The Causal Effect of FTAs on the Trade Margins: Evidence from Geographically Distant Partners

Sang-Wook (Stanley) Cho[1,*]

School of Economics, UNSW Business School, University of New South Wales, Sydney, NSW, 2052, Australia

Hansoo Choi[2]

School of Economics and Trade, Kyungpook National University, 80 Daehak-Ro, Buk-Gu, Daegu, 41566, South Korea

Julián P. Díaz[3]

Department of Economics, Quinlan School of Business, Loyola University Chicago, 820 N. Michigan Avenue, Chicago, IL, 60611, USA

Abstract

We estimate the causal effects of FTAs on the trade margins by looking at recent agreements involving geographically distant partners. To address endogeneity issues, we employ a differences-in-differences (DID) methodology at the product level, choosing border-sharing countries as a control group. Our DID estimates reveal that FTAs had positive and significant effects, with the extensive margin accounting from one-third to more than half of the growth in exports, depending on the agreement. In terms of timing, we find that the intensive margin effects preceded those of the extensive margin. At the sectoral level, our results indicate that the extensive margin drove export growth in sectors with differentiated products, whereas export growth in sectors with homogeneous products was due to the intensive margin. Finally, a synthetic control method analysis corroborates the strong export growth observed along the extensive margin.

JEL classification: F10, F13, F14, F6

Keywords: Free trade agreement, differences-in-differences estimation, synthetic control method, extensive margin, intensive margin

---

[*] Corresponding author. We thank Eric Bond, Arpita Chatterjee, Juyoung Cheong, Peri Da Silva, Timothy Kehoe, James Lake, Isabelle Mejean, Taewhan Rhee, W. Charles Sawyer, Alan Woodland and seminar and workshop participants at the Society for the Advancement of Economic Theory Conference, Midwest International Trade Conference, Latin American Meeting of the Econometric Society, Western Economic Association International Conference, Sydney Trade Workshop, Kansas State University, Korea Institute for International Economic Policy and Korea Development Institute for helpful comments.

[1] Email: s.cho@unsw.edu.au; Tel.: +61 (2) 9385-3287; Fax: +61 (2) 9313-6337.

[2] Email: choihs91@knu.ac.kr; Tel.:+82 (53) 950-5434.

[3] Email: jdiaz17@luc.edu; Tel.: +1 (312) 915-7045.

1. Introduction

Free trade agreements (FTAs) are among the most actively pursued forms of trade liberalization. Indeed, according to the World Trade Organization's Regional Trade Agreements Database, as of December 2018 there were 309 active regional agreements. Because of their prevalence, the international trade literature has devoted considerable efforts aimed at understanding the effects of such type of agreements on trade growth. The literature has also delved into the issue of which types of goods drive the observed growth in trade after it is liberalized: those that had been traded intensively in the past (usually referred to as the intensive margin of trade), or new goods (the extensive margin). Notably, Kehoe and Ruhl (2013) found that the extensive margin played a substantial role in trade liberalization episodes such as the Canada-US FTA and NAFTA, while Handley and Limão (2015) found evidence that small exporting firms accounted for a significant fraction of export growth during another episode of trade liberalization, Portugal's accession to the European Community in the late 1980s. Subsequent studies, such as Baier, Bergstrand and Feng (2014) and Foster (2012), have used econometric methods to uncover the effects of FTAs on the trade margins.

Existing articles, however, generally exhibit two limitations when quantifying the effects of bilateral FTAs on trade growth. First, as Baier and Bergstrand (2007) pointed out, most of the studies suffered from endogeneity bias problems since it could well be the case that countries that trade heavily with each other endogenously choose to engage into FTAs. Second, much of the current literature uses aggregate trade data, which makes it difficult to analyze more detailed dimensions and mechanisms of FTAs. Here, we address such shortcomings by conducting a generalized differences-in-differences (DID) analysis using highly disaggregated product-level trade data. Our analysis focuses on the FTAs Chile signed with the European Union in 2003, and Korea and the US in 2004. Those agreements are salient examples of the "new breed" of FTAs that have entered into force since 2000, which are characterized by having been signed mainly by distant partners, instead of being bound by geographical proximity as it was the norm in the past. Indeed, according to the Regional Trade Agreements Database, 126 out of 237 FTAs that have come into force since 2000 have been signed by countries that were neither border-sharing nor located in the same continent. This feature provides an opportunity to uncover a causal relationship between FTAs and trade growth patterns and offer a more comprehensive assessment of the effects of FTAs.

Our approach is line with previous studies such as Baier and Bergstrand (2007), Trefler (2004), and Anderson and Yotov (2016) since, as an identification strategy, we use a two-way fixed effect model in order to address the potential endogeneity bias. To enhance the rigor of our analysis, we check the parallel (or common) trend assumption, which is key to the validity of the strategy, but absent in the studies mentioned previously. In addition, we select

Chile's neighboring countries that did not sign FTAs as control groups, which contrasts with other studies that select the rest of the world as controls. Since those bordering countries share many similarities with Chile—such as common language, legal system and colonizers, among others—and are equally distant from its FTA partners, our empirical strategy can control not only for distance effects but also for unobserved and time-invariant regional features, thus alleviating the concerns for omitted variable biases. Finally, while most of the aforementioned articles have focused on the behavior of trade margins at the aggregate level, we use product-level data, which allow us to study more detailed aspects of the effects of FTAs on the trade margins, such as their sectoral and product-specific implications, as well as the particularities of each treaty.

Our DID analysis yields three main results. First, we find that post-FTA export growth per product was significantly higher than in the absence of an agreement, and that this growth was substantial along both trade margins. Moreover, we find that the role of the extensive margin was crucial. Indeed, ten years after the FTAs entered into effect, exports of new goods accounted for one-third to more than half of total export growth, implying that growth along the extensive margin was as important as the intensive margin.

Second, since our study considers long post-FTA periods, this allows us to trace the dynamic patterns of the FTA effects. We find that there are statistically significant differences in the timing of trade margins. Export growth along the intensive margin takes place earlier—within the first three years from the implementation of the FTAs—and those effects amplify over time. On the other hand, trade growth along the extensive margin lags the intensive margin, taking considerably longer to become significant, which occurs only in a longer horizon of more than five years post-FTA. This reflects the fact that it may take some time for some exporters to serve new markets after a newly implemented FTA because of, for example, the presence of fixed costs. This pattern is consistent with the empirical findings of Kehoe and Ruhl (2013) and Baier, Bergstrand and Feng (2014), as well as with the predictions of theoretical models of product- and market-specific fixed costs such as Arkolakis (2010) and Mayer, Melitz and Ottaviano (2014), where new exports are more responsive to permanent shocks. When we analyze the dynamic patterns for all products, they resemble those of the extensive margin. This in turn reveals that, in order for an FTA to cause an increase in trade volumes, it is not sufficient for exports of existing products to increase, but rather it is also necessary that they are accompanied by increases in exports of new goods.

Finally, when we analyze the FTA effects at the sectoral level, we find positive and significant effects on the extensive margin in all sectors, regardless of their trade elasticity. On the intensive margin, however, the FTA effects vary by sector and by country. Additionally, when we conduct a decomposition analysis to quantify the relative contributions of the trade margins to export growth, we find that the intensive margin played a dominant role only in the high-elasticity sector, composed for the most part of homogeneous products. In sectors with lower elasticities—characterized by differentiated products—export growth was mainly driven by the extensive margin. These findings provide empirical evidence of the theoretical sectoral predictions of Chaney (2008).

We also conduct a number of tests to assess the robustness of the DID results. Our main findings are robust to a falsification test, which supports the underlying parallel trend assumption of the DID methodology. In addition, we also consider a specification with standard errors clustered at the year, country and industry level, and find that our results are still robust. Furthermore, adding country-specific and industry-specific time trends, as well as other control variables related to the size of the market and income levels, does not fundamentally alter our main findings. Finally, our results remain robust when we assess the product-specific heterogeneity of each FTA by incorporating the fact that some products were granted tariff-removal exemptions.

As a way to provide further validity to the results from our DID analysis, we use the synthetic control method (SCM)—an alternative statistical methodology pioneered by Abadie and Gardeazabal (2003) and popularly used on data-driven case studies—to compare the behavior of exports to Chile with those bound to a "synthetic Chile," a weighted combination of similar, but untreated, countries. We find that increases in exports to Chile were indeed associated with the signing of FTAs. This effect took place immediately for exports from Korea and the US, and it lasted throughout the post-FTA period. On the other hand, exports from the EU exhibited faster growth only after a lag. For all the FTAs we consider, trade growth along the extensive margin was substantially larger than along the intensive margin, a finding that confirms the results we obtained in the DID analysis.

Our methodological approaches—and the results they produce—yield several contributions to the literature. First, whereas previous studies, such as Baier and Bergstrand (2007) and Anderson and Yotov (2016) used a panel approach at the country-pair level to address concerns about possible omitted variable biases, we first tackle this issue by adopting a clearly defined DID event-study methodology—which is commonly used as a program-evaluation technique—at the product level. In that respect, our work is similar to Trefler (2004). However, none of those studies checked one of the most critical assumptions of a DID analysis: the parallel trend assumption, and failure to check this assumption does not guarantee that the estimator of interest is unbiased. Thus, by testing the validity of the parallel trend assumption, our work provides unbiased estimates of the effects of trade liberalization. Moreover, our article provides a more rigorous analysis than previous works that just compare trade flows before and after the signing of an FTA, or contrast the differences with the rest of the world using country-level trade data. Those works provide little justification as for why such a diverse set of countries is an appropriate candidate for a control group to uncover the causal relationship between FTAs and the patterns of trade margins.

Furthermore, our SCM analysis addresses the endogeneity concerns due to omitted variables by allowing for the effect of the unobserved individual heterogeneity to be time-varying. This improves upon existing panel models which can only account for time-invariant unobservable confounders. SCM also provides a data-driven (instead of ad hoc) method to select a suitable control group, which provides an alternative to our DID methodology.[1] As a result, our findings—based on two methodologies of causal inference—directly strengthen those by Kehoe and Ruhl (2013) who document that the extensive margin is strongly correlated with post-liberalization export growth, but who do not establish any causal relationships.

Second, our analysis tracks the dynamic effects of FTAs, documenting the different patterns for the intensive and extensive margins at an annual frequency. As such, it complements other country-pair level works such as Bernard, Jensen, Redding and Schott (2009) and Baier, Bergstrand and Feng (2014) that report the dynamic effects in five-year intervals.

Third, to the best of our knowledge, our study is the first one to use product-level cross-country data[2] to shed new light on the differences in sectoral FTA effects on the trade margins. Our empirical results on the sectoral effects of FTAs are consistent with the theoretical predictions of Chaney (2008), and may also foster future developments in predicting trade margin growth at the industry level, similar to the work of Kehoe, Rossbach and Ruhl (2015). In particular, our findings on which specific sectors are more likely to experience increases in new-goods trade certainly complement the literature on the productivity gains generated by export growth along the extensive margin following trade liberalizations originating from Melitz (2003).

Last, our findings of significant and positive effects of these recent class of FTAs for distant trade partners augments the results of previous studies that had mostly considered FTAs signed between neighboring countries, such as Baier, Bergstrand and Feng (2014).

The rest of the paper is organized as follows. Section 2 details the data set used in the DID analysis. In Section 3 we describe the DID methodology we employ and discuss its advantages. Section 4 presents the DID estimation results, and Section 5 assesses their robustness. Section 6 shows the results from the SCM analysis. We conclude in Section 7.

[1]While SCM has been adopted recently in the international trade literature (for example, as in Saia, 2017), our study is the first one to apply this methodology to understand the trade margin effects of trade liberalization.

[2]Working with product-level data has some advantages over firm-level data, since most of the latter are not publicly available and their coverage is limited to a handful countries, thus making it difficult to conduct cross-country studies such as ours.

2. Data

2.1. Trade data

We employ highly disaggregated product-level trade data from the World Bank's World Integrated Trade Solution (WITS) database, using data as reported by the exporter country. We work with a 6-digit level of disaggregation—the finest one available from WITS—organized according to the 1996 Harmonized System (HS) product classification. Since our analysis also deals with industry-level implications, we assign each product to a 4-digit level industry according to the International Standard Industrial Classification (ISIC) Revision 3. After the product-industry pairing, we are left with 5020 products.

The WITS database provides data expressed in current dollars only. We deflate the nominal data using each country's goods exports deflators, taken from the OECD National Accounts database.

2.2. Treatment and control countries

Our empirical focus is on Chile, whose policymakers have actively been pursuing trade liberalization agreements since the 1980s. Indeed, after concluding free trade agreements with most countries in Central and South America in the 1990s, Chile pursued additional FTAs with advanced and geographically distant economies during the 2000s. These efforts culminated in the signing of FTAs with the European Union—which came into force in 2003—and the United States and Korea, which became effective in 2004. Our study analyzes the behavior of EU[3], Korean and US exports to Chile following the signing of those three agreements. We cover the 1996–2015 period. This gives us pre- and post-FTA span which are long enough to examine the short- and long-term dynamics of liberalized trade. Moreover, the long post-FTA windows allow us to capture any lagged effects of the trade reforms—an issue of particular concern raised in Baier and Bergstrand (2007).

As the gravity model postulates, the size of trade flows between any two countries is inversely proportional to their geographical distance. Thus, for comparison purposes, we also construct a "control" group, consisting of countries that border Chile (Argentina, Bolivia and Peru) and that did not sign FTAs with the EU, Korea or the US when Chile did.[4]

An additional advantage of our control group choice is that geographical proximity can be translated into similarity in trade costs, infrastructures, and even institutional factors, such as common language, legal system and colonizers, among others, all of which may influence

[3]By EU we refer to the fifteen Union members prior to the 2004 expansion.

[4]Peru eventually signed FTAs with the US (in 2009), Korea (2011) and the EU (2013). We take these facts into account later in the empirical analysis.

trade flows among countries. This enables us to control for unobserved and time-invariant regional features, alleviating the concerns of omitted variable biases. One potential issue with our control group choice is that we may abstract from the trade diversion effect of FTAs. As Dai, Yotov and Zylkin (2014) document, FTAs may divert trade away from non-member countries, which implies that our strategy may overestimate the FTA effects. However, the graphical evidence from Figure 1 suggests that the potential trade diversion induced by the Chilean FTAs is unlikely to be substantial, since we do not observe any noticeable drops in exports to Chile's neighboring countries (both in levels and as shares of output).

