Market-Specific Trade Costs and Firm Dynamics in Pakistan: Evaluating the US Integrated Cargo Containers Control Programme

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Abstract

Using novel firm-level microdata that track the locations of 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 overall exports to the US relative to the EU dropped by between 8% and 11% depending on the fixed effects structure. This security policy caused therefore a significant loss of US market access between 2007 and 2014. The IC3 effect on trade was, however, heterogeneous across firms depending upon where they exported from pre-IC3 and whether they switched export location following IC3. 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 of 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 in 2001 the US administration conducted several reviews of national security policy.[2] That containerised cargo could be used to smuggle radioactive or nuclear materials into the US featured heavily in this analysis. The policy responses were numerous[3] and extended beyond exports destined for the US from Pakistan. The 9/11 Commission Act of 2007 required 100% scanning of US-bound exports from all countries, with 2012 set as the date for full implementation. There are therefore some potential wider lessons from the Pakistan experience for other countries, but the timing and nature of the measures applying in the case of Pakistan were specific to the Integrated Cargo Container Control (IC3) program. Following the passing by the US Congress of a law requiring mandatory screening and scanning and 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 (GAO, 2008). Once security clearance was given by Washington, the container was allowed to enter the US without further checks. The scanning technology was made available by the US to the Pakistan authorities for use at Qasim Port only (see maps in appendix for location of this port). In the year prior to IC3, Port Qasim accounted for around 35% of Pakistan-US freight but this share rose significantly after 2007.

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. Pre-IC3 Pakistan's exports to the US were subject to random interception and diversion to ports in Sri Lanka, Hong Kong or Oman for scanning.[4] Table 1 reports on the comparison of shipping distances and times from Pakistan to the US (New York and Los Angeles) with (possible pre-IC3) and without (certain post-IC3) diversion to one of the above

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 The exception to this was less than full load containers 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.

international ports for scanning. For shipments to New York, for example, the shipping distance is nearly 20% shorter and saves six days in sailing time with diversion to Sri Lanka avoided. Indeed, it was for this reason that the program was viewed and presented ex-ante as trade-promoting by the Pakistan government and others. "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." (World Trade Review, 2007).

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

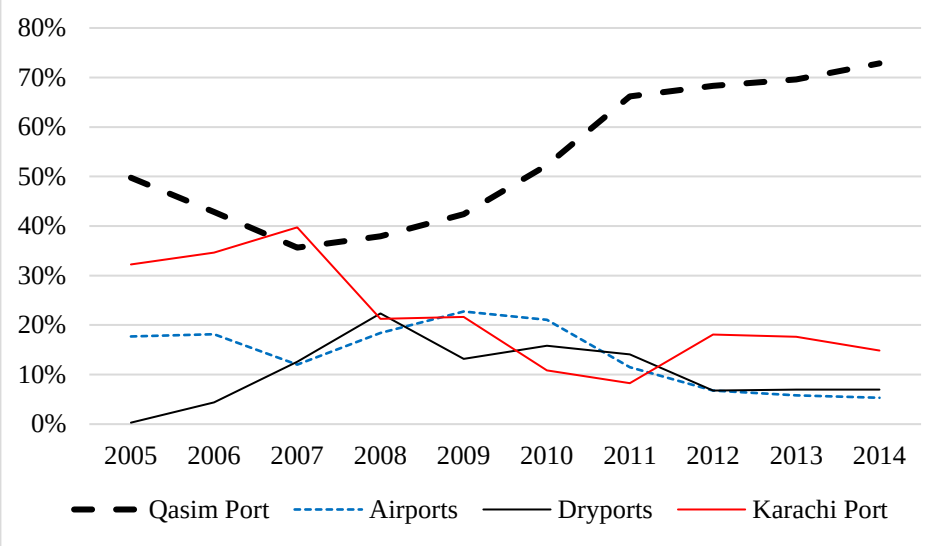
Source: http://www.searates.com/reference/portdistance/

Focussing on beyond-the border costs, however, did not accurately capture the effect of the program on overall trade costs, which include also at and behind-the border costs. In fact, at- and behind-the-border trade costs rose as a consequence of IC3. Most obviously, they rose because of the time taken to complete the 100% scanning requirement (at the border or on route) compared to the probabilistic stop and search (on route) approach used 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. Fig. 1 reports on the proportion of US-bound exports each year from alternative ports in Pakistan for the period 2005 to 2014. Note the marked rise in the proportion from Qasim after 2007; rising from less than 40% in 2007 to nearly 70% by 2011. The journey to Qasim via road was longer to and around Karachi compared with that to Port Karachi (see maps in the Appendix – Figures A.1 and A.2).

