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

(Preliminary draft)

Sang-Wook (Stanley) Cho[1]

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

Hansoo Choi[2,*]

Korea Institute of Public Finance, 336 Sicheong-daero, Sejong City, Korea

Julián P. Díaz[3]

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

Abstract

This paper estimates the causal effect of FTAs on the extensive margin (or the "new goods margin") of trade growth by looking at three specific FTA episodes involving Chile in 2003 and 2004. Using highly-disaggregated product-level data, we empirically investigate how much of increases in intensive and extensive margins are due to the FTAs coming into effect. To address endogeneity issues involving empirical procedures, we employ differences-in-differences (DID) event-study methodology. Based on insights from gravity equations, we choose the neighboring non-FTA countries as control groups. Our DID estimates show that during the post-FTA years from 2004 to 2015, the extensive margins account for 49% and 56% of export growth for Korea and the US to Chile, respectively. We also find that the effect of the FTAs on the extensive margin becomes significantly visible after five years or more which is consistent with findings of Kehoe and Ruhl (2013) and Arkolakis (2010) that the extensive margin growth is stronger in the medium and long run rather than in the short term.

JEL classification: F10, F13, F14

Keywords: Free trade agreement, Extensive margin, Differences-in-differences estimation

*Corresponding author. We thank Eric Bond, Arpita Chatterjee, James Lake, Taewhan Rhee and seminar/workshop participants at Korea Institute for International Economic Policy and Midwest International Economics Confor helpful comments.

[1]Email: s.cho@unsw.edu.au

[2]Email: choihs@kipf.re.kr; Tel.:+82 (44) 414-2126; fax: +82 (44) 414-2129.

[3]Email: jdiaz17@luc.edu

1. Introduction

Recent literature has studied the relative importance of extensive and intensive margins of trade in exports. While studies such as Bernard, Jensen, Redding and Schott (2009) find that export patterns over time are mostly driven by the intensive margin in the US, other studies such as Hummels and Klenow (2005) determine that at the exporter level the extensive margin accounts for more than 60% of the exports of larger economies. Other studies have narrowed the focus to analyze trade margins during periods of trade liberalizations with little consensus.

One particular type of trade liberalization that has gathered attention in the past few decades is free trade agreements (FTA), or more broadly, economic integration agreements. Early estimates studying the trade expansion effects of FTAs, however, found effects that ranged from both positively significant and insignificant, to even negatively significant effects. However, Baier and Bergstrand (2007) pointed out that most of such studies suffered from an endogeneity bias since they included FTA dummies as exogenous variables in their specifications, when it could well be the case that countries that trade heavily endogenously choose to engage into FTAs with their trade partners. This produced a downward bias in the estimations of the FTA trade volumes effects. After correcting for such bias, Baier and Bergstrand (2007) found that, on average, an FTA nearly doubles bilateral trade after 10 years. These results were later confirmed by other studies, such as Anderson and Yotov (2016).

On the other hand, the FTA effects on the margins of trade have been covered less intensively. Recently, Kehoe and Ruhl (2013) found significant expansions along the extensive margin of trade that coincides with trade liberalization episodes—including FTAs such as NAFTA and CUSFTA—using a decomposition methodology based on Hummels and Klenow (2005), a result also shared by Hillberry and McDaniel (2002). Some studies have used econometric analysis to uncover the effects of FTAs on the trade margins. For example, Baier, Bergstrand and Feng (2014) found statistically significant—and positive effects of various trade liberalization arrangements—including FTAs—on the extensive margin for a large sample of countries covering the 1962-–2000 period (although the effects on the extensive margin were smaller than on the intensive margin). Additionally, Foster (2012) found that, for a sample of 174 countries also covering the 1962-–2000 period, most of the increases in imports due to FTAs (59% to 83%, depending on the specification) was due to the extensive margin of trade. However, since 2000 FTAs have no longer been bound by geographical proximity with the majority of the new agreements having been signed among distant countries and regions. In fact, according to the World Trade Organization, as of March 2018 there are 305 active regional trade agreements, 233 of which were signed in 2000

or later. The economic impact of these new types of FTAs have yet to be analyzed in the literature.

In this paper, we explore the effect of FTAs on the growth of trade margins by analyzing recent FTA episodes and using highly-disaggregated product-level panel data spanning more than 20 years of pre- and post-FTA period. Our comprehensive econometric analysis allows us to empirically investigate and quantify the roles of intensive and extensive margins in the overall trade growth following trade liberalization. Our analysis thus offers a microscopic view of the dynamics of FTAs capturing not only the short term but also medium (and long) term effects.

It is worthwhile to note that these trade margins terminologies do not necessarily have the same meaning across the literature. In some cases, the extensive margin refers to the number of exporters (firms) for a given product (for example, as in Chaney, 2008), while in other cases it refers to the country-pair specific export relationship (as in Rose, 2004). For our paper, we analyze extensive margin at the country-pair specific product level by concentrating on goods that were non-traded prior to FTAs. This definition of "new goods" in international trade follows the methodology laid out in Kehoe and Ruhl (2013), who define the set of new (or "least-traded") goods as those initially accounting for the lowest 10% of trade volume. This implies that the set of new goods includes products initially traded in small volumes, but also includes goods with zero trade values. Once the set of least-traded goods has been constructed, we trace how its share out of total trade grew over time.

Our empirical focus is on Chile, and in particular, the free trade agreements it signed with Korea and the US in 2004. Unlike most FTAs signed in the past, these FTAs were no longer characterized by geographical proximity. This distinct feature allows us to analyze the exports of Korea and the US to Chile and compare with exports to Chile's border-sharing neighbors that did not sign FTAs. We use product-level trade data from the World Bank's World Integrated Trade Solution (WITS) database at 6-digit level of disaggregation over a time period staring from 1996 until 2015.

For our empirical analysis, we use differences-in-differences (DID) event-study methodology to quantify the causal effects of FTAs on the new goods margin. The use of DIDs to understand the effect of FTAs can be traced back to Trefler (2004) which empirically explored the short-run adjustment costs and long-run efficiency gains that emanate from CUSFTA. However, most studies used the rest of the world as a control group without testing the prerequisites of choosing control groups under DID methodology. This paper instead chooses countries sharing borders with Chile as control group.

Our empirical analysis yields the following results. First, we find that the effect of FTAs on the export growth was visible and large across both least-traded (or new) goods and non

least-traded goods. Over a ten year horizon upon FTAs, the exports of new goods accounted for around 49% and 56% of total export growth for Korea and the US, respectively, implying that the growth along the extensive margin was equally as important as the intensive margin.

Second, as for the dynamic effect of FTAs, we first find that both FTAs drive overall growth in export volumes that accumulates over time. However, there were statistically significant differences in the behavior of least-traded exports in the two countries we compare. For Korea, there is an immediate effect of FTAs, which is not observed in the case of the US where an observed change in the trade volumes occur only after five years post-FTA. Comparing the contributions of different trade margins, we observe changes in the trade growth along the intensive margin in the short run, which amplifies over time. On the other hand, trade growth along the extensive margin takes considerable time. This may indicate that it takes time for exporters to prepare for new export markets under a newly implemented FTA. As a result, our result show that in order for an FTA to cause an increase in the trade volume, it is not sufficient to export more of the existing exports, but rather it is also necessary to be accompanied by increases in the export of new products. This pattern is consistent with the empirical findings of Kehoe and Ruhl (2013) and also with 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.

We also carry out a number of checks to see if our results are immune to various robustness checks. Our main findings are robust to a falsification test which allows us to preserve the parallel trend assumption under the DID methodology. In addition, adding country-specific trends as well as other control variables related to the size of the market (such as GDP variables and population size) does not fundamentally alter our results. Finally, we find our results to remain robust under clustered standard errors.

Our article contributes to the understanding of the effects of trade liberalization on the extensive margin of trade, a topic characterized by contentious debate, and for which the literature does not provide a conclusive answer regarding the causality. By focusing on the FTAs signed by Chile in 2004, we use clearly defined policy experiments to quantify the effect of FTAs along the extensive margin. Our study directly complements Kehoe and Ruhl (2013) by estimating the relationship between trade liberalization and trade margins by way of a causal inference based on a DID methodology that controls for pre-treatment trends. Our empirical strategy thus allows us to find a more consistent and unbiased estimator to quantify the effect of trade liberalizations on the extensive margin. Second, our analysis extends the time horizon to sufficiently capture both short- and long-run dynamics. As our analysis spans up to ten years post FTA, our analysis documents and distinguishes both short and long run

implications which complements other works such as Bernard, Jensen, Redding and Schott (2009) that had considered five-year time intervals. Furthermore, instead of showing the average treatment effects during the time horizon, our analysis tracks the dynamic effects on a year-by-year basis which enable us to differentiate any cross-country variations. Finally, our paper extends the findings of Baier, Bergstrand and Feng (2014) by considering more recent FTAs. Unlike FTAs signed until 2000, which is the focus of Baier, Bergstrand and Feng (2014), recent FTAs were no longer restricted by geographical closeness, which enables us to more precisely estimate the causality of FTA's effect using the DID methodology.

The rest of the paper is organized as follows. Section 2 details the data set we work with and Section 3 describes the methodology we employ in our analysis. Section 4 presents the main results and Section 5 conducts further robustness checks. We conclude in Section 6.

2. Data

2.1. Treatment and Control Groups

Our empirical focus is on Chile, one of South America's most economically stable and prosperous nations and also a member of the Organization for Economic Co-operation and Development (OECD) since 2010. Since 1980s, successive Chilean governments have actively pursued trade-liberalizing agreements. After concluding free trade agreements with most countries in Central and South America in the 1990s, Chile pursued more FTAs with larger and advanced economies in 2000s. As a result, Chile signed landmark free trade agreements with the European Union which came into force in 2003, followed by ones with the US and Korea in 2004. This study focuses on the case of the latter two FTAs and analyze exports of Korea and the US to Chile.[4] To quantify the effects of the respective FTAs signed in 2004, we consider pre- and post-FTA periods spanning from 1996 to 2015. As suggested by Baier and Bergstrand (2007), having more than ten years of post-FTA period enables us to capture both the short and long run effects of the FTA.

Our analysis employs highly disaggregated product-level trade data from the World Bank's World Integrated Trade Solution (WITS) database. We work with a 6-digit level of disaggregation—the finest one available from WITS—according to the 1996 Harmonized System (HS) product classification. As our regression specification in equation (2) controls for sector-wide shocks, we also assign each product to 4-digit level industries according to

[4]We do not consider Chile's exports to Korea and the US because we do not have a comparable group of "neighbor" countries where the FTAs did not come into effect. In fact, Chile's FTA with Korea was immediately followed by FTAs with China and Japan in 2006 and 2007, respectively. In addition, Chile had already signed FTAs with the neighboring countries of the US prior to 2004, namely, with Canada in 1997 and with Mexico in 1999.

the International Standard Industrial Classification (ISIC) Revision 3. In the end, our study covers 5020 products.

In addition to Chile, we also construct a group of "control" countries for comparison purposes. As mentioned in Section 3, this group is made up of countries that share borders with Chile—Argentina, Bolivia and Peru— that did not sign FTAs in 2004. Since Peru also signed FTAs with Korea and the US in 2011 and 2009, respectively, we take this into account later in the empirical analysis. The export shares of all four countries under consideration are shown in Table **??**. The table shows that for both Korea and the US, exports to Chile and Peru have increased significantly between the pre- and post-FTA periods in comparison to exports to Bolivia and Argentina.[5]

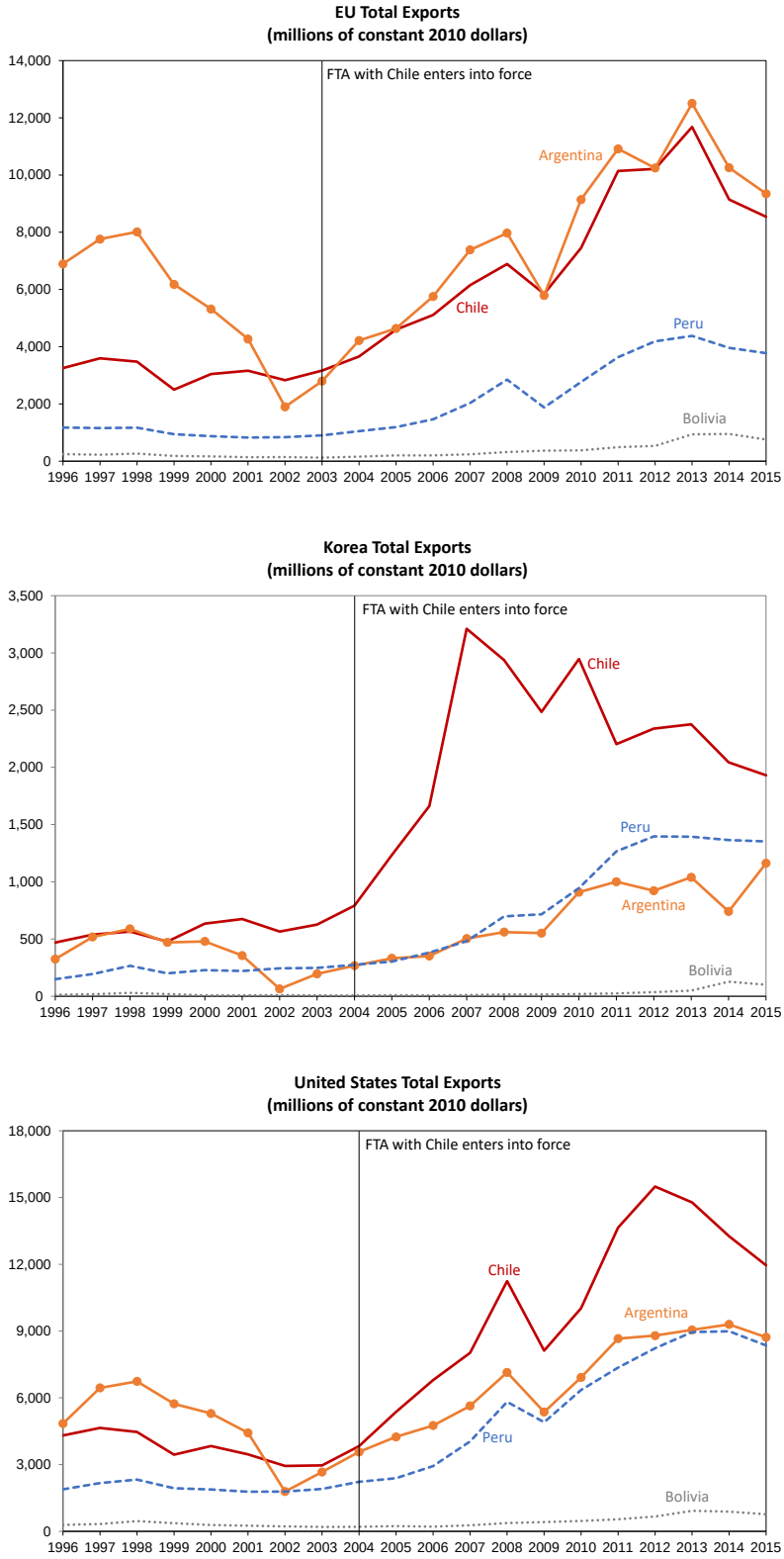
Figure 1 shows that, up to 2004, the shares of Chile and its neighbors in exports of Korea and the US was on a declining trend. However, after 2004, the trend reverted for exports to Chile, in particular, whose share in total exports of Korea and US continuously increased to peak at 0.8% (in 2007) and 1.2% (in 2012), respectively. On the other hand, the increasing trend for the other countries post-2004 is much less visible. Export growth to Peru in the post-FTA period comes at a time where export growth to other countries are decreasing or staying constant.

2.2. Defining New Goods

In order to construct a measure of the extensive margin in international trade, we follow the methodology proposed 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% of trade is accumulated. To ensure that exactly 10% 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% 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-

[5]For our analysis, we use the exporter-reported data instead of importer-related data. This is due to the availability of HS 1996 classification export data from Korea and the US for the whole sample period. The import data from the four Latin American countries are not consistently available for the whole period. For example, Peru's import data under the HS 1996 classification only starts from 1998.

Figure 1: **Total Exports (1996–2015)**



traded" (LT) goods, or "new" goods.[6] Once all goods have been assigned to the ten brackets, we trace the evolution of their export shares over time including the least-traded exports to the four countries under consideration.

Figure **??** breaks down export volumes of LT products to Chile and its neighbors according to the KR methodology. Note that the vertical dotted lines denote the years in which FTAs came into force—2004 for FTAs with Chile, 2009 for US-Peru FTA and 2011 for Korea-Peru FTA. While the export patterns of LT goods prior to 2004 are similar across all countries, we find an explosive growth in LT exports to Chile after the FTA milestones entered into force for both Korea and the US. Graphically, we also find a visible growth in LT exports to Peru after the respective FTA came into force for Korea when LT export growth to other countries remained sluggish. For post-FTA US exports of LT goods to Peru, