject of intense debate in countries that are heavily reliant on exports to the US. Its implementation has faced significant resistance from EU port operators, Asian governments and the World Customs Organization (WCO) in particular. These

institutions object to the unilateral nature of the legislative requirement and argue that it inherently ignores the international character of global maritime trade. The European Commission (EC) expressed concerns regarding implementing a measure designed to protect the US, which could divert resources away from strengthening the EU's security. The EU further alluded to retaliatory measures aimed at forcing the US export cargo containers to undergo similar scanning before being shipped to the EU market. A pilot programme launched at Southampton port in the UK in 2006 faced a great many technical and operational issues (EC, 2009). After the conclusion of the pilot phase in 2008, Her Majesty's Revenue and Customs decided to cease participation in the SFI. As a result, the process reverted to Container Security Initiative protocols. The US Customs and Border Protection also approached the port of Singapore, but delays and complications in starting the trials meant the port operator decided not to participate in the programme.

The practicability of the 100% scanning of US-bound cargo originating from other trading partners and its potential trade-inhibiting effect have been the subject of intense debate in economies that are heavily reliant on exports to the US. Moreover, its implementation has faced significant resistance from EU port operators, Asian governments and the World Customs Organization (WCO). These institutions object to the unilateral nature of the legislative requirement and argue that it inherently ignores the international character of global maritime trade. The European Commission (EC) expressed concerns regarding implementing a measure designed to protect the US, which could divert resources away from strengthening the EU's security. The EU further alluded to retaliatory measures aimed at forcing the US export cargo containers to undergo similar scanning before being shipped to the EU market.

A similar pilot programme launched at Southampton port in 2006 faced a great many technical and operational issues (EC, 2009). After the conclusion of the pilot phase in 2008, Her Majesty's Revenue and Customs (HMRC) decided to cease participation in the SFI. As a result, the process reverted to CSI protocols. CBP also approached the port of Singapore, but delays and complications in starting the trials meant the port operator decided not to participate in the programme. However, Pakistan, being a frontline state in the war against terrorism, had to accept these arrangements because prior to the launch of IC3 at QP, its US-bound commercial cargo containers were diverted to Sri Lanka, Hong Kong or Oman for scanning purposes (EC, 2009). This random diversion caused uncertainty in the timing of delivery of shipments to the final buyers. In these circumstances, the project was perceived as a trade facilitation initiative as it allowed direct shipments to the US markets by completing the scanning requirements at the port of origin.

Table 7: Exporting Firms and Products in the Control (EU) and Treatment (US) Groups

	Firms					Products				
	All Firms		Single Market		Both Markets	All Products		Single Market		Both Markets
Year	EU	US	EU	US	EU & US	EU	US	EU	US	EU & US
2002	191	80	176	65	15	160	67	126	33	34
2003	1,041	724	777	460	264	568	354	345	132	223
2004	2,287	1,463	1,648	824	639	1,346	834	1,000	357	673
2005	4,064	2,513	2,764	1,213	1,300	2,401	1,640	1,131	372	1,284
2006	5,921	3,575	3,941	1,595	1,980	2,210	1,520	1,004	314	1,206
2007	6,415	3,586	4,357	1,528	2,058	2,273	1,469	1,093	430	1,168
2008	6,673	3,485	4,612	1,424	2,061	2,062	1,280	1,034	244	1,040
2009	6,791	3,428	4,835	1,472	1,956	2,239	1,344	1,143	241	1,108
2010	6,977	3,563	4,953	1,539	2,024	2,268	1,411	1,128	262	1,154
2011	7,341	3,789	5,174	1,622	2,167	2,270	1,412	1,130	265	1,152
2012	7,605	3,931	5,296	1,622	2,309	2,348	1,469	1,173	286	1,187
2013	7,631	3,981	5,248	1,598	2,383	2,202	1,420	1,063	272	1,155
2014	7,404	3,833	5,068	1,497	2,336	2,101	1,363	990	247	1,120

Note: Products are identified at the HS8 level.
Source: Pakistan Customs.

Figure A2: Geographical Map of Pakistan

Source: maps.google.co.uk

Table 8: Heterogeneity of the IC3 Effect over Time

The dependent variable is the log of exports per firm by destination

	Coeff. (1)	SE (2)
Interaction (*Treat* x *After*) x		
2007	-0.478***	(0.022)
2008	-0.495***	(0.024)
2009	-0.497***	(0.024)
2010	-0.349***	(0.024)
2011	-0.083***	(0.024)
2012	0.245***	(0.024)
2013	0.367***	(0.024)
2014	0.398***	(0.025)
R^2	0.50	
Observations	463,931	

Note: Robust standard errors are in parentheses. These coefficients were obtained using Stata 13 SE; * p < 0.10, ** p < 0.05, *** p < 0.01. The coefficients for other regressors are not reported as they are not of direct interest. The regressions include fixed effects for firms, products and time.

Table 9: Parallel Trend Tests for Control and Treatment Groups US and China, 2002–2006

Δ Growth	Control	Treatment	Difference	t-statistic
(1)	(2)	(3)	(4)	(5)
2003	-0.315	0.1539	-0.469	-0.551
	(0.335)	(0.379)	(0.851)	
2004	0.51615	0.34353	0.17261	0.424
	(0.416)	(0.112)	(0.172)	
2005	0.416	0.399	0.016	0.091
	(0.146)	(0.088)	(0.182)	
2006	0.027	0.157	-0.131	-1.251
	(0.027)	(0.154)	(0.038)	

Note: Δ Growth indicates annual growth rate of exports. Standard errors are in parentheses. The t-statistics pertain to column (4) for the difference in the means of treatment and control groups.