Table 2 summarises the increase in internal road distances for exports diverted from Port Karachi to Qasim Port for firms located in different cities in Pakistan. The average internal distance that exports were transported rose by about 5% (in unweighted terms) and by 9.3% when weighted by export values from the different locations. The distance-raising effect was greater for export firms nearer to Karachi (where the majority of exporters were located); doubling the distance for firms in Karachi, but increasing it by only 3.4% for firms in Peshawar (firms here on average being over 1600 km from both ports). For those firms, therefore, that switched to exporting through Qasim behind-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 on average 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 and over time depending on their pre-IC3 use of ports.

Figure 1: Internal Diversion of US-bound Export Cargo to Qasim Port due to Centralisation of the Scanning Operations, 2005-2014



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

Table 2 'Behind the Border': Increases in Internal Distance to Port for Diverted Exports

Export Origin	Distance to ports (in Km)		% Increase	Export wt. 2009
	Karachi	Qasim		
(1)	(2)	(3)	(4)	(5)
Faisalabad	1,188	1,243	4.6	0.123
Gujranwala	1,345	1,400	4.9	0.010
Hyderabad	147	202	37.4	0.001
Islamabad	1,506	1,561	3.7	0.001
Karachi	55	110	100.0	0.532
Lahore	1,265	1,320	4.3	0.149
Multan	943	998	5.8	0.004
Peshawar	1,601	1,656	3.4	0.000
Quetta	670	725	8.2	0.019
Rawalpindi	1,501	1,556	3.7	0.001
Sargodha	1,396	1,451	3.9	0.000
Sialkot	1,219	1,274	4.5	0.161
		% Increase		
Simple Average	1,070	1,125	5.1 15.3	
Weighted Average	593	648	9.3 55.4	

Source: Authors' calculations.
Notes: Columns (2) and (3) contain shortest road distances from centres of towns to seaports measured with the Google Maps. Column (4) contains export weights for 2009.

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.[5] 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.

The formal modelling identifies a fall in exports relative to the counterfactual, one that is statistically significant. This is consistent with an interpretation that IC3 raised overall trade costs to the US for Pakistan exporters. The magnitude of this effect is sensitive to the inclusion of controls for time invariant firm-destination effects in the estimation, halving it in magnitude compared to a regression without these controls. This strongly suggests selection by exporters into serving the US and EU markets, and the importance of removing the effects of this selection bias from the estimated export effects of the program. This sensitivity of the main findings to the inclusion of firm-destination fixed effects helps to demonstrate the value of using highly disaggregated trade data compared to standard data on bilateral trade flows to answer a question about the effects of IC3.[6]

The finding of net export destruction is robust to the addition of various combinations of controls for firms, destinations, products and years. We also provide evidence of 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 operations 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 exports relative to the counterfactual. This evidence indicates that it was not the introduction of a domestic scanning capacity per se that had a negative effect on trade, but rather its availability at only a single outbound domestic port that was export-reducing. The drop in trade for firms that switched to Port Qasim after IC3 is greatest for the first four

[5] Its timing was also difficult to anticipate owing to delays in funding (World Trade Review, 2007).
[6] We show evidence in the paper 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 (Table 4).

years of the programme, from 2007 to 2011. The port expansion in 2011 offset these negative effects to some extent, although their net effects over the whole post-IC3 period 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.

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, describes the empirical setting and the estimation methodology. Section 3 presents the main estimation results and section 4 the robustness checks. Section 5 concludes by highlighting the policy implications of the study.

2 Data and Estimation Framework

Data

The study uses data on international trade from Pakistan Customs[7]. This dataset contains transaction level information, including firm identifiers, 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 contains 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 seven 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 606,351 observations, of which 458,838 pertain to the EU and 147,413 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 has been retrieved from the open data sources of the World Trade Organization (WTO) and the World Bank.

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 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

[7] Use of this dataset is subject to a confidentiality agreement. Most of the information however is available from the Exporter Dynamic Database of the World Bank.

the interaction term *(US *TIME).* A negative significant coefficient for this regressor, $\beta_{3,}$ would suggest that exports to the treatment group (US) relative to the control group (EU) have dropped following the introduction of the IC3 programme in 2007. ε_{ijkt} is an idiosyncratic error term. Throughout standard errors are clustered at the market-year level, the level of variation of regressor of interest.

To this specification, we add a series of control variables that account for time invariant firm-destination country characteristics, product 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.

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 part of the earlier Container Security Initiative 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, but was also

[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, which 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).

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 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 Qasim (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.

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 the 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.

Selection of a Control Group and Tests for Parallel Trends

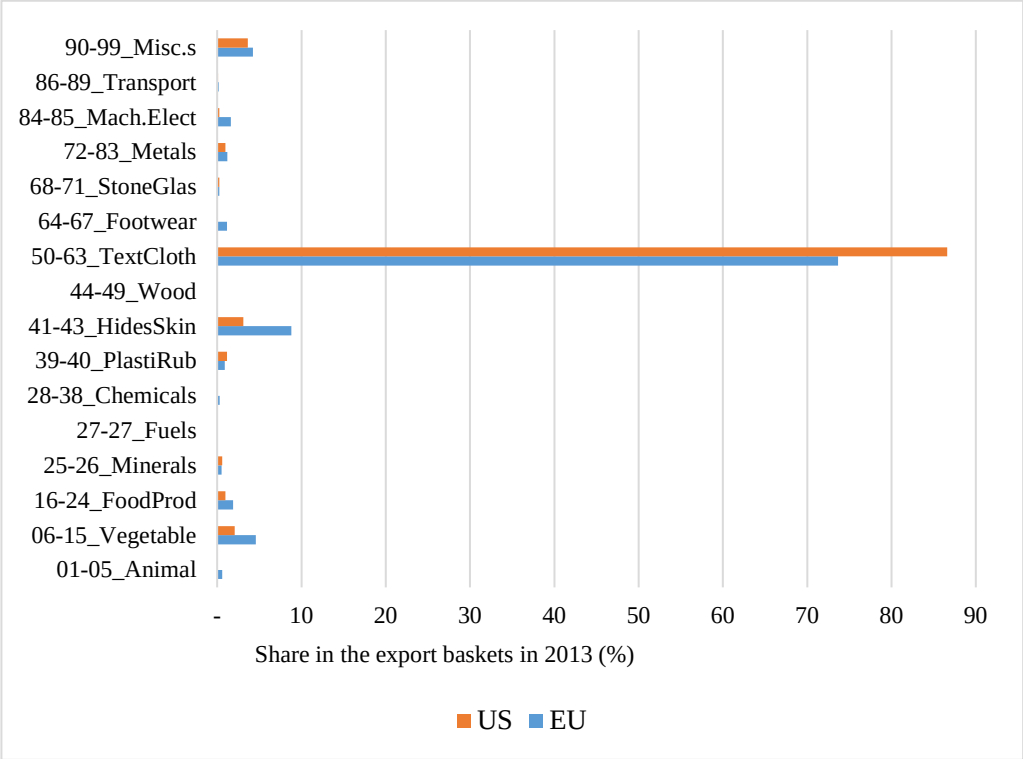
The scope and implementation of IC3 differs from many trade-related port or infrastructure projects, such as the construction of a new port or improvements in existing trade processing infrastructure, in that it effects are destination market specific. IC3 influenced the processing of Pakistan's exports 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. This empirical setting has another attractive feature: unlike in cross-country studies, there is no obvious variation in institutional quality, production patterns and endowment that

[11] Mega-ports 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).

might explain the differential response of firms, as both treatment and control groups are from the same country.

Besides the US, the major destinations of Pakistan exports include China, the EU and the United Arab Emirates (UAE). Although exports to these markets is comparable to that destined for the US, the structure of exports varies. 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 (see 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.

Figure 2: Composition of Exports to the Control (EU) and Treatment (US) Groups



Source: Authors' construction using dataset of Pakistan Customs.

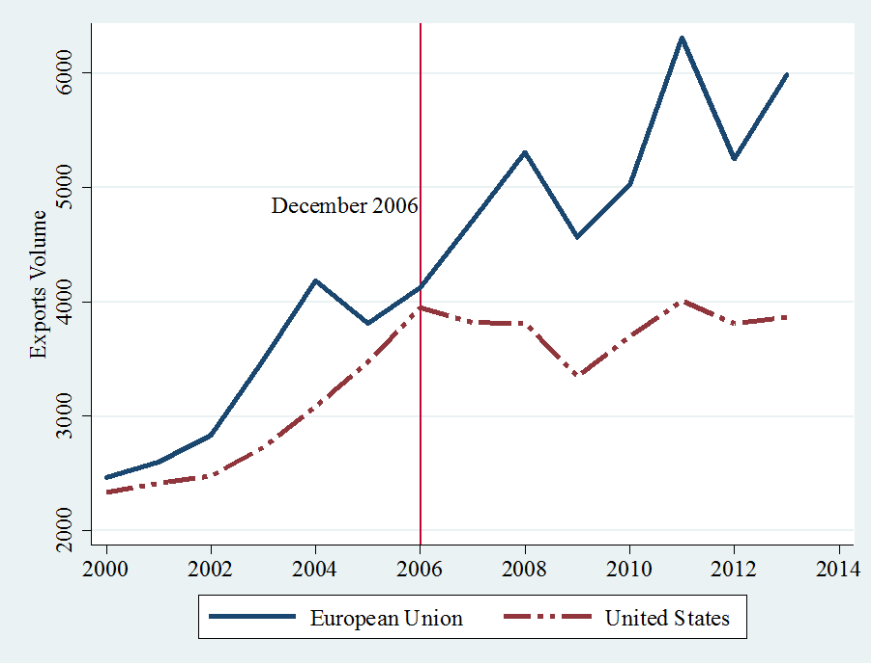
Before proceeding to develop a formal estimation strategy, we test the key identifying assumption of parallel trends in the evolution of the control and treatment groups in the pre-treatment period. The following graphical and statistical analysis indicates that this assumption holds. Figure 3 plots Pakistan's total exports to the EU and US, the control and treatment groups respectively. The chart suggests that the

[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.

evolution of exports to both markets was similar before the launch of IC3 but differed afterwards. Table A.1 in the appendix presents the results of two sample t-tests on an annual basis, and shows that the difference in exports 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.

Figure 3 Pre- and Post-Treatment Trends for the Control (US) and Treatment (EU) Groups, 2000–2013



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

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. We then test the robustness of these results.

Baseline Estimations

The introduction of IC3 meant a change in the pattern of trade costs for Pakistan's exporters. The evidence presented in Figure 3 suggests that the effect was to reduce exports to the US market. The growth of Pakistan's exports prior to the launch of IC3 to the US and EU is similar, but there is a marked deviation post-IC3 implementation. After 2007 the value of exports to the US remains largely unchanged until the end of the period whereas exports to the EU continue to rise[16]. This evidence is consistent with an interpretation of rising overall trade costs for US trade.

[16] Formal testing also shows no break in trend for exports to the EU between the pre- and post IC3 period. This is consistent with any negative IC3 effect on exports to the US not being explained mainly by a source substitution or diversion effect which increased exports to the EU.

Table 3: Baseline Estimates of the Effect of IC3 on US-bound Exports

Regression	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)						
$TIME_{2007-2014}$	-0.273*** (0.010)	0.027*** (0.010)	0.004 (0.012)				
Additional Controls							
Firm-Destination		Y	Y	Y	Y	Y	
Products			Y	Y	Y		
Year				Y			Y
Firm-Year					Y		
Product-Year						Y	
Firm-Dest-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 clustered at market-year level are in parentheses. These coefficients were obtained using Stata 13 SE; * p < 0.10, ** p < 0.05, *** p < 0.01. Y indicates the inclusion of fixed effects. The estimates in column (4) are used as a baseline in subsequent robustness checks.

Regression 1 in Table 3, where we present the estimation results for the simplest form of the difference-in-difference model, 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 exports 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 is the effect 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.[17]

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.

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

From the results, one might suggest that firms that export to the US are typically more able or better equipped than those who export to EU markets to sell to the US market 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 exports fell by an estimated 11% as a consequence of the IC3 program.

As already noted the type 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 are year-specific but are common across the US and EU as export markets for 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 effect of IC3 is 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 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 8%.

Robustness

We consider now some further issues around the robustness of the baseline results in Table 3. Of the various regressions in Table 3 we use regression 4 as the baseline, controlling for firm-destination, product and year effects. This reduces the magnitude of the coefficient noticeably compared to regression 1, but the coefficient on IC3 from this specification remains robust to the inclusion of other combinations of control variables.

The first-difference estimator is often proposed as part of the robustness testing for the difference in difference estimator, since 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 1 in Table 4. The results in Table 4 provide support for our baseline findings as the coefficient of interest bears the expected signs and is 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 is in the range of the estimates found in Table 3.

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 2 in Table 4. Our findings again appear robust to this issue and if anything the magnitude of the effect of the IC3 program increases compared to the estimates in Table 3.

In Table 3 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 pace of recovery across the EU and US. That is shocks had a market specific dimension. To address this concern, we control for import demand[18] in the regression. The coefficient of interest in this regression (reported as regression 3 in Table 4) remains negative and statistically significant at the 1% level, while the import demand variable has a significant and positive effect as expected.

[18] This variable is measured by net imports in market *j* (US) less imports by *j* from Pakistan in product *k* at time t.

Table 4: Robustness of the Effects of IC3

Regression number	1	2	3	4	5	6	7	8
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		Y	Y	Y	Y	Y		
Products		Y	Y	Y	Y	Y	Y	Y
Year			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.

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 (see Table A2 in the appendix for a summary of firm types). On the assumption that 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 4 and exporters who serve both the US and EU markets in regression 5. 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 7%, whereas for firms serving both US and EU markets trade fell by 12% in the post-IC3 period.

In regression 6 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 the Agreement on Textiles and Clothing (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[19]. Regression 6 in Table 4 indicates that the drop in trade between Pakistan and the US is even larger when using trade with China as the counterfactual than using Pakistan's trade with the EU as a control group. In the post-treatment period, Pakistan's US-bound exports relative to China drop by 19%, on average.

[19] We also formally conducted parallel trends test for Pakistan's exports to China and the US in the pre-IC3 period in the same way as for the base results. The assumption of a parallel trend is satisfied.

As a further 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, the disadvantage of using such data is that it does 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 of Table 3 suggest that this was an important difference for the magnitude of estimates of the effects of IC3[20].

In regression 7 we first show the robustness of our results for Pakistan to the use of the UN Comtrade data. The difference in the different estimates shows 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 regression 4 in Table 3 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 for Indian exports to the same markets over this time period reported in regression 8. 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.

4 Extended Analysis: Heterogeneity across Firms and over Time

The results in Table 3 and Table 4 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 following the introduction of IC3 for freight continuing to be sent via Port Qasim or being switched to Port Qasim ; freight now being sent with certainty directly to the US 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.[21] At- and behind-the-border costs rose, however, for some exporters. Exporters continuing to export after IC3 from Qasim ('Incumbents') or switching to export from Qasim post-IC3

20 We also find the coefficient on IC3 effect to be of very similar magnitude (-0.258) if we aggregate our own data on the same basis as Comtrade data.

21 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.

('Switchers') faced increased costs because of the time spent scanning at the port and because of congestion at the port gates due to the concentration of scanning equipment at this single location.[22] These latter costs were alleviated to some degree by the 2011 port expansion.

For those exporters that continued to use ports other than Qasim ('Stayers'), beyond-the-border trade costs rose compared to the pre-IC3 scheme because of their required diversion onto a foreign port for scanning. This is demonstrated by the increased maritime distances and sailing times given in Table 1, but also arose because of 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 home 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 to Karachi or their other previous choice of shipment (see Table 2).

A natural question that follows from these differential changes in behind- and beyond-the-border trade costs for different types of exporting firms 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 1. Following the introduction of IC3 the percentage of export value using Karachi Port fell, although this appears to be driven by a rise in the use of dry-ports and airfreight as well as 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 limited immediate 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 rose more quickly in the years 2009 and 2010, such that by 2011 it accounted for over 65% of total exported cargo to the US.

In an extension to the empirical analysis we study the trade effects separately for those firms that had used Qasim and non-Qasim ports prior to introduction of IC3. For this we create three sets of firms according to their use of exporting locations in the 2006 data; those that previously used Port Qasim exclusively and continued to export from Qasim post-IC3 ('Incumbents'); those that had previously used Karachi Port, dry ports and airfreight and changed to Qasim ('Switchers'), and those that continued to export from other than Qasim ('Stayers').

22 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 pass through the city only after 11 pm.

In Table 5 we group firms according to this classification of exporting firms and to distinguish between the average post-IC3 effect and the effect of IC3 after the expansion of Port Qasim facilities in 2011. In these regressions the variable *IC3 (1st Treatment effect)* is a dummy variable equal to 1 for the period 2007–2014 and 0 otherwise and *IC3 (2nd Treatment effect)* is also a dummy variable equal to 1 for the period 2011–2014 and 0 otherwise. This latter variable therefore captures the additional effect of changes in the post-2011 time period arising from the expansion of port facilities at Qasim.

Table 5: Heterogeneity of the IC3 Effect across Firms and over Time
Dependent variable is log of exports per firm, by destination, by product and year

	(1) Incumbents	(2) Switchers	(3) Stayers
1st Treatment_2007-2014	-0.205	-0.151***	-0.361**
	(0.144)	(0.023)	(0.169)
2nd Treatment_2011-2014	0.001	0.082***	0.002
	(0.028)	(0.017)	(0.113)
Firm-destination, product & year fixed effects	Y	Y	Y
R2	0.631	0.530	0.713
Observations	147,449	365,566	7,665

Note: Robust standard errors clustered at market-year level are in parentheses. These coefficients were obtained using Stata 13 SE; * p < 0.10, ** p < 0.05, *** p < 0.01. Y indicates the inclusion of fixed effects. The three sets of firms mentioned at the column heads are constructed as per the use of exporting locations in the 2006 data: Incumbents_ those that previously used Port Qasim exclusively and continued to export from Qasim in post-IC3 period; Switchers_ those that had previously used Karachi Port, dry ports and airfreight and changed to Qasim; and Stayers_ those that continued to export from other than Qasim Port.

Regressions 1 to 3 in Table 5 report regressions for the modified treatment effect for each of the groupings of exporting firms. We anticipate that an increase in total (behind and beyond the border) trade costs was least likely for 'Incumbents', since any increase in costs arising from IC3 –induced congestion at Port Qasim would tend to be offset by expected lower beyond the border trade costs due to the avoidance of diversion for scanning on route to the US. By contrast, 'Stayers' must experience higher trade costs; although behind the border costs are unaltered, on average beyond the border costs must have risen because all shipments were diverted to an international port for scanning post-IC3. Like incumbents (and for the same reason), beyond the border trade costs fell for 'Switchers' as a result of IC3, but this may have been more than offset by the effects of switching on behind the border trade costs; increases in internal transport distances to the port of exporting and increased delays due to port congestion pushing up this element of trade costs.

The results in Table 5 are in line with the expected heterogeneity of the IC3 effect across exporter types and over time. We find no significant IC3 effect on the exports of 'Incumbents' (regression 1), but a significant negative effect of IC3 on both 'Switchers' (regression 2) and 'Stayers' (regression 3). The negative IC3 effect on exports is in fact greater for 'Stayers' than 'Switchers'. Indeed, the negative effect on 'Switchers' is shown to be reduced post the expansion of port facilities and capacity at Qasim in 2011. Note also the highly credible finding that there is not a significant 2nd treatment effect in the case of 'Incumbents' and 'Stayers'. Firms continuing to export from other than Qasim (stayers) would not be expected to affected by the expansion of Qasim's facilities. 'Incumbents' could have been

affected by the improvements in 2011, but were not in any case found to be significantly affected by IC3 after 2007 (though the pattern of signs on the 1st and 2nd treatment effects is consistent with an improvement story).[23]

5 Summary Conclusions and Policy Implications

The US has aimed over the last decade to reduce the threat to national security from containerised cargos shipped to its ports. In the case of the IC3 programme introduced in 2007, the US sought to reduce the security threat by requiring the comprehensive scanning of imports from Pakistan, but also to reduce 'beyond the border' trade costs for Pakistan exporters by providing scanning technology in Pakistan (thereby avoiding the need for the diversion of ships to international ports with scanning facilities). The program was represented ex-ante as being both pro-security and trade facilitating. The present study finds, however, that IC3 actually reduced Pakistan's exports to the US in the period 2007-14. This finding is robust to alternative estimation methods and alternative controls; including controls made possible by the use of firm and destination level export data. In particular, the scale of the export reduction effect of IC3 is upwardly biased if aggregate trade is used and which does not allow for the control of firm-destination specific effects; with specific firms in Pakistan selecting to or having acquired the attributes required for the US export.

The finding of net export reduction is consistent with raising total trade costs for Pakistan exporters to the US, relative to their trade costs to other destinations and in particular to the control destination of the EU. This might be considered an unexpected outcome because the provision as part of IC3 of a scanning facility in Pakistan avoided the diversion of ships to international ports and reduced international shipping distances and shipping times between Pakistan and US ports. The simultaneous reduction in 'beyond the border' trade costs and increase in total trade costs is only possible if IC3 also led to an increase in 'behind the border' trade costs. This we find occurred because of a specific feature of the design of the IC3 programme, with scanning facilities only made available in Pakistan at one port, namely Port Qasim.

We observe from our data the switching in post-IC3 period of some firms' US-bound exports via Qasim Port. These exporters who switched to Qasim had to incur increased internal transport costs associated with greater distances travelled to this port. The increase in exporting from Qasim also resulted in greater congestion in and around the port and to slower clearance through the port for those continuing

[23] As a final check on the robustness of our findings, we explore the IC3 effect (for the whole post-2007 period and the expansion of Port Qasim facilities in 2011) using the number of shipments rather than export values as the dependent variable. The DID estimates, using the same methodology as for the main results, are reported in Table A.3 in the Appendix. They show a statistically significant (at the 1% level) drop in the number of shipments to the US relative to the EU after the first intervention and rise in the same after the second intervention, which is consistent with our main results.

to export from Qasim and for those switching to Qasim. Indeed, these bi-product effects of the increased use of Qasim by exporters to the US would have reduced the incentive for some exporters to switch to this port. Again, we observe from the data firms that continued to export via other Qasim, including Port Karachi and many of the exporters from the Karachi area. For these firms 'behind the border' trade costs were not directly affected by IC3, but the 100% scanning requirement meant that diversion via an international port with scanning facilities was now certain rather than possible. Average or expected 'beyond the border' trade costs rose in fact for this group of 'stayers'.

The present findings emphasise the need to recognise both behind and beyond the border trade cost effects in the design of measures to increase security. They also demonstrate the benefits of using disaggregate, firm-level data to model and measure the trade effect of such security measures, since it allows the investigator to explore the heterogeneity of the trade effect across firms in different locations who may or may not export from the same port before and after the implementation of the programme. In the present context, we show that firms already exporting from Qasim pre-IC3 ('incumbents') did not experience a significant impact on their exports due to IC3. By contrast, for those exporters who switched to exporting from Qasim ('switchers') and those continuing to export from other than Qasim ('stayers') IC3 had a significant negative effect on exports; though the negative effect for 'switchers' was reduced post-2011 by the expansion of facilities at Port Qasim.

The present findings have policy implications for the ongoing drive to deploy similar technologies aimed at ensuring the security of the global supply chain. They show how adding another layer of security to 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 different parts of the world, the implementation of arrangements similar to IC3 at other ports may also have the unintended effect of reducing rather than facilitating trade. This implies that policymakers need to consider domestic, as well as international, aspects of trade costs and have a comprehensive view of the nature of trade costs.

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6 Appendix Tables and Figures

Table A.1: Parallel Trend Tests, 2002–2006 (Pakistan's Exports to US and EU)

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 A.2: Exporting Firms 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.

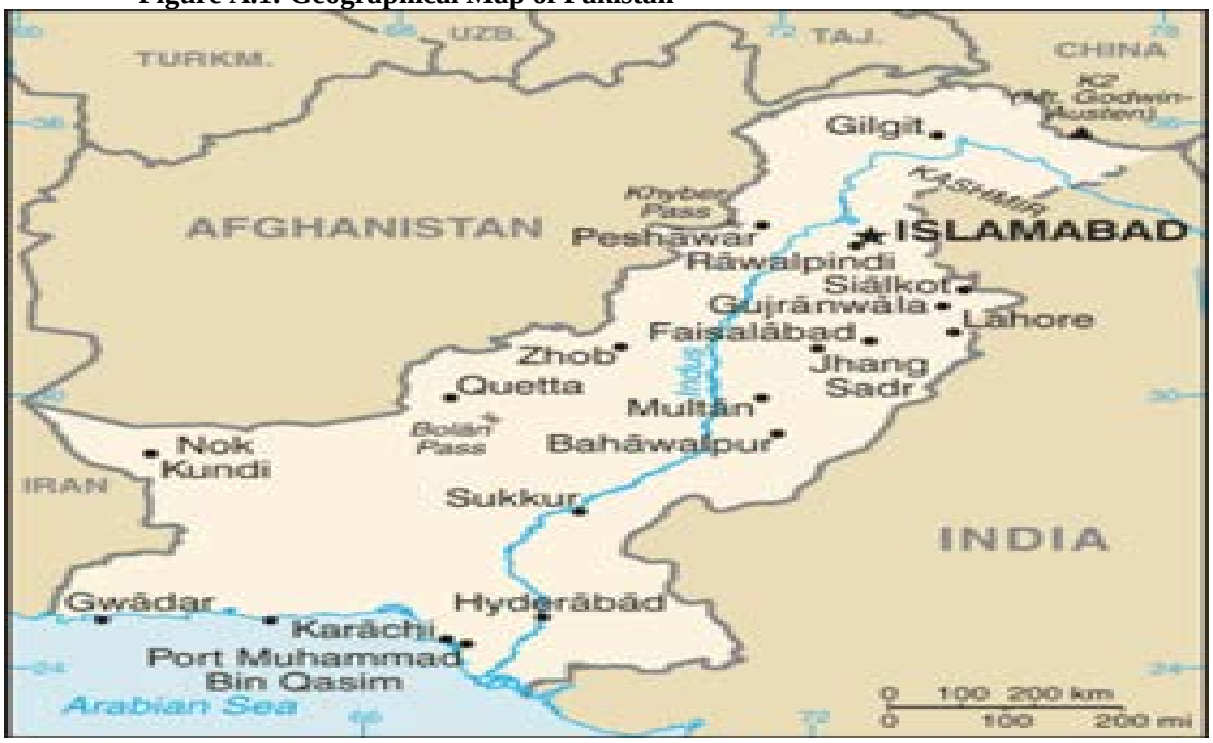
Table A.3: Effect of IC3 on Frequency of Shipment: DID Estimates

The dependent variable is number of shipments per firm by market by year in log

	(1)
IC3(US x Time)	
1st Treatment_2007-14	-0.126***
	(0.016)
2nd Treatment_2011-14	0.040***
	(0.013)
R2	0.703
Observations	165,794

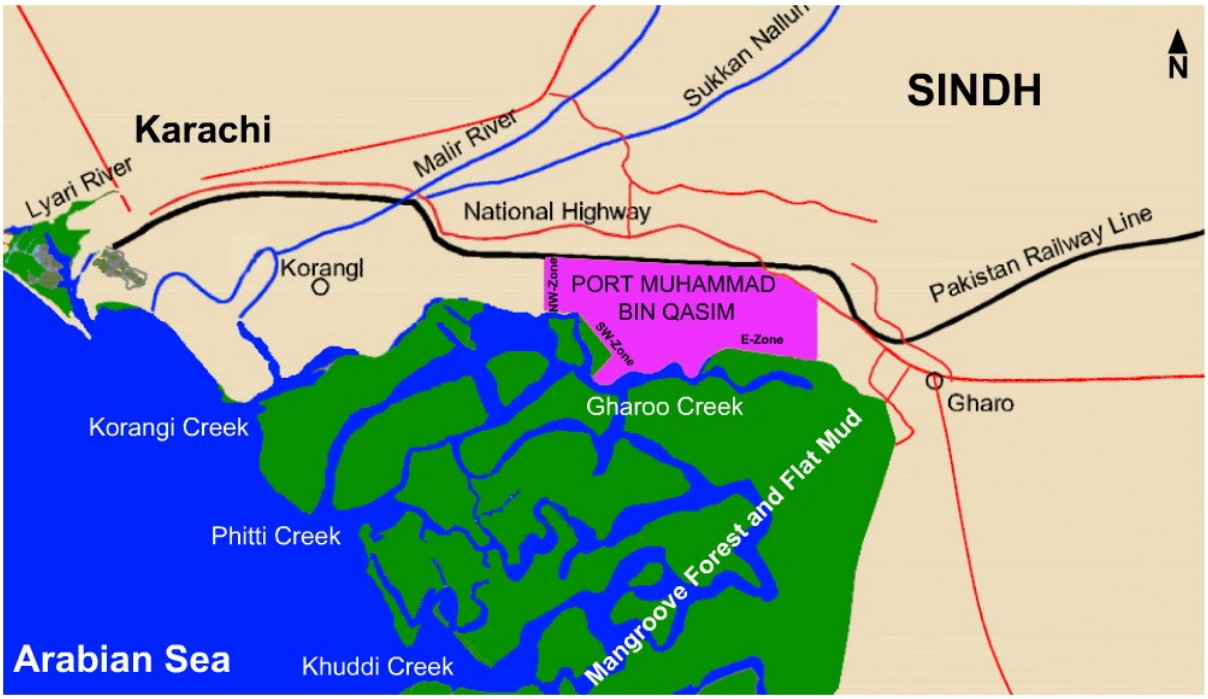
Notes: Robust standard errors are in parentheses. These coefficients were obtained using Stata 13SE.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The regression includes fixed effects for firms-market and time.

Figure A.1: Geographical Map of Pakistan



Source: maps.google.co.uk

Figure A.2: Location of Port Qasim



Source: Pakistan Customs.