2.3. Defining "new goods"

To construct a measure of the extensive margin of trade, we follow the methodology laid out in Kehoe and Ruhl (2013), hereinafter KR, who define the set of new goods as that including goods initially traded in small volumes, or not traded at all. More specifically, KR first average the trade value of goods over the first three years in their sample, in order to avoid any distortions implied by a potentially anomalous initial year. Next, goods are sorted in ascending order according to their initial trade value. Finally, ordered goods are included into a bracket until 10 percent of trade is accumulated. To ensure that exactly 10 percent of trade is contained in each bracket, some goods had to be split across different sets. Once this threshold has been reached, the remaining goods are assigned into the next bracket until 10 percent of trade has been added. This process continues until ten equally-sized brackets have been constructed. The goods in the first bracket are those with the smallest trade values—including some with initially zero trade—and as such are labeled as "least-traded" (LT) goods, or "new" goods.[5] In our analysis, LT goods will serve as our measure of the extensive margin, whereas non-LT goods will represent the intensive margin.

In Table 1 we report the distribution of LT exports from the EU, Korea and the US to Chile and its neighbors. A few facts are worth highlighting. One is that the LT goods baskets account for the vast majority of products. Indeed, more than 80 percent of all products were initially least-traded (in general, the smaller the importer or the exporter country, the larger

[5]The KR methodology is not the only approach to analyze the patterns of the extensive margin. We choose to follow the KR methodology over other competing techniques because of one of its main attributes: it determines whether a good is least-traded or not by using a threshold that considers its relative, rather than absolute, importance—or lack thereof—in total trade. Alternative studies, most notably among them Evenett and Venables (2002), use a fixed cutoff value (for example $50,000) to classify a good as not traded. But depending on the specific country pair—in particular, those with small nations—an arbitrary value of $50,000 can have significant implications, leading to very few goods being treated as actually traded. Since our article deals with many countries—large and small—the country-pair specific nature of the KR methodology seems to be the most appropriate one to employ. Other studies, such as Amarsanaa and Kurokawa (2012), Dalton (2017) and Cho, Choi and Díaz (2018) share this view and use the KR methodology as well.

Table 1: Least-traded goods

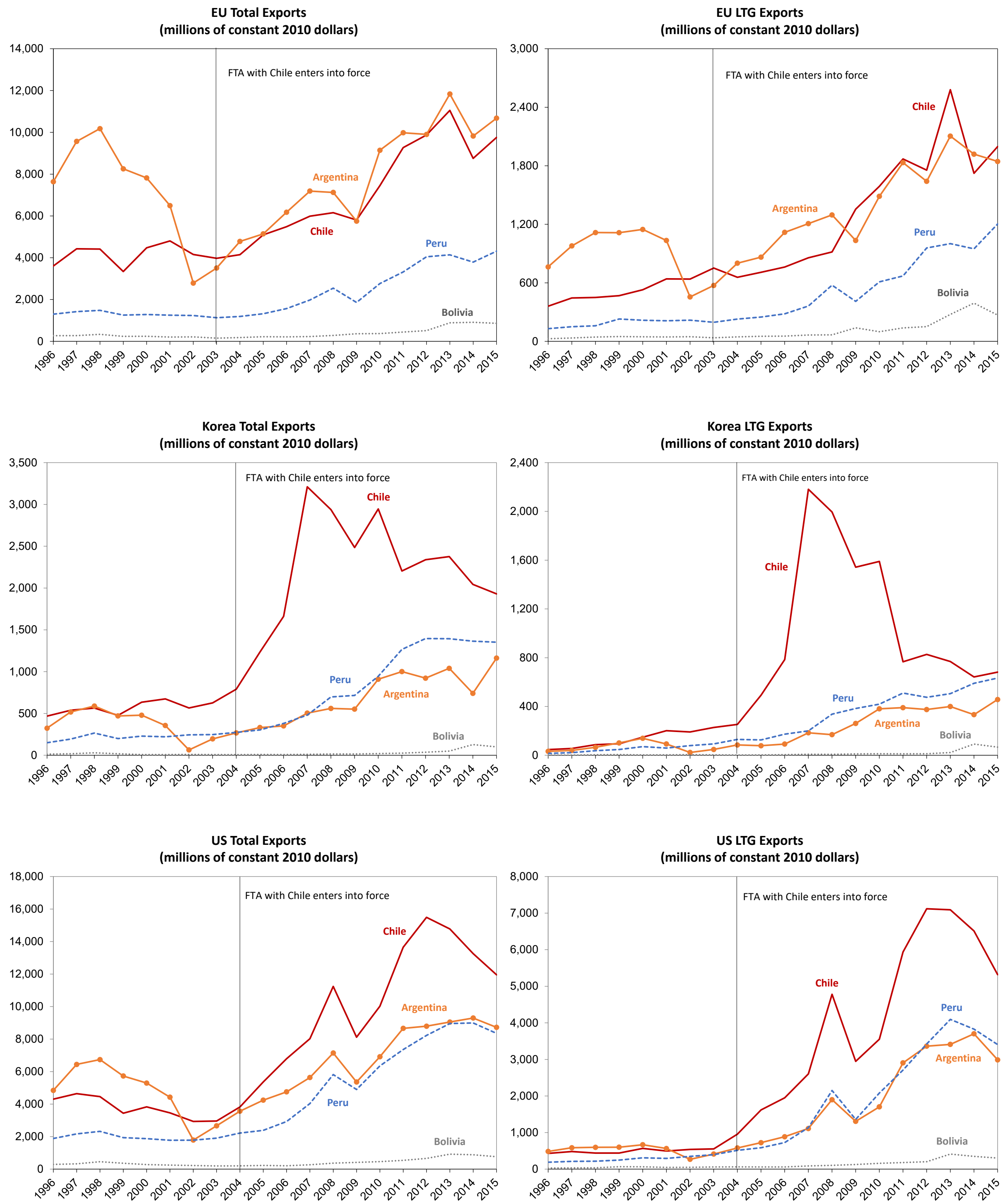
	Distribution of least-traded goods					
	All LT goods		Zero-trade goods (1996)		Top LT (TLT) goods (2015)	
	Number	% of all goods	Number	% of all LT goods	Number	% of all LT goods
EU exports to:						
Argentina	4,109.1	81.9	632	15.4	108.2	2.6
Bolivia	4,566.8	91.0	2,387	52.3	31.7	0.7
Chile	3,994.4	79.6	858	21.5	106.0	2.7
Peru	4,272.6	85.1	1,396	32.7	81.8	1.9
Korean exports to:						
Argentina	4,896.0	97.5	3,715	75.9	12.8	0.2
Bolivia	4,968.6	99.0	4,680	94.2	8.5	0.2
Chile	4,951.3	98.6	3,803	76.8	23.6	0.5
Peru	4,965.5	98.9	4,193	84.4	18.7	0.4
US exports to:						
Argentina	4,195.6	83.6	1,067	25.4	0.9	0.0
Bolivia	4,641.6	92.5	3,076	66.3	27.2	0.6
Chile	4,227.0	84.2	1,053	24.9	0.8	0.0
Peru	4,287.2	85.4	1,441	33.6	0.8	0.0
Average	4,506.3	89.8	2,358	50.3	35.1	0.8

the fraction of all goods belonging to the LT basket). We also find that a substantial share of the LT goods were actually not traded at all, although the figures vary significantly across countries—from 15 percent for the case of EU exports to Argentina, to 94 percent for the Korea-Bolivia pair. Finally, we find that LT goods trade ended up being clustered around a very small number of products. On average, the group of "top" LT goods—those accounting for half of LT exports in 2015—was composed of 35 products, or 0.8 percent of all LT goods.

In Figure 1 we plot the evolution of total and LT exports of the EU, Korea and the US to Chile and its neighbors (for convenience, we have included a vertical line to denote the year when a particular FTA entered into effect). We find that, prior to the signing of the FTAs, exports to Chile and its neighbors were relatively constant, and in some instances even on a declining trend. However, exports to Chile increased considerably after the FTAs entered into force, a pattern that cannot be so easily discerned for the cases of its neighbors. The increases were even more pronounced for the cases of LT goods.[6] The pertinent question is then: Can these patterns—and timing—be attributed to the signing of the agreements? We tackle these issues in the following sections.

[6]We also show total and LT exports as a fraction of GDP in Figure A1 in the Appendix. The general trends are quite similar to ones observed in Figure 1.

Figure 1: Total and least-traded goods exports (1996–2015)



3. Methodology

In this section, we lay out our econometric strategy. A naive regression to estimate the trade volume effects of an FTA would be:

$$Y_{it} = \beta_0 + b_1 FTA_t + b'\mathbf{X} + e_{it} \tag{1}$$

where Y_{it} denotes the exports of either the EU, Korea or the US of product i in year t to Chile; FTA_t is an indicator dummy for FTA status that takes the value of 1 if an FTA is in place in year t, and 0 otherwise; $\mathbf{X}$ captures all factors related to determinants of FTAs; and e_{it} is the error term.

However, attempting to empirically estimate the effects of free trade agreements on trade growth using equation (1) inevitably raises several concerns. The main one is that simple trade outcomes comparisons before and after FTA in general do not identify a causal relationship between FTAs and trade growth due to endogeneity problems. Even after controlling for FTAs determinants such as distance, economic size and so on, there is still a threat to the validity of such empirical strategies, as noted in Baier and Bergstrand (2004).

The ideal approach to address those concerns would be to randomize FTAs among countries, but that strategy is clearly not feasible. Thus, we employ the differences-in-differences approach pioneered by Card and Krueger (1994), and recently used in international trade studies such as Martincus and Blyde (2013) and Cheong, Kwak and Yuan (2017). Since, in principle, the effects of FTAs begin to take place after their implementations—but not prior to them—pre-FTA trade volumes can serve as key variables that capture the unobserved confounders whose effects are time-invariant. The DID framework helps us quantify an unbiased estimate of the effects of FTAs.

The two-way fixed effects specification we adopt is:

$$Y_{ict} = \beta_0 + b_1 FTA_{ct} + \tau_t + m_c + \lambda_i^s + e_{ict} \tag{2}$$

Note that this specification is different from a two-group in two-period DID design, which does not accommodate the complexity encountered in applications that involve more than two groups or periods (see Wing, Simon and Bello-Gomez 2018). Thus we adopt a generalized DID estimation, which allow us to deal with a variety of related research questions, such as placebo tests, time-varying treatment effects, and sectoral effects of FTAs.

We specify equation (2) in levels, and not in logs, because we want to keep all the zeros in the trade data. Y_{ict} and FTA_{ct} are as previously defined; τ_t is a time dummy to control for any business cycle fluctuations; m_c controls for country fixed effects, such political systems and other legal or social institutions, which are known to be potential determinants of FTAs. Finally, λ_i^s captures industry-specific shocks for product i in industry s. This industry-specific component is included since FTAs can be the outcome of strategical considerations driven by sector-specific trends. For example, a country might be experiencing rapid increases in productivity in some sectors due to technological progress, and might try to sign a bilateral agreement to take advantage of those efficiency gains. However, those sectors would exhibit upward trends in their exports even in the absence of FTAs. An observed increase in trade volumes may coincide with the signing of the agreement, and this would lead to an upward bias in the estimation of the effect of the FTA. To address this concern, we include the sector-specific shocks λ_i^s in the main regression.

Our focus is on the coefficient b_1, which captures the effect of the FTA on export growth. Moreover, we can quantify the FTA effects on either the extensive or intensive margin depending on whether product i belongs to the LT or non-LT categories in the initial year.

4. Benchmark Results

In this section, we start by reporting the estimates that quantify the average treatment effects of the FTAs on overall volume as well as on the intensive and extensive margins. We then present the time-varying effects to understand the dynamic effects of the FTAs. We then follow up with sectoral effects of FTAs.

4.1. Average treatment effects

The DID regression estimates are presented in Table 2. All estimated coefficients are positive and statistically significant at the 1 percent significance level, suggesting strong FTA effects on export growth not only for all goods, but also for the least-traded and non least-traded categories. The coefficients imply that the Korea, EU and US FTAs led, on average, to additional overall exports of $221,000, $290,000 and $724,000 per product, respectively, when compared to the exports to the control group. For comparison purposes, we present the results of the simple OLS regression for the case of Chile only in Table A1 in the Appendix. When compared to the DID estimates, the OLS coefficients overestimate the FTA effects by nearly twofold.

To grasp the relative magnitudes of the increases in exports due to the FTAs, we divide the estimated coefficients by the average exports to Chile (as a reference country) on the year that the FTAs were signed. Figure 2 shows that increases in exports due to the FTA

Table 2: Average treatment effect of FTAs on trade volumes

	(1) All goods	(2) LT goods	(3) Non-LT goods
EU FTA	289.508***	89.658***	1103.072***
	(48.357)	(18.812)	(262.611)
R^2	0.049	0.025	0.092
Obs.	401,600	338,820	62,780
Korea FTA	220.925***	126.483***	8416.820***
	(41.207)	(36.827)	(1391.195)
R^2	0.018	0.007	0.145
Obs.	401,600	395,580	6,020
US FTA	724.003***	425.313***	2226.051***
	(117.701)	(130.859)	(254.781)
R^2	0.026	0.023	0.098
Obs.	401,600	346,980	54,620
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes

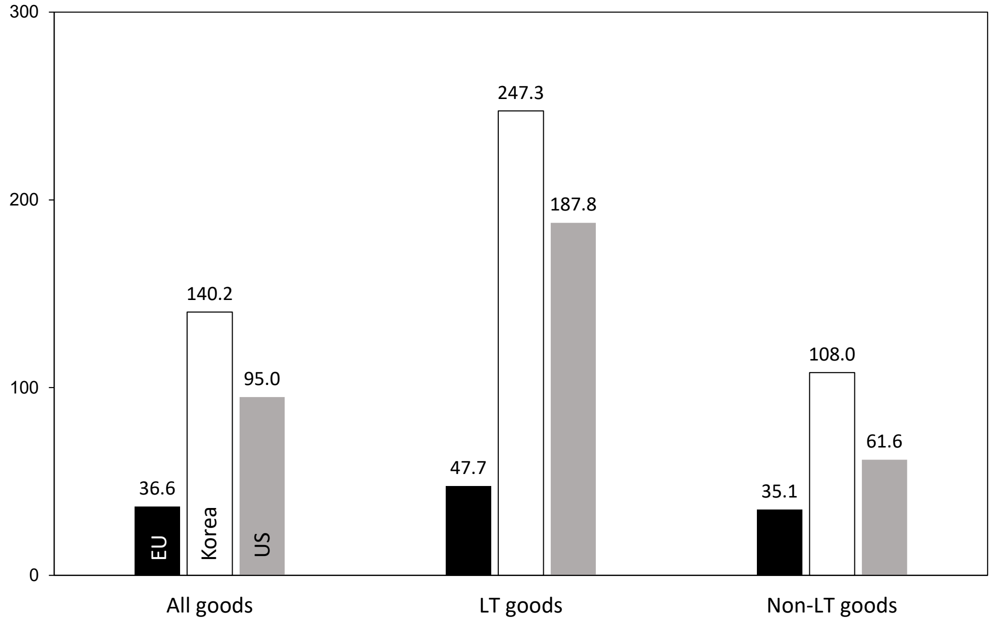
Notes: FEs denotes fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars.

range from roughly 36 percent for EU exports to around 95 and 140 percent for the US and Korea, respectively.

Exports of both LT and non-LT goods were also significantly higher than in the absence of an FTA. Relative to the average exports of the year when the FTA was signed, EU exports of LT goods increased by around 48 percent, and the increases were even higher for US and Korean exports LT goods (188 and 247 percent, respectively). Similarly, the increase in EU exports of non-LT goods was 35 percent, 62 percent for US and 108 percent for Korea. Overall, we find that smaller exporting countries and LT products experienced disproportionately higher export growth following an FTA.

While Table 2 and Figure 2 show the absolute and relative magnitudes of the export increases for the different product groups, we are also interested in determining which margin played a more dominant role in the overall export growth. To do so, we compute the relative contribution of each trade margin using a simple decomposition where we compare the average increase of LT and non-LT exports, weighted by the number of products in each category. The decomposition shares are presented in Table 3. We find that the contribution of the extensive margin to total trade growth is sizable, ranging from close to one third for

Figure 2: Percent increase in exports per product due to FTA



the case of the EU FTA, to more than half for Korea and US FTAs.[7] These findings are quantitatively similar to those in Kehoe and Ruhl (2013), who find that after ten years, a 10 percent increase in total trade is associated with a 43 percent increase in the value of the least-traded goods. We confirm their findings using causality-based inference. Our results are also in line with to those of Foster, Poeschl and Stehrer (2011) and Foster (2012), who find that between 59 to 83 percent (depending on the specification) of increases in imports three years after the FTAs came into force were due to the extensive margin.

Table 3: Contributions to total export growth (percent)

	LT goods	Non-LT goods
EU FTA	30.5	69.5
Korea FTA	49.7	50.3
US FTA	54.8	45.2

4.2. Time-varying FTA effects

So far we have implicitly assumed that the coefficient b_1 in equation (2) is constant, implying that we estimate the average treatment effects (ATE) during the post-FTA period.

[7]For example, for the Korea FTA, the corresponding weighted average increases in LT and non-LT exports are \$124,587 (=\$126,483 × $\frac{395{,}580}{401{,}600}$) and \$126,169 (=\$8,416,820 × $\frac{6{,}020}{401{,}600}$). The figures in the table represent the share of each product group out of the sum of the two weighted averages.

However, the impact of FTAs on trade could be immediate or lagged over time, and may possibly vary with time across the two margins. In fact, as Baier and Bergstrand (2007) argue, the economic effects of most FTAs are typically "phased-in" over ten years from the time they came into force.

To explore the gradual effects of the FTAs, we allow for lags in the regression specification as suggested by Autor (2003). More specifically, we add a dummy variable for each year up to the fourth year after the FTA came into effect, as well as a dummy that captures the fifth and later years since the FTA entered into force. Each dummy variable takes the value of one in its relevant year. Our modified specification with post-treatment dynamic effects is:

$$Y_{ict} = \beta_0 + \sum_{j=0}^{q} b_j FTA_{c,t-j} + \tau_t + m_c + \lambda_i^s + e_{ict} \tag{3}$$

Here, b_0 captures the immediate effect of FTAs, while the b_j ($\forall j > 0$) coefficients pick up any subsequent effects. If $b_j > b_0 (> 0)$, this implies that the effect of the FTA rises over time, while if the opposite is true then the initial impact of the FTA fades with time.

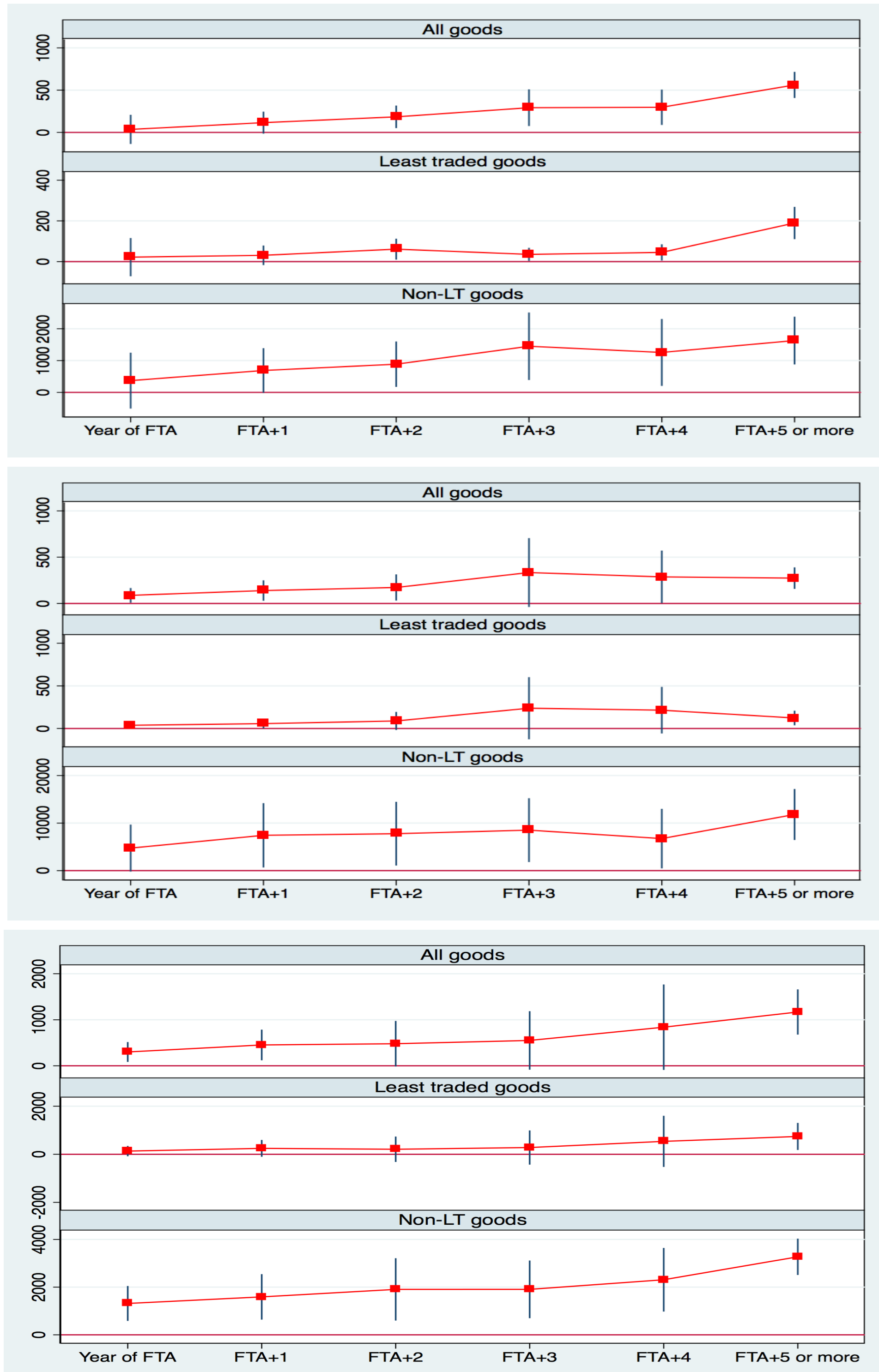
In Table 4, we present the regression estimates when we allow for lagged effects, sorted by product categories (we also present the same estimates, grouped by country, in Figure 3). We refer to the first two years since the signing of the FTA as the "short-run" and to the following three years as the "medium-run." The "long-run" corresponds to the estimates for five years and beyond. For our analysis, we will only consider coefficients at either the 1 or 5 percent significance levels.

Looking at the "all goods" category, the common result we find across agreements is a long-run FTA effect since that is the horizon when the coefficients are all positive and statistically significant. However, in shorter horizons the effects varied across FTAs. For example, in the cases of the Korea and US FTAs, we found initial short-run effects, which disappeared in the medium run, only to return in the long run. On the other hand, the short-run effects of the EU FTA were not significant, but the medium- and long-run effects were significantly positive, monotonically growing over time.

Next, we find an LT pattern resembling that of all goods, that is, a long-run FTA effect. For shorter horizons, the effects are mixed across cases. For the EU FTA, we found significant effects starting two years after the FTA went into effect, and those remained significant over time. For the Korea FTA, we found a positive short-run effect, which faded in the medium run and turned back to significance in the long run. For the US FTA, there were no significant effects in the short and medium runs.

Finally, for all three FTAs we consider, the effects on non-LT goods all showed up two years after the signing of the FTA and remained significant during the medium and long

Figure 3: Time-varying effects of FTAs: EU(top), Korea (middle) and US (bottom)



Notes: FTA+N indicates N year(s) after the FTAs are signed. Each point represents coefficient estimates of lag term in Table 4. The coefficient of the before-FTA periods were normalized to zero. Vertical lines indicate the 95 percent confidence intervals of each point estimate. Units are thousands of 2010 US dollars.

Table 4: Time-varying effects of FTA

	All goods			LT goods			Non-LT goods		
	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA
Year of FTA	35.925	87.785**	300.301***	21.881	37.977**	132.300	370.124	4736.974*	1315.275***
	(87.964)	(40.539)	(110.018)	(47.891)	(16.512)	(109.411)	(447.885)	(2519.677)	(373.075)
FTA+1	115.631*	139.478**	452.679***	30.993	57.387**	246.615	688.256*	7426.842**	1590.378***
	(66.322)	(56.298)	(169.891)	(24.534)	(29.125)	(178.213)	(357.514)	(3450.364)	(486.373)
FTA+2	184.370***	172.889**	479.795*	61.301**	88.672	209.125	886.474**	7765.869**	1905.113***
	(67.959)	(72.276)	(252.358)	(26.204)	(53.946)	(269.312)	(363.732)	(3418.674)	(666.674)
FTA+3	292.446***	334.270*	550.925*	35.597**	238.071	280.588	1449.660***	8519.544**	1905.911***
	(110.704)	(189.866)	(324.282)	(16.520)	(185.904)	(362.924)	(540.902)	(3424.531)	(616.715)
FTA+4	297.657***	287.245**	838.638*	45.282**	214.892	537.714	1255.481**	6739.497**	2309.177***
	(106.568)	(144.973)	(473.665)	(20.318)	(139.229)	(542.702)	(536.485)	(3190.960)	(680.482)
FTA+5 and more	561.860***	274.081***	1169.011***	189.838***	123.535***	742.037***	1628.549***	11808.716***	3271.303***
	(78.803)	(59.327)	(250.608)	(40.457)	(43.516)	(286.959)	(382.431)	(2736.444)	(388.468)
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.049	0.018	0.026	0.025	0.007	0.023	0.092	0.145	0.098
Obs.	401,600	401,600	401,600	338,820	395,580	346,980	62,780	6,020	54,620

Notes: FTA+N indicates N years after the FTA is signed. FEs denotes fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars.

runs. Only for the US FTA we found significant short-run effects as well as long-run ones. In all, this reveals that the FTA effects on non-LT goods preceded those on LT goods.

Summarizing, we find that the effects of the FTAs on non-LT goods showed significance within the first three years and remained as such from then on. On the other hand, for LT goods the common theme across the three FTAs is that the effects are significant in the long run. However, in shorter horizons, there are variations across countries. While there are differences in the timing of post-treatment effects across different trade margins, the pattern of all goods resembles that of LT goods—strong effects in the long run but mixed in the shorter horizons. This indicates that trade growth along the intensive margin (reflected by the non-LT products) alone was not sufficient to drive the growth in overall trade. In other words, in order for an FTA to cause substantial increases in the trade volumes, it is not sufficient for exports of existing products to increase, but rather it is also necessary to be accompanied by increases in the exports of new products.

Our results concur with those of Kehoe and Ruhl (2013), who document that the extensive margin growth is stronger in the medium or longer term rather than in the short run. Our findings are also consistent with Baier, Bergstrand and Feng (2014) who found that the FTA effects on the extensive margin follow those on the intensive margin.

4.3. Sectoral FTA effects

Our previous findings show that the extensive margin played a crucial role in the growth of aggregate trade. We are also interested in determining whether this pattern is consistent at the sectoral level. In a theoretical setup, Chaney (2008) predicts that sectors with a larger product variety and lower elasticity of substitution are expected to experience a strong and positive response at the extensive margin. This is because, with reduction in the trade barriers, some firms with lower productivity are able to export and can capture relatively larger market shares, despite having to charge higher prices than other firms. Vice versa, the intensive margin would be the dominant force in sectors with more homogeneous products, characterized by a higher elasticity of substitution.

To investigate the empirical validity of these predictions, we conduct a sectoral analysis of the FTA effects. We proceed as follows: first, we assign products into three-digit SITC Revision 3 industries. Then, we sort those industries according to their trade elasticity, as estimated by Ossa (2015).[8] Finally, we group the products contained in the sorted industries into three sectors. Products with trade elasticities belonging to the top quartile in the distribution were grouped into what we label as the "high-elasticity" sector, while those in

[8] Ossa (2015) uses data from 49 countries between 1994 and 2008 to estimate 251 industry-level trade elasticities.

the bottom quartile were assigned into the "low-elasticity" sector. The remaining products (those in the middle two quartiles) were assigned into the "medium-elasticity" sector.[9] The resulting classification is presented in Table 5. For the three countries, the shares of LT goods in each sector are quite similar. Note that the average elasticity of the high sector is approximately twice as large as that of the medium sector, which in turn is roughly 50 percent higher than the elasticity of the low sector.

Table 5: Sectoral classification according to trade elasticities

	Percent of	LT goods' fraction (%)			Elasticity	
Sectors	all goods	EU FTA	Korea FTA	US FTA	Mean	Median
Low-elasticity sector	25.0	83.3	98.4	87.4	1.93	1.93
Medium-elasticity sector	48.9	84.1	99.1	85.5	2.70	2.63
High-elasticity sector	26.1	85.9	97.5	87.1	5.77	4.45

In Table 6 and, we present the sectoral FTA coefficients. For all goods, we find positive and significant FTA effects across all sectors with stronger export growth in sectors with medium and high-elasticity than from the low-elasticity sector. When looking at the FTA effects on LT goods versus non-LT goods, however, we find contrasting results across sectors. LT goods in the low- and medium-elasticity sectors exhibited positive and significant coefficients for all countries. On the other hand, non-LT goods in those same sectors showed mixed results, with variations across countries. For instance, in the case of the EU, neither sector showed statistical significance at either the 1 or 5 percent levels. Finally, both LT and non-LT goods in the high-elasticity sector exhibited significant effects.

Table 6: Sectoral effects of FTAs

	All goods			LT goods			Non-LT goods		
	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA
Low-elasticity sector	247.000*** (72.274)	69.569*** (15.194)	416.272*** (56.233)	64.595*** (13.051)	35.943*** (6.345)	121.206*** (20.930)	834.438* (429.204)	2378.019*** (742.228)	1959.351*** (362.499)
Medium-elasticity sector	172.661*** (53.039)	209.997*** (75.032)	888.579*** (230.241)	69.982*** (12.824)	208.480*** (74.441)	769.358*** (267.984)	540.207* (306.225)	1680.192 (1361.955)	1391.757*** (263.057)
High-elasticity sector	548.921*** (139.481)	386.271*** (70.005)	710.528*** (112.753)	148.928** (65.363)	58.062*** (12.650)	76.753*** (11.190)	2543.781*** (763.426)	17620.229*** (3091.687)	4247.197*** (794.320)

Notes: The table reports DID treatment effects for each sector. All models include country, time and industry fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars.

[9] In the Appendix, we present FTA outcomes with alternative cut-offs in the sectoral classification. Tables A2 to A4 present the alternative classifications and outcomes when we group products into quintiles (with the top and bottom quintiles representing the high and low elasticity sectors, respectively).

Next, in order to determine which margin played a more dominant role in sectoral export growth in each country, we conduct a decomposition similar to the one in Section 4.1 for all sector-country pairs that exhibit statistically significant coefficients at all levels (as a result, we do not report decomposition shares for the medium-elasticity sector for Korea). The decomposition shares are presented in Table 7.

Table 7: Contributions to total export growth (percent)

	EU FTA		Korea FTA		US FTA	
	LT goods	Non-LT goods	LT goods	Non-LT goods	LT goods	Non-LT goods
Low-elasticity sector	27.8	72.2	48.9	51.1	30.0	70.0
Medium-elasticity sector	40.7	59.3	—	—	76.5	23.5
High-elasticity sector	26.3	73.7	11.3	88.7	10.9	89.1

We find that the contribution of the intensive margin is the largest in the high-elasticity sector, accounting for 74 to 89 percent of export growth in that sector. This result holds for all FTAs we consider. Turning to the extensive margin, we find that its contribution is always stronger in low-elasticity sectors than in high-elasticity one. For Korea and the US, the contributions of extensive margin in the low-elasticity sector are 3 to 4 times larger than in the high-elasticity sector. However, we also discover that the largest extensive-margin contribution is in the medium-elasticity sector. Thus, we do not find a linear relationship between trade elasticities and trade margin contributions to export growth. While the magnitudes of the sectoral effects vary depending on the particular FTA under consideration, the main lessons we extract are fairly consistent with the theoretical sectoral predictions of Chaney (2008) and the empirical findings of Crozet and Koenig (2010), who also found large variances in the shares of the two margins across sectors.

5. Robustness Checks

In this section, we assess the robustness of the estimated FTA effects along a variety of dimensions. First, we run some diagnostics on the pre-treatment parallel-trend assumption of our DID strategy and conduct a placebo test on the years prior to the treatment. Second, since panel-data observations can be correlated with each other within certain categories or time, we report the results when we cluster the standard errors on country, year and industry jointly. Third, we conduct an alternative check on the DID identification strategy by adding country-specific and industry-specific time trends to the regressors. Fourth, we assess the product-specific heterogeneity of FTAs by acknowledging that some products were granted tariff removal exemptions. Finally, we further test for the robustness of our results by including additional, country-specific controls.

5.1. Placebo (falsification) test

The key identifying assumption of DID estimation is a parallel (or common) trend assumption, meaning that—in the absence of treatment—the average change for the treated group would have been identical to the observed average change for the control group. In our setup, this implies that trade trends would have been the same in both Chile and its neighbors had Chile not signed an FTA. In fact, while FTAs can be stand-alone policy reforms, they can also be part of a broader series of market reforms, or a response to negative macroeconomic shocks in the past—see Trefler (2004). In addition, as it takes a considerable amount of time (typically three to five years) to negotiate and conclude the final terms of an agreement, one might observe exports anticipating the actual implementation of the FTA, thus potentially violating the parallel trend assumption.

A simple way to test for the validity of the parallel trend assumption is to visually check the evolution of exports prior to the signing of the FTAs. As Figure 1 suggests, total and LT exports to all countries appear to move in parallel prior to the FTAs entering into effect. Post FTA, however, exports to Chile (and to a smaller degree to Peru) seem to increase considerably more that those to its neighbors. Also, we cannot discern any anticipatory effect where exports to Chile start growing prior to FTAs actually entering into force. While eyeballing the data provides a preliminary validation on the parallel trend assumption, a more rigorous verification is necessary, especially since our data set covers a lengthy period and the treatments start at different points in time. An alternative way to deal with this issue—referred to by Autor (2003) as a "placebo" test—is to include leads in the baseline regression:

$$Y_{ict} = \beta_0 + \sum_{j=1}^{q} b_{t+j} FTA_{c,t+j} + \tau_t + m_c + \lambda_i^s + e_{ict} \quad (4)$$

The basic idea behind the test is that if a variable of interest, say $FTA_{c,t}$, causes outcome variables, say Y_{ict}, future values of $FTA_{c,t}$ should not have any effect on Y_{ict}. This type of a falsification test allows us to check for any anticipatory effect in years prior to the FTA being signed. In our specification, we include leads of up to five years before the signing of the FTA because of the lengthy negotiating periods typically preceding the agreement conclusion.

Table 8 presents the results.[10] For all goods and LT goods, we find no indication of any positive anticipatory effect for all five years leading up to the signing of the FTA. This suggests that the parallel trend assumption is not violated and that the policy intervention

[10] The coefficients and confidence intervals, arranged by country, are plotted in Figure A2 in the Appendix.

Table 8: Placebo tests

	All goods			LT goods			Non-LT goods		
	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA
FTA−5	-52.929	-13.600	72.750	-6.557	-8.551	22.758	-322.565	216.988	452.463
	(54.440)	(24.581)	(80.447)	(14.409)	(18.755)	(66.395)	(331.126)	(1119.060)	(379.138)
FTA−4	-99.055**	-45.505	72.505	-37.078*	-52.834	10.013	-260.388	1315.511	519.770
	(47.540)	(66.287)	(86.163)	(20.358)	(64.200)	(74.760)	(286.615)	(1301.138)	(383.321)
FTA−3	-49.802	-8.559	59.184	-32.476	-24.862	4.437	18.144	2063.068	473.964
	(82.432)	(52.371)	(91.479)	(22.670)	(48.608)	(80.166)	(448.361)	(1415.722)	(403.888)
FTA−2	-6.259	6.594	133.664	-33.964	-7.529	31.772	372.311	1758.477	904.586**
	(97.442)	(35.518)	(104.228)	(28.637)	(29.476)	(102.765)	(518.266)	(1331.141)	(368.709)
FTA−1	105.556	3.617	121.085	33.569	-7.149	30.211	942.803**	2106.178	766.509*
	(70.102)	(47.147)	(176.962)	(21.205)	(36.587)	(193.799)	(383.302)	(2000.210)	(405.953)
Year of FTA	275.629***	213.760***	783.319***	79.424***	113.889***	438.029***	1210.287***	9316.630***	2649.275***
	(51.744)	(32.438)	(124.772)	(17.613)	(25.158)	(136.275)	(309.137)	(1516.139)	(308.112)
Obs.	401,600	401,600	401,600	338,820	395,580	346,980	62,780	6,020	54,620
R^2	0.049	0.018	0.026	0.025	0.007	0.023	0.092	0.146	0.098
Partial F stat.	1.80	0.17	0.47	1.99	0.22	0.04	1.99	0.85	1.80
Prob>F	(0.109)	(0.975)	(0.800)	(0.076)	(0.954)	(0.999)	(0.076)	(0.517)	(0.108)

Notes: FTA−N indicates N years before the FTAs are implemented. All models include country, time and industry fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Partial F stat. and Prob>F report the F-statistics and p values for the null hypothesis that the leading coefficients are jointly equal to zero. Units are thousands of 2010 US dollars.

occurs before its effect. Similarly for non-LT goods, we mostly observe no anticipatory effects prior to the FTAs, with just a couple of isolated exceptions. We also calculate the F statistic for the hypothesis that the leading coefficients are jointly equal to zero, which further shows evidence of the parallel trend assumption.

5.2. Clustered standard errors

When using panel data, observations can be correlated with each other within certain categories or groups. This in essence depends on the underlying structure of the data. In international trade data, correlations may happen along more than just one dimension, with the possibility that observations might be correlated at the year, country, and industry categories, which in turn may result in biased estimators. For example, exporting patterns of firms in certain industries may be serially correlated over time as well as across industries. In addition, within a country, industry-specific policies may drive exports to be correlated across the different trade partners we consider (see Cameron and Miller, 2015). To correct for this bias, we re-run the regressions clustering the standard errors on country, year and industry jointly (this produces 1,280 clusters in total, covering four countries over twenty years for each of the sixteen 2-digit level ISIC industries) since those variables are the essential units of observation in our experiment. This will impose a general correlation structure across observations within each cluster, but no correlation across clusters. This helps us consider standard errors that can account for the clustering of observations.

Table 9: Average treatment effects with clustered standard errors

	(1) All goods	(2) LT goods	(3) Non-LT goods
EU FTA	289.508***	89.658***	1103.072***
	(83.180)	(22.556)	(334.796)
Korea FTA	220.925***	126.483***	8416.820***
	(45.103)	(35.902)	(1700.097)
US FTA	724.003***	425.313***	2226.051***
	(123.613)	(112.763)	(343.425)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes

Notes: FEs denotes fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Clustered standard errors in parentheses. Units are thousands of 2010 US dollars.

Table 9 replicates the benchmark results of the average treatment effects when using clustered standard errors. As in the case of the benchmark results, we find that the estimated coefficients are still significantly different from zero at the 1 percent level. Table 10 reports the FTA time-varying effects of using clustered standard errors. Compared to the benchmark case, we still obtain similar qualitative results with a slightly weaker precision due to the standard errors becoming larger: trade growth along the intensive margin picks up first mostly within the first three years after the FTAs are implemented, followed by the extensive margin showing significance in the longer horizon of 5 years or more. Finally, the pattern of all goods resembles that of LT goods with strong and significant effects in the long run but mixed in the shorter horizons.

5.3. Country- and industry-specific trends

An alternative way to check for the robustness of the DID strategy is to include country- or industry-specific time trends to the regression, since one could very reasonably conjecture that FTAs were signed strategically between countries whose trade volumes were increasing. Similarly, certain industries might be subject to productivity-enhancing innovations which could lead to rising exports prior to the FTAs being signed. Including the specific trends allows each country (or industry) to follow distinctive time trends. For example, adding a country-specific time trend to the regressions would imply a specification of the form:

$$Y_{ict} = \delta_{0c} + \delta_{1c}t + b_1 FTA_{ct} + \tau_t + m_c + \lambda_i^s + e_{ict} \quad (5)$$

where δ_{0c} is a country-specific intercept and δ_{1c} is a country-specific trend coefficient multiplied to the time trend variable t.

On the other hand, adding industry-specific time trends results in the following specification:

$$Y_{ict} = \gamma_0^s + \gamma_0^s t + b_1 FTA_{ct} + \tau_t + m_c + \lambda_i^s + e_{ict} \quad (6)$$

where γ_0^s is an industry-specific intercept and γ_0^s is an industry-specific trend coefficient multiplied to the time trend variable t.

In Table 11 we present the results when adding country and industry-specific time trends. The first column replicates the benchmark results without allowing for any specific time trends. Columns (2) to (4) include country-specific time trends in the presence of various fixed effects. Column (5) includes industry-specific time trends with all the fixed effects.

We find that the FTA effects remain robust after the inclusion of industry-specific time trends, as evident in column (5). This suggests that the observed post-FTA changes in trade volumes are not driven by productivity growth or technological progress in certain sectors, which, for instance, may occur in IT industries in advanced countries. We also find that in

Table 10: Time-varying effects of FTA with clustered standard errors

	All goods			LT goods			Non-LT goods		
	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA	EU FTA	Korea FTA	US FTA
Year of FTA	35.925	87.785*	300.301**	21.881	37.977	132.3	370.124	4736.974*	1315.275***
	(147.425)	(49.219)	(148.139)	(55.738)	(23.399)	(119.991)	(655.413)	(2740.304)	(442.154)
FTA+1	115.631	139.478**	452.679***	30.993	57.387**	246.615**	688.256	7426.842**	1590.378***
	(110.676)	(63.434)	(159.850)	(28.645)	(26.979)	(110.630)	(451.733)	(3759.896)	(573.937)
FTA+2	184.37	172.889**	479.795**	61.301*	88.672*	209.125	886.474*	7765.869**	1905.113**
	(132.789)	(81.365)	(238.820)	(33.722)	(49.270)	(183.346)	(526.685)	(3931.488)	(919.144)
FTA+3	292.446*	334.270*	550.925*	35.597	238.071	280.588	1449.660***	8519.544**	1905.911**
	(152.861)	(197.481)	(283.981)	(27.812)	(183.236)	(266.469)	(455.741)	(4184.075)	(743.342)
FTA+4	297.657	287.245*	838.638**	45.282	214.892	537.714	1255.481**	6739.497*	2309.177***
	(193.202)	(150.711)	(426.916)	(39.768)	(135.066)	(443.402)	(535.706)	(3767.229)	(864.677)
FTA+5 and more	561.860***	274.081***	1169.011***	189.838***	123.535***	742.037***	1628.549***	11808.716***	3271.303***
	(136.929)	(80.355)	(254.657)	(44.308)	(41.599)	(255.153)	(474.062)	(3993.250)	(481.403)
Country FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.049	0.018	0.026	0.025	0.007	0.023	0.092	0.147	0.098
Obs.	401,600	401,600	401,600	338,820	395,580	346,980	62,780	6,020	54,620

Notes: FTA+N indicates N years after the FTA are signed. FEs denotes fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Clustered standard errors in parentheses. Units are thousands of 2010 US dollars.

the presence of country-specific time trends, the effects are robust in the case of the Korea FTA, whereas for the EU and the US agreements the effects are nullified—see column (4). The latter results suggest that FTAs are, to some extent, strategically decided. Indeed, as Whalley (1998) and Baldwin and Jaimovich (2012) among others document, there is a variety of reasons which could encourage countries to pursue regional trade agreements—from the traditional gains from trade argument to seeking increased multilateral bargaining powers. As the economic determinants of the FTA may correlate with other trends affecting the country's trade volume, this makes it hard to fully disentangle the causal effect of the FTA from these underlying trends.

Table 11: Country- and industry-specific trends

	(1)	(2)	(3)	(4)	(5)
			All goods		
EU FTA	289.508***	252.266***	288.153***	-84.450	289.508***
	(48.357)	(42.191)	(48.373)	(56.879)	(48.291)
Korea FTA	220.925***	210.902***	220.486***	166.004**	220.925***
	(41.207)	(36.384)	(41.231)	(65.546)	(41.152)
US FTA	724.003***	744.148***	721.937***	92.442	724.003***
	(117.701)	(109.999)	(117.592)	(190.796)	(116.591)
			LT goods		
EU FTA	89.658***	83.790***	89.233***	-17.801	91.489***
	(18.812)	(15.707)	(18.793)	(28.921)	(18.581)
Korea FTA	126.483***	112.030***	126.365***	129.762**	126.126***
	(36.827)	(31.361)	(36.853)	(58.726)	(36.698)
US FTA	425.313***	412.380***	424.025***	18.194	419.769***
	(130.859)	(122.362)	(130.704)	(213.391)	(128.518)
			Non-LT goods		
EU FTA	1103.072***	747.730***	1101.384***	-75.585	1216.811***
	(262.611)	(231.884)	(262.682)	(272.255)	(293.620)
Korea FTA	8416.820***	8522.251***	8391.954***	3650.766*	8416.075***
	(1391.195)	(1375.735)	(1391.266)	(2134.503)	(1390.988)
US FTA	2226.051***	2472.469***	2220.963***	443.738	2399.395***
	(254.781)	(238.536)	(255.060)	(379.168)	(261.285)
Country FEs	Yes	No	No	Yes	Yes
Time FEs	Yes	No	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes
Country-specific Trends	No	Yes	Yes	Yes	No
Industry-specific Trends	No	No	No	No	Yes

Notes: The table reports DID estimates of the effects of FTAs on trade margins using regressions allowing for country (or industry)-specific trends. The first column is a replication of the benchmark test without any time trends. FEs denotes fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars.

5.4. Product-specific FTA effects

In the benchmark specification, the dummy variable FTA_{ct} was country- and time-specific, but not product-specific. This is because FTAs not only mandate the elimination of tariffs, but the removal of non-tariff barriers, as well as wider implications for investment, government procurement and dispute settlement, to mention a few. In addition to these aggregate implications, FTAs might impact products in a differentiated manner. For example, pre-FTA tariff rates may vary across products[11], or some products may already enjoy duty-free status. In addition, depending on the specific agreement, some products are waived from tariff removal either temporarily—though gradual removal and/or allowing for grace periods—or permanently, as in the case of Korean washing machines and refrigerators to Chile. Given that we have product-level data and finer details on the actual FTAs signed, we can explore in detail the specifics of each treaty and incorporate certain product-specific differences. Specifically, we review each FTA signed and calculate the number of products that were given tariff removal exemptions—either permanent or with the longest temporary exemption. For such products, we set $FTA_{ict} = 0$ if product i was excluded from the tariff removal schedule in the FTA with country c (either temporarily or permanently). As shown in Table 12, the number of products waived from tariff elimination represented 1 to 2 percent of all goods, most of which were least-traded. Compared to the FTAs with Chile, the number of goods in this category in the latter FTAs with Peru was even lower.

Table 12: Number of products waived from tariff elimination

	Chile's tariff schedule		Peru's tariff schedule	
	Total	LT goods	Total	LT goods
EU FTA	64	61	10	8
Korea FTA	50	46	13	13
US FTA	93	89	8	8

Table 13 presents the average treatment effects results when we allow for product-specific effects. We find that the DID estimates are still significant across different product categories and countries, with little changes in their values when compared to the benchmark estimates. In addition, the contribution of the extensive margin ranges from 30.9% for EU exports, followed by 48.0% and 58.0% for Korean and the US exports, respectively. These outcomes are quite similar to those presented in Table 3.

[11]For Chile, however, pre-FTA tariff rates were uniform at 6 percent for the products we consider.

Table 13: Average treatment effects: product-specific FTA

	All goods	LT goods	Non-LT goods
EU FTA	302.899***	91.790***	1106.254***
	(47.802)	(18.819)	(261.588)
R^2	0.049	0.025	0.092
Obs.	401,600	338,820	62,780
Korea FTA	213.599***	123.560***	8812.259***
	(41.366)	(36.991)	(1398.085)
R^2	0.018	0.007	0.146
Obs.	401,600	395,580	6,020
US FTA	709.014***	435.291***	2000.111***
	(118.367)	(131.657)	(260.665)
R^2	0.026	0.023	0.097
Obs.	401,600	346,980	54,620
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes

Notes: FEs indicates fixed effects. The 6-digit product-level data excludes the products listed in Table 12. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars.

5.5. Additional controls

In this section, we further test for the robustness of our results by including additional controls of country-specific nature. As documented by Eaton, Kortum and Kramarz (2011), extensive margins are more likely to increase with the size of the destination market, while Baier and Bergstrand (2004) find economically similar trade partners are more likely to engage into a FTA. Additionally, trade volumes might be affected by other macroeconomic variables such as income levels and business cycle fluctuations. Consequently, we include several proxies for the size of a market (such as the level of GDP, both in real and PPP terms, and the population size, all in natural logs), living standards (GDP per capita in logs) and the nominal exchange rate (in US dollars) into the baseline regression, both individually and also jointly. These data were extracted from the World Development Indicators database.

As Table 14 shows, the main findings on the average treatment effects remain robust to the inclusion of the country-specific controls. All estimated coefficients are still statistically different from zero for all types of goods at 1 percent level for the Korea FTA and the 5 percent level for the US FTA. For the EU FTA, LT goods estimates are also positive and statistically significant at the 5 percent level, although there is some evidence that the effects for non-LT goods are nullified when including GDP variables such as GDP per capita and

GDP in PPP terms.[12] Finally, the magnitude of the FTA effects is smaller when controlling for market size (such as the population size), since the estimated coefficients are smaller than in the benchmark specification.

Table 14: Average treatment effects: additional controls

	(1) GDP per capita	(2) GDP (PPP)	(3) GDP (real)	(4) Population	(5) Exchange rate	(6) All
			(All goods)			
EU FTA	128.14***	50.71	217.90***	187.46***	280.08***	124.18***
	(48.37)	(43.97)	(45.95)	(57.28)	(50.49)	(45.10)
Korea FTA	220.65***	196.18***	233.14***	198.09***	220.49***	213.82***
	(51.61)	(48.91)	(47.79)	(43.31)	(41.04)	(49.80)
US FTA	589.72***	424.31***	741.14***	561.37***	721.99***	510.042***
	(131.53)	(136.65)	(129.52)	(125.20)	(117.42)	(127.45)
			(LT goods)			
EU FTA	73.63***	60.90***	96.87***	46.36**	88.64***	78.71***
	(20.62)	(18.81)	(19.89)	(20.81)	(19.99)	(19.33)
Korea FTA	140.06***	132.70***	141.57***	116.66***	126.23***	139.29***
	(47.76)	(44.19)	(43.84)	(38.53)	(36.65)	(45.82)
US FTA	452.20***	349.40**	541.58***	275.09**	424.33***	431.39***
	(146.28)	(150.52)	(145.52)	(138.83)	(130.51)	(141.67)
			(Non-LT goods)			
EU FTA	173.25	-165.04	482.87**	936.92***	1015.216***	95.953
	(248.91)	(230.05)	(238.24)	(292.49)	(271.28)	(225.951)
Korea FTA	7296.18***	5984.15***	7818.39***	8167.95***	8395.14***	6450.39***
	(1454.76)	(1517.23)	(1428.74)	(1407.31)	(1387.77)	(1458.82)
US FTA	1247.99***	638.68**	1573.82***	2136.87***	2220.28***	692.61**
	(285.30)	(303.69)	(269.10)	(265.81)	(254.86)	(296.13)

Notes: The table reports DID estimates of the FTA effects using regressions that incorporate each additional control (coefficients for the controls are not reported). All models include country, time and industry fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars. Column (6) includes GDP per capita, population and nominal exchange rate as control variables.

6. Synthetic Control Analysis

In order to further validate our results, in this section we use the synthetic control method (SCM) proposed by Abadie and Gardeazabal (2003), and later developed in Abadie, Diamond and Hainmueller (2010) and Abadie, Diamond and Hainmueller (2015). The SCM

[12]We suspect that the mixed results observed for the EU FTA can be partly attributed to the fact that the post-FTA period overlaps with the recovery of the Argentinean economy following the crisis it experienced between 1998 and 2002. As the Argentinean economy resumed growth, European exports to Argentina surged back (see Figure 1).

is a popular approach for comparative case studies, which has also been used to quantify the economic effects of shocks or policy interventions. For example, Billmeier and Nannicini (2013) assessed the impact of economic liberalization on income per capita, while Puzzello and Gomis-Porqueras (2018) assessed the effects of adopting the euro on the income per capita of six early members. However, to the best of our knowledge, no other studies have used SCM to understand the trade-margin effects of FTAs.

In the benchmark DID analysis, we chose to have a control group made up of border-sharing countries. Instead, the SCM requires *constructing* a synthetically generated control unit—a weighted combination of potential control countries—such that this control unit approximates the most relevant characteristics of the treatment country prior to the policy intervention. Once the intervention—in our case, the FTA—takes place in the treatment group, we can compare its effect with the evolution of the untreated synthetic control unit to assess the counterfactual situation corresponding to the absence of the regime change. It has been shown that SCM has several nice properties that can augment our previous DID analysis, since it provides a more rigorous—i.e., less ad-hoc—way of selecting control units from a large pool of potential countries (or "donors"), and because it also allows the effect of unobservable country heterogeneity to vary over time, which offers an advantage over standard DID or fixed-effect models.

6.1. Sample and data

In our SCM analysis, the treatment country is Chile.[13] For each FTA case (EU, Korea and the US), we follow two steps in order to construct a control group that mimics Chile prior to the signing of the FTA. First, we pool 40 countries that are similar to Chile in terms of average exports between 1996 and the year prior to the respective FTAs. Second, from this large list of countries we drop those that signed an FTA at any point during the entire sample period (1996–2015). This process leaves us with 22 countries for the case of the FTA with Korea, 29 for the US FTA, and 25 for the EU FTA (we list the control group countries and regions for each of the FTA signatories in Table 15). Note that, just as in the DID case, Argentina is included as a control country for all the FTA cases. On the other hand, both Peru and Bolivia end up being excluded; the former because it signed FTAs in the latter years of our sample period, and the latter because of its small share of exports.

The outcome variables of interest for each FTA signatory are total exports, as well as exports of LT and non-LT goods to Chile. To construct the synthetic control units that

[13] In the DID analysis, we considered post-FTA Chile and Peru as the treatment group. However, in the SCM approach we only consider post-FTA Chile as the treatment country, since the post-FTA period for Peru is too short to be analyzed.

Table 15: Control groups

FTA signatory	Control group (ISO code)				
EU	Argentina (ARG)	Iran (IRN)	New Zealand (NZL)	Qatar (QAT)	Thailand (THA)
	Belarus (BLR)	Kazakhstan (KAZ)	Nigeria (NGA)	Saudi Arabia (SAU)	Ukraine (UKR)
	Côte d'Ivoire (CIV)	Kuwait (KWT)	Oman (OMN)	South Africa (ZAF)	United Arab Emirates (ARE)
	India (IND)	Libya (LBY)	Pakistan (PAK)	Syria (SYR)	Venezuela (VEN)
	Indonesia (IDN)	Malaysia (MYS)	Philippines (PHL)	Taiwan (TWN)	Vietnam (VNM)
Korea	Argentina (ARG)	Canada (CAN)	Liberia (LBR)	Panama (PAN)	United Arab Emirates (ARE)
	Australia (AUS)	Egypt (EGY)	Mexico (MEX)	Russia (RUS)	Uzbekistan (UZB)
	Bahamas (BHS)	Guatemala (GTM)	New Zealand (NZL)	Saudi Arabia (SAU)	
	Bangladesh (BGD)	Iran (IRN)	Nigeria (NGA)	South Africa (ZAF)	
	Brazil (BRA)	Israel (ISR)	Pakistan (PAK)	Sri Lanka (LKA)	
US	Argentina (ARG)	Egypt (EGY)	Italy (ITA)	Philippines (PHL)	Switzerland (CHE)
	Austria (AUT)	Finland (FIN)	Jamaica (JAM)	Russia (RUS)	Thailand (THA)
	Belgium (BEL)	Hong Kong (HKG)	Kuwait (KWT)	Saudi Arabia (SAU)	Turkey (TUR)
	Brazil (BRA)	India (IND)	Malaysia (MYS)	South Africa (ZAF)	United Arab Emirates (ARE)
	Denmark (DNK)	Indonesia (IDN)	New Zealand (NZL)	Spain (ESP)	Venezuela (VEN)
	Ecuador (ECU)	Ireland (IRL)	Norway (NOR)	Sweden (SWE)	

approximate the pre-FTA export characteristics to Chile, we use a set of covariates typically used in a gravity model as exports determinants. These include: per capita real GDP, distance from the FTA signatory, population, real effective exchange rate (REER), and average MFN tariffs. Following Abadie, Diamond and Hainmueller (2010), we also include lagged (one year and four years prior to FTA) values of the pre-treatment outcome variables, as this will improve the overall pre-treatment fit. All of our data are taken from the Penn World Tables (PWT), WITS, World Development Indicators (WDI) and the Centre d'Études Prospectives et d'Informations Internationales (CEPII) Gravity Database.

The weights assigned for the synthetic control unit are shown in Table A5 in the Appendix. In addition, the predictor means for the treated and synthetic control unit, as well as the overall pre-treatment fit (as measured by the root mean square prediction error, RMSPE) are shown in Table A6 in the Appendix. For comparison purposes, the table also shows that the synthetic control unit does a better job than the simple average of all the countries in the control group at replicating the covariates that we use to approximate the exports behavior.

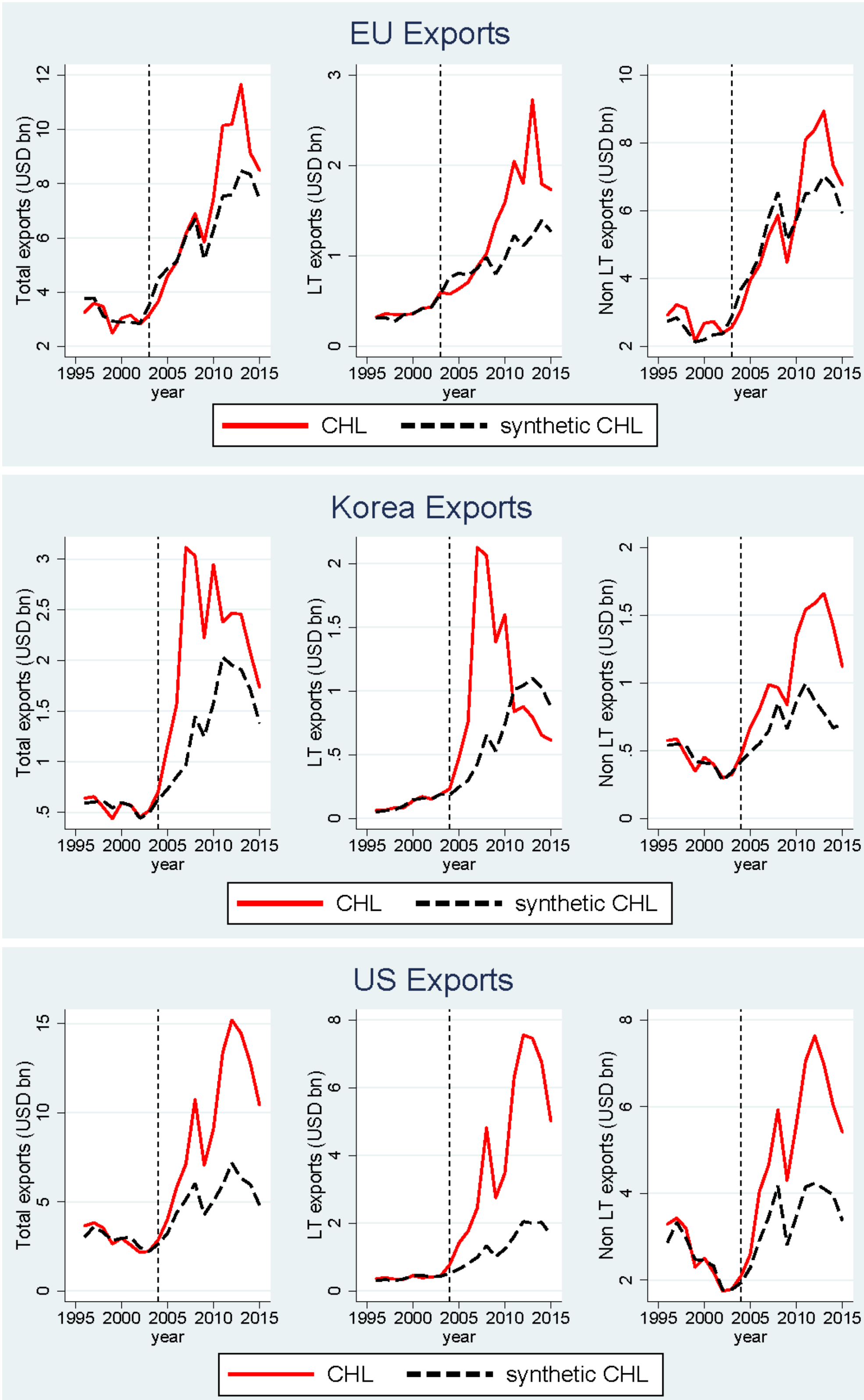
6.2. Baseline SCM Results

In this subsection, we present and discuss the implemented FTA experiments and their effects on aggregate exports as well as on the trade margins.

First, we present the results for each FTA, by type of exports, in Figure 4 (the vertical dotted line indicates the year of the FTA).[14] For the case of the EU FTA, we do not see a

[14] An alternative graph, showing the gap between the treated and the synthetic control unit, is presented in Figure A3 in the Appendix.

Figure 4: Exports to Chile vs. synthetic control unit (1996–2015)



visible divergence in exports to Chile from its synthetic counterpart immediately after the FTA takes place in 2003. Instead, the treatment effects become visible later in the post-FTA period, with LT exports to Chile growing much faster than to its synthetic counterpart after 2008, and total and non-LT exports starting to diverge on 2010. Comparing the two margins, we observe more noticeable divergence and growth for LT exports than for non-LT exports.[15]

On the other hand, there is a clear divergence taking place from the year of Korea-Chile FTA implementation, which is most prominent in the case of LT exports, followed by total exports. However, the gap between LT exports to Chile and its synthetic counterpart narrows down around five years post-FTA. This may be attributed to the growing competition arising from other FTAs (e.g., with the US) or the new treaties that Chile signed with other countries such as China and Japan, which took place in 2006 and 2007, respectively. During later periods, non-LT exports to Chile grow more substantially and play a more dominant role in total export growth. Finally, in the case of US FTA with Chile, we find a clear break in exports (of all types) occurring on the year of FTA, with an increasing divergence over time. Similarly to what we find in the other two FTA cases, export growth is more prominent for LT goods. In sum, for all the FTAs we consider, most of the post-FTA export growth is mainly driven by exports of LT goods rather than non-LT goods, although with some variations over different horizons—stronger short-run effects for Korea, while stronger long-run effects for the EU.

Next, we quantify the magnitude of the post-FTA growth in exports by calculating the difference between exports to Chile and its synthetic counterpart as a fraction of the latter for each year, and then computing the simple average across the whole post-FTA window. These measures capture the average treatment effect of the FTAs, and are shown in Table 16. For each case, we find that total exports to Chile are higher than in the absence of an FTA. The increases in total exports range from 10 percent (EU-Chile FTA) to nearly 77 percent (US-Chile FTA). Moreover, we also find that the main contributor to exports growth was the extensive margin: in each case, the increase in LT exports is noticeably larger than the increase in non-LT goods. Indeed, the magnitude of the increase in LT goods is 1.5 to almost 12 times larger than the increase of non-LT goods, depending on the specific agreement. These findings qualitatively confirm the results of our DID analysis. That is, the order of magnitude in export increases—largest in the US followed by Korea and weakest in the EU—under SCM is identical to the order we found in our earlier DID estimate. More

[15]Running the SCM analysis for the largest economy in the EU (Germany) did not alter the results qualitatively. This result is available upon request.

importantly, our SCM estimates confirm our earlier DID results that export growth along the extensive margin was as important as—if not more than—the intensive margin.

Table 16: Relative increase in post-FTA exports to Chile (percent)

	Total exports	LT exports	Non-LT exports
EU FTA	10.1	31.1	2.7
Korea FTA	64.3	86.2	55.7
US FTA	76.8	192.3	48.7

6.3. Placebo tests

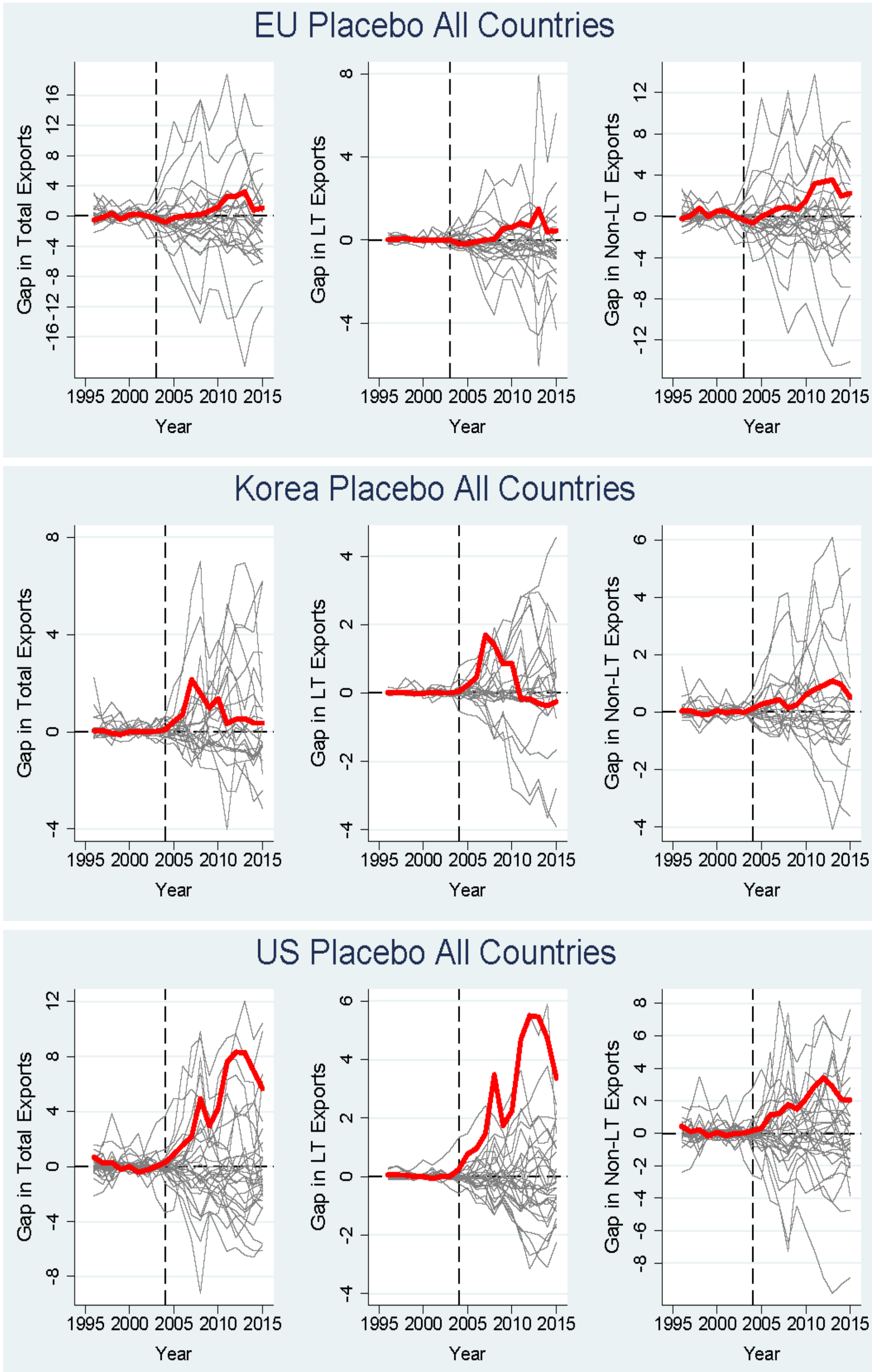
To assess the robustness of our baseline SCM results we conduct placebo (or falsification) tests based on permutation techniques, as suggested in Abadie, Diamond and Hainmueller (2010). More specifically, we run cross-sectional placebo tests by sequentially applying the synthetic control algorithm to each country in the pool of potential controls, which generates a distribution of placebo estimates.[16] We then can compare the benchmark estimates of the truly treated economy with this distribution.

The cross-sectional placebo tests are shown in Figure 5. The gray lines shows the gap between exports to each country in the control group and its respective synthetic version. The thick red line depicts the baseline results for the FTA with Chile. Visual inspection for EU FTA case shows a number of countries with higher export growth (of all types) than to Chile after 2003, the year when the FTA was signed. Our benchmark estimate does not appear in the upper end of the distribution, which lowers the significance of the FTA effect on EU's exports growth to Chile. For the FTA with Korea, we find that LT exports to Chile lie in the upper end of the distribution immediately after the FTA was signed, but not in latter years. Korea's non-LT exports to Chile do not seem to be distinctively higher than to other countries. Finally, for the US FTA case, LT goods exports to Chile appear consistently in the upper range of the distribution, indicating a high significance of the FTA effects.

While the previous figures offer visual evidence of the treatment effects over time, they do not provide a numerical measurement that quantifies the significance of our results. To overcome this issue, we follow Abadie, Diamond and Hainmueller (2015), who offer an alternative approach for an inference test. Recall RMSPEs measure the gap between the variable of interest for the treated country and its synthetic counterpart. Thus, we calculate the

[16]We also perform a different set of placebo test to assess whether the estimated FTA effects for Chile differ by arbitrarily assigning the FTA intervention on a year preceding the actual implementation of the FTA (i.e. placebo in-time). These results are available upon request.

Figure 5: Cross-sectional placebo tests



ratio of the post- to pre-treatment RMSPE to quantify the post-treatment exports divergence, relative to the estimated gap pre-treatment. We compute this ratio for each country in the cross-sectional placebo test, and compare them with the ratio obtained for Chile. The distribution of the RMSPE ratios (from highest to lowest) is shown in Figure 6. P-values are given by the ranking of Chile among all countries in the control group. This measures the probability of observing a ratio as high as the one obtained for Chile, if one were to pick a country at random from the list of potential controls.

For the EU FTA, overall p-values range from around 27 percent (since Chile ranks 7th out of 26 countries) for LT exports to more than 73 percent for both total and non-LT exports (since Chile ranks 19th out of 26 countries). These high p-values suggest that the EU-Chile FTA had neither aggregate nor trade-margin effects for EU exports. On the other hand, for the Korea and US FTAs, the p-values are much lower for all types of exports. P-values for the Korea FTA range from 4 percent for LT exports to 17 percent for non-LT exports, while for the US FTA they range between 3.3 percent (for LT exports) and 13.3 percent (for total exports).[17] Therefore, we find strong statistical significance of our estimates of the FTA effects on the extensive margin. Note that both Korea and US LT exports show post- to pre-treatment RMSPE ratios—both ranked first—that are far higher than those obtained for other countries in the control group.

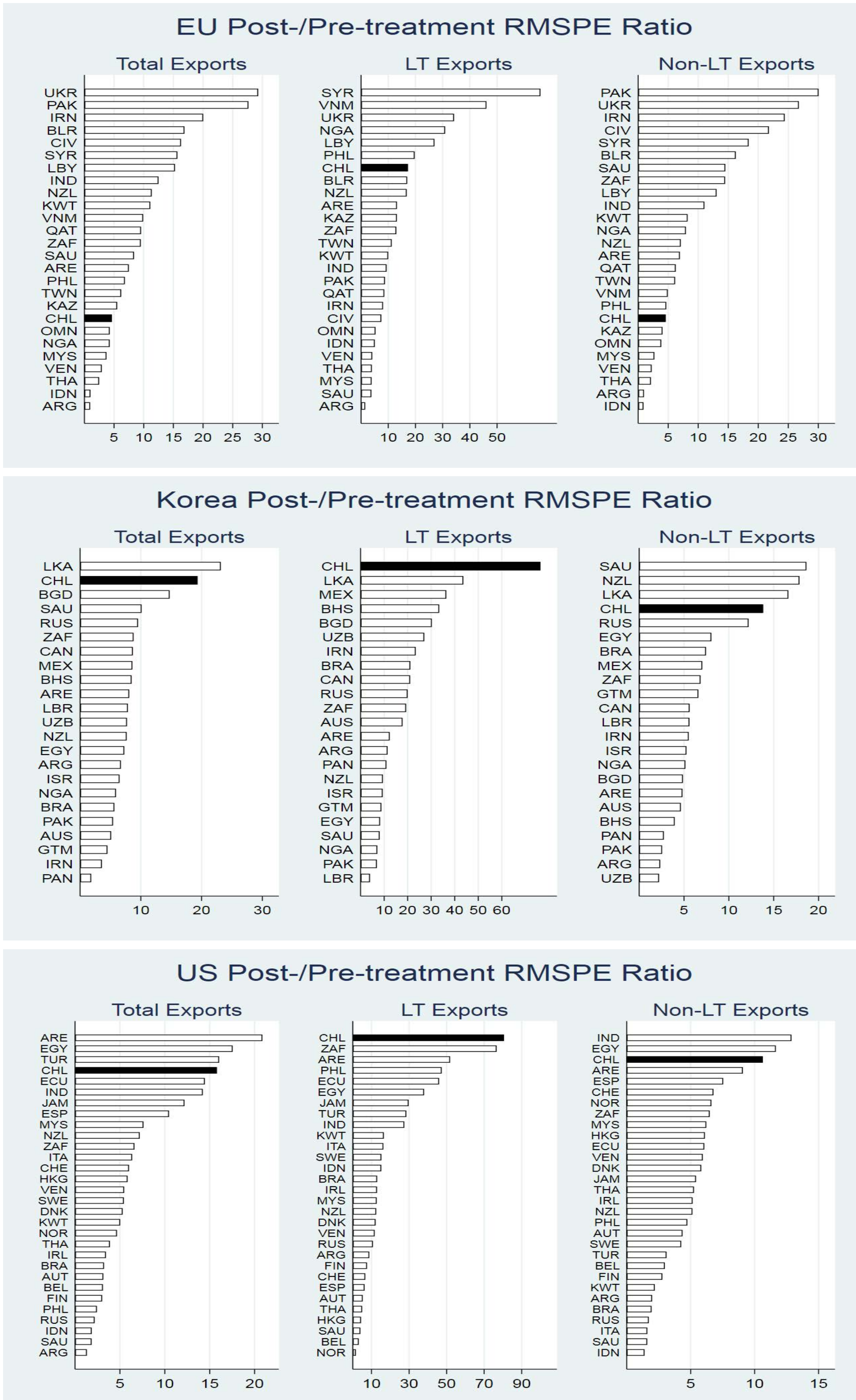
7. Conclusion

This article presents unbiased estimates of the FTA effects on export growth along the extensive and intensive margins. Understanding such effects is important, for example, because as the literature has recently shown, exports of new goods have further implications on welfare and productivity. Employing a DID approach at the product level, we focus on recent FTA episodes signed between geographically distant partners, using border-sharing neighbors who did not sign the FTAs as a control group. This allows us to overcome potential endogeneity issues and calculate unbiased estimates of the causal effects of trade liberalization in the form of FTA.

Our DID estimates show that FTAs had a positive and significant effects on trade growth and that the extensive margin accounted for one-third to more than half of exports growth. The significance of the extensive margin in post-FTA export growth is further validated through an alternative SCM estimation. Since we consider long post-FTA windows, we can

[17]For some countries, the RMSPE ratios appear large due to a sizable decrease —rather than an increase— in exports during the post-intervention period. Korea's exports to Sri Lanka (LKA), and US exports to Egypt (EGY) and South Africa (ZAF) are some notable examples of exports collapse after 2004. Removing these cases would increase the significance of our results.

Figure 6: Ratio of post- to pre-treatment RMSPE



also distinguish between the short- and long-term effects of the agreements. Indeed, we find that the effects of the FTAs on extensive margin increase over time and become significant five (or more) years after the agreements were signed, lagging the effects observed on the intensive margin. This supports the findings of Kehoe and Ruhl (2013), who document that extensive margin growth is stronger in the medium and long runs, but not in the short term. Our main findings are robust to inclusions of several controls and alternative error structures.

Additionally, we explore the sectoral variations in the FTA effects. We find that in sectors with homogeneous goods—characterized by high elasticities of substitution—trade growth was driven by the intensive margin. On the other hand, in sectors with low elasticities of substitution, we found significant responses on the extensive margin of trade.

In sum, we show that FTAs raise the overall volume of trade by affecting the trade margins differently, both in terms of timing and sectors. Given that FTAs similar to the ones we focus on have come into force in the recent years, our analysis can be applied to study them, in turn enhancing our understanding of the effects of trade liberalization among remote partners—an issue which should also be of interest to policymakers working on the design of trade reforms. Lastly, our findings on which specific sectors are more likely to experience increases in the trade of new goods can certainly complement the vast literature on the productivity gains derived by export growth along the extensive margin following trade liberalizations originating from Melitz (2003). We do not explicitly examine those issues, but believe that such explorations would serve as interesting topics for future research.

References

Abadie, A., Diamond, A., Hainmueller, J., 2010. Synthetic control methods for comparative case studies: Estimating the effect of California's tobacco control program. Journal of the American Statistical Association 105, 493– 505.

Abadie, A., Diamond, A., Hainmueller, J., 2015. Comparative politics and the synthetic control method. American Journal of Political Science 59, 495– 510.

Abadie, A., Gardeazabal, J., 2003. The economic costs of conflict: A case study of the Basque country. American Economic Review 93, 113–132.

Amarsanaa, C., Kurokawa, Y., 2012. The extensive margin of international trade in a transition economy: the case of Mongolia. Working paper 2011–005. University of Tsukuba.

Anderson, J.E., Yotov, Y., 2016. Terms of trade and global efficiency effects of free trade agreements. Journal of International Economics 99, 279–298.

Arkolakis, C., 2010. Market penetration costs and the new consumers margin in international trade. Journal of Political Economy 118, 1151–1199.

Autor, D.H., 2003. Outsourcing at will: The contribution of unjust dismissal doctrine to the growth of employment outsourcing. Journal of Labor Economics 21, 1–42.

Baier, S.L., Bergstrand, J.H., 2004. Economic determinants of free trade agreements. Journal of International Economics 64, 29–63.

Baier, S.L., Bergstrand, J.H., 2007. Do free trade agreements actually increase members' international trade? Journal of International Economics 71, 72–95.

Baier, S.L., Bergstrand, J.H., Feng, M., 2014. Economic integration agreements and the margins of international trade. Journal of International Economics 93, 339–350.

Baldwin, R., Jaimovich, D., 2012. Are free trade agreements contagious? Journal of International Economics 88, 1–16.

Bernard, A.B., Jensen, J.B., Redding, S.J., Schott, P.K., 2009. The margins of US trade. American Economic Review 99, 487–493.

Billmeier, A., Nannicini, T., 2013. Assessing economic liberalization episodes: A synthetic control approach. Review of Economics and Statistics 95, 983–1001.

Cameron, A.C., Miller, D.L., 2015. A practitioner's guide to cluster-robust inference. Journal of Human Resources 50, 317–372.

Card, D., Krueger, A.B., 1994. Minimum wages and employment: A case study of the fast-food industry in New Jersey and Pennsylvania. American Economic Review 84, 772–793.

Chaney, T., 2008. Distorted gravity: the intensive and extensive margins of international trade. American Economic Review 98, 1707–1721.

Cheong, J., Kwak, D.W., Yuan, H., 2017. Trade to aid: EU's temporary tariff waivers for flood-hit Pakistan. Journal of Development Economics 125, 70–88.

Cho, S.W.S., Choi, H., Díaz, J.P., 2018. Do free trade agreements increase the new goods margin? Evidence from Korea. Open Economies Review .

Crozet, M., Koenig, P., 2010. Structural gravity equations with intensive and extensive margins. The Canadian Journal of Economics 43, 41–62.

Dai, M., Yotov, Y.V., Zylkin, T., 2014. On the trade-diversion effects of free trade agreements. Economics Letters 122, 321–325.

Dalton, J.T., 2017. EU enlargement and the new goods margin in Austrian trade. Open Economies Review 28, 61–78.

Eaton, J., Kortum, S., Kramarz, F., 2011. An anatomy of international trade: evidence from French firms. Econometrica 79, 1453–1498.

Evenett, S.J., Venables, A.J., 2002. Export growth in developing countries: market entry and bilateral trade flows. Manuscript. Oxford University.

Foster, N., 2012. Preferential trade agreements and the margins of imports. Open Economies Review 23, 869–889.

Foster, N., Poeschl, J., Stehrer, R., 2011. The impact of preferential trade agreements on the margins of international trade. Economic Systems 35, 84–97.

Handley, K., Limão, N., 2015. Trade and investment under policy uncertainty: Theory and firm evidence. American Economic Journal: Economic Policy 7, 189–222.

Kehoe, T.J., Rossbach, J., Ruhl, K.J., 2015. Using the new goods margin to predict the industry-level impact of trade reform. Journal of International Economics 96, 289–297.

Kehoe, T.J., Ruhl, K.J., 2013. How important is the new goods margin in international trade? Journal of Political Economy 121, 358–392.

Martincus, C.V., Blyde, J., 2013. Shaky roads and trembling exports: Assessing the trade effects of domestic infrastructure using a natural experiment. Journal of International Economics 90, 148–161.

Mayer, T., Melitz, M.J., Ottaviano, G.I., 2014. Market size, competition, and the product mix of exporters. American Economic Review 104, 495–536.

Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71, 1695–1725.

Ossa, R., 2015. Why trade matters after all. Journal of International Economics 97, 266–277.

Puzzello, L., Gomis-Porqueras, P., 2018. Winners and losers from the Euro. European Economic Review 108, 129–152.

Saia, A., 2017. Choosing the open sea: The cost to the UK of staying out of the euro. Journal of International Economics 108, 82–98.

Trefler, D., 2004. The long and short of the Canada-US Free Trade Agreement. American Economic Review 94, 870–895.

Whalley, J., 1998. Why Do Countries Seek Regional Trade Agreements?, in: The Regionalization of the World Economy. National Bureau of Economic Research, Inc. NBER Chapters, pp. 63–90.

Wing, C., Simon, K., Bello-Gomez, R.A., 2018. Designing difference in difference studies: Best practices for public health policy research. Annual Review of Public Health 39, 453–469.

Appendix

Table A1: OLS estimates of FTAs effects on exports to Chile

	(1) All goods	(2) LT goods	(3) Non-LT goods
EU FTA	590.668***	211.163***	2068.002***
	(53.508)	(25.527)	(235.950)
R^2	0.001	0.000	0.003
Obs.	100,400	79,880	20,520
Korea FTA	320.966***	184.305***	10126.886***
	(52.730)	(46.076)	(1845.536)
R^2	0.000	0.000	0.015
Obs.	100,400	99,020	1,380
US FTA	1285.724***	876.769***	3462.353***
	(193.561)	(221.862)	(311.952)
R^2	0.000	0.000	0.006
Obs.	100,400	84,520	15,880

Notes: *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Standard errors in parentheses. Units are thousands of 2010 US dollars.

Table A2: Alternative sectoral classification according to trade elasticities

	Percent of	LT goods' fraction (%)			Elasticity (Ossa, 2015)	
Sectors	all goods	EU FTA	Korea FTA	US FTA	Mean	Median
Low-elasticity sector	18.6	83.3	98.7	86.5	1.88	1.91
Medium-elasticity sector	61.4	83.2	98.9	85.6	2.74	2.63
High-elasticity sector	20.0	88.9	97.1	88.7	6.43	4.73

Table A3: Alternative sectoral classification — Sectoral effects of FTAs

	All goods			LT goods			Non-LT goods		
	EU	Korea	US	EU	Korea	US	EU	Korea	US
Low-elasticity sector	264.481***	99.387***	505.967***	76.467***	48.676***	129.636***	891.883	4449.666***	2245.720***
	(95.494)	(18.506)	(75.045)	(16.520)	(8.438)	(27.951)	(565.682)	(1057.208)	(450.331)
Medium-elasticity sector	222.184***	174.066***	766.588***	78.261***	174.057***	634.940***	737.651***	781.171	1325.542***
	(44.666)	(59.915)	(183.689)	(12.556)	(59.485)	(213.253)	(240.232)	(952.201)	(223.534)
High-elasticity sector	519.751***	478.135***	796.146***	133.468*	51.245***	65.757***	3069.809**	19331.540***	5715.837***
	(177.466)	(90.658)	(142.256)	(79.745)	(10.858)	(12.729)	(1215.818)	(3404.866)	(1147.055)

Notes: The table reports DID treatment effects for each sector. All models include country, time and industry fixed effects. *, ** and *** denote statistical significance at the 10, 5, and 1 percent levels, respectively. Robust standard errors in parentheses. Units are thousands of 2010 US dollars.

Table A4: Alternative sectoral classification — Contributions to total export growth (percent)

	EU		Korea		US	
	LT goods	Non-LT goods	LT goods	Non-LT goods	LT goods	Non-LT goods
Low-elasticity sector	—	—	45.1	54.9	27.0	73.0
Medium-elasticity sector	34.5	65.5	—	—	74.0	26.0
High-elasticity sector	25.7	74.3	8.0	92.0	8.3	91.7

Table A5: SCM weights

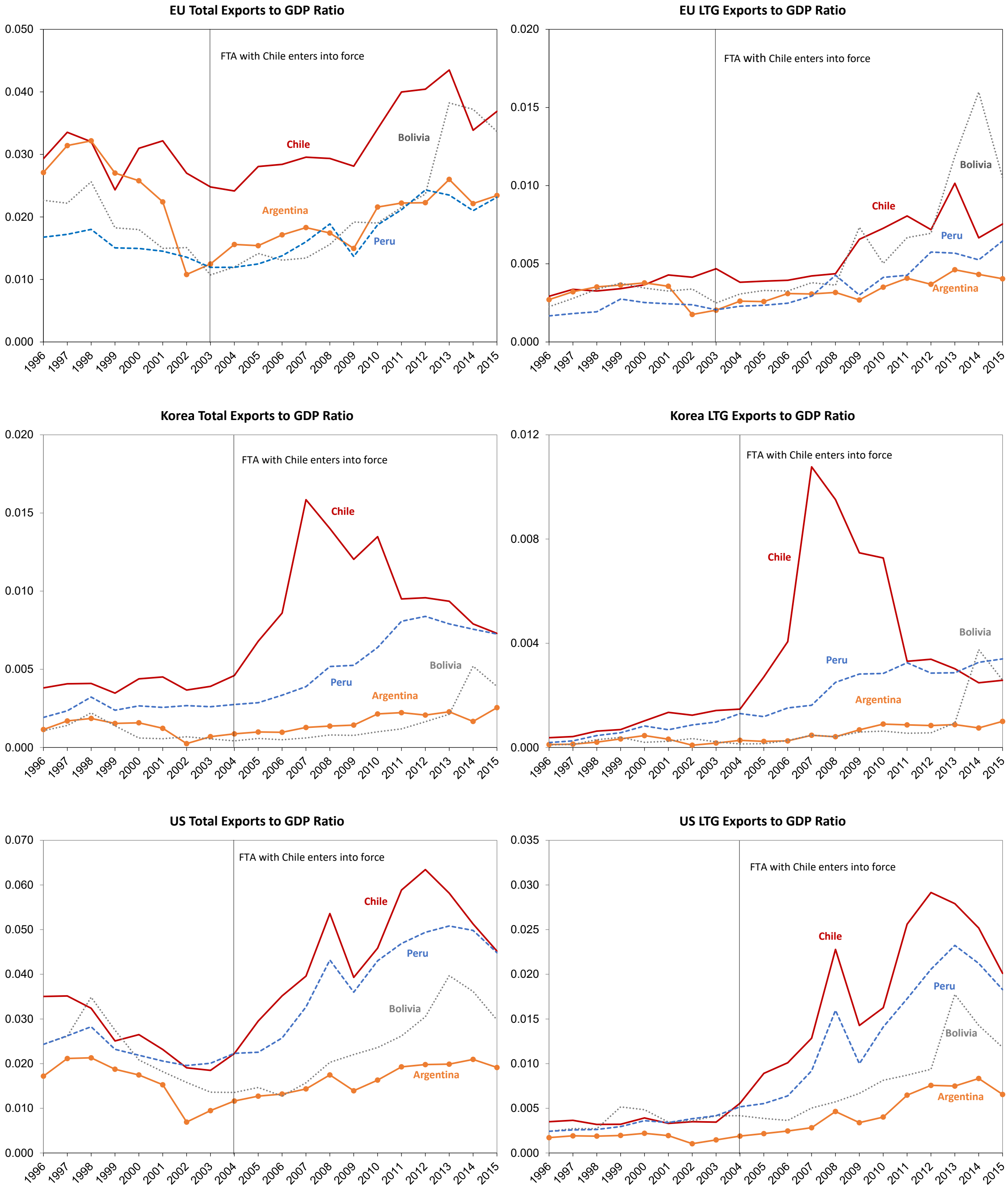
EU FTA				Korea FTA				US FTA			
Control (ISO)	All goods	LT goods	Non-LT goods	Control (ISO)	All goods	LT goods	Non-LT goods	Control (ISO)	All goods	LT goods	Non-LT goods
ARE	0.007	0.000	0.013	ARE	0.000	0.000	0.000	ARE	0.004	0.005	0.008
ARG	0.109	0.056	0.043	ARG	0.320	0.146	0.456	ARG	0.027	0.089	0.199
BLR	0.003	0.002	0.025	AUS	0.000	0.093	0.000	AUT	0.007	0.009	0.042
CIV	0.010	0.002	0.047	BGD	0.000	0.000	0.000	BEL	0.002	0.004	0.003
IDN	0.097	0.057	0.036	BHS	0.000	0.033	0.000	BRA	0.004	0.009	0.006
IND	0.011	0.000	0.011	BRA	0.092	0.127	0.031	CHE	0.003	0.005	0.006
IRN	0.008	0.055	0.019	CAN	0.000	0.000	0.000	DNK	0.005	0.010	0.013
KAZ	0.009	0.004	0.114	EGY	0.000	0.000	0.000	ECU	0.005	0.018	0.030
KWT	0.008	0.002	0.035	GTM	0.310	0.332	0.270	EGY	0.072	0.039	0.001
LBY	0.006	0.005	0.022	IRN	0.000	0.000	0.000	ESP	0.003	0.007	0.007
MYS	0.011	0.002	0.020	ISR	0.000	0.000	0.000	FIN	0.005	0.007	0.014
NGA	0.011	0.002	0.023	LBR	0.000	0.000	0.000	HKG	0.003	0.004	0.005
NZL	0.479	0.508	0.080	LKA	0.000	0.000	0.000	IDN	0.122	0.080	0.197
OMN	0.011	0.003	0.090	MEX	0.000	0.000	0.000	IND	0.001	0.019	0.000
PAK	0.061	0.094	0.026	NGA	0.000	0.044	0.000	IRL	0.003	0.006	0.005
PHL	0.015	0.115	0.039	NZL	0.208	0.225	0.075	ITA	0.002	0.005	0.004
QAT	0.009	0.000	0.083	PAK	0.000	0.000	0.000	JAM	0.084	0.146	0.133
SAU	0.007	0.001	0.012	PAN	0.070	0.000	0.072	KWT	0.102	0.002	0.087
SYR	0.007	0.002	0.028	RUS	0.000	0.000	0.000	MYS	0.003	0.006	0.004
THA	0.017	0.001	0.022	SAU	0.000	0.000	0.000	NOR	0.005	0.009	0.013
TWN	0.009	0.001	0.012	UZB	0.000	0.000	0.000	NZL	0.194	0.272	0.052
UKR	0.003	0.002	0.024	ZAF	0.000	0.000	0.097	PHL	0.004	0.085	0.005
VEN	0.018	0.081	0.033					RUS	0.002	0.010	0.013
VNM	0.067	0.001	0.128					SAU	0.008	0.008	0.015
ZAF	0.009	0.002	0.013					SWE	0.005	0.009	0.012
								THA	0.005	0.009	0.011
								TUR	0.008	0.012	0.022
								VEN	0.243	0.114	0.075
								ZAF	0.069	0.001	0.016

Table A6: Predictor means and RMSPE

	All goods			LT goods			Non-LT goods		
Predictor means	Chile	Synthetic	Avg. controls	Chile	Synthetic	Avg. controls	Chile	Synthetic	Avg. controls
EU FTA									
Distance	9.392	9.409	8.674	9.392	9.374	8.674	9.392	8.746	8.674
Population	2.725	2.732	3.119	2.725	2.721	3.119	2.725	2.714	3.119
GDP per capita	8.515	8.531	7.885	8.515	8.498	7.885	8.515	7.854	7.885
REER	105.235	105.342	125.746	105.235	105.063	125.746	105.235	114.042	125.746
Tariff (%)	9.069	9.086	11.267	9.069	9.051	11.267	9.069	10.076	11.267
Lagged Exports									
FTA–4 yrs	2.499	2.936	4.028	0.352	0.351	0.532	2.146	2.131	3.496
FTA–1 yrs	2.830	2.842	4.784	0.435	0.433	0.754	2.395	2.379	4.029
RMSPE		0.3144			0.0338			0.3528	
Korea FTA									
Distance	9.811	9.573	9.122	9.811	9.458	9.122	9.811	9.653	9.122
Population	2.731	2.731	3.100	2.731	2.728	3.100	2.731	2.998	3.100
GDP per capita	8.512	8.512	8.026	8.512	8.513	8.026	8.512	8.432	8.026
REER	102.893	119.116	123.131	102.893	102.855	123.131	102.893	137.837	123.131
Tariff (%)	9.069	9.144	11.762	9.069	9.067	11.762	9.069	9.938	11.762
Lagged Exports									
FTA–4 yrs	0.593	0.599	1.005	0.139	0.148	0.238	0.454	0.411	0.767
FTA–1 yrs	0.517	0.495	1.138	0.191	0.191	0.352	0.326	0.342	0.785
RMSPE		0.0509			0.0100			0.0444	
US FTA									
Distance	9.029	9.030	9.104	9.029	9.019	9.104	9.029	9.011	9.104
Population	2.731	2.735	2.991	2.731	2.722	2.991	2.731	2.971	2.991
GDP per capita	8.512	8.509	8.949	8.512	8.508	8.949	8.512	8.494	8.949
REER	102.893	102.859	101.600	102.893	102.849	101.600	102.893	113.384	101.600
Tariff (%)	9.069	9.079	7.798	9.069	9.057	7.798	9.069	9.044	7.798
Lagged Exports									
FTA–4 yrs	2.968	2.966	4.825	0.458	0.457	0.652	2.511	2.454	4.173
FTA–1 yrs	2.236	2.235	4.306	0.442	0.441	0.740	1.794	1.787	3.566
RMSPE		0.3182			0.0423			0.1884	

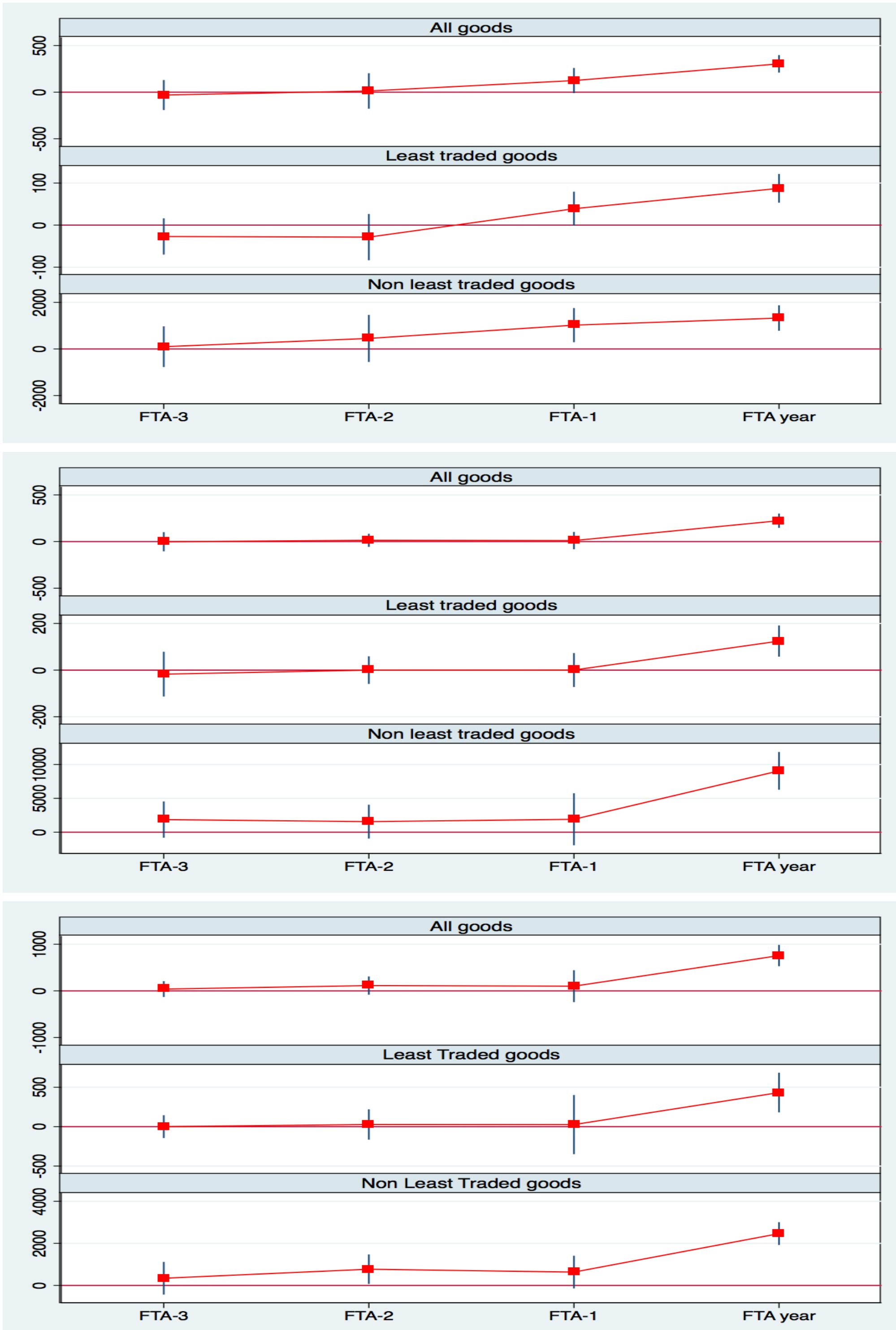
Notes: Distance, population and GDP per capita variables are in logs. Real effective exchange rate (REER) is normalized to 100 in 2007. Lagged exports are in billion US dollars. RMSPE is root mean squared prediction error, which measures the overall pre-treatment fit. "Avg. controls" refers to the simple average of all the countries in the control group.

Figure A1: Total and least-traded goods exports to GDP ratio (1996–2015)



Notes: We divide export volumes by GDP of each destination country. Vertical line denotes the year in which the respective FTAs were in place.

Figure A2: Placebo tests: EU (top), Korea (middle) and US (bottom)



Notes: FTA−N indicates N years before the FTAs are signed. Each point represents the coefficient estimates of lead terms in Table 8. Vertical lines represent the 95 percent confidence intervals of each point estimates. Units are thousands of 2010 US dollars.

Figure A3: Export gap between Chile and synthetic control unit (1996–2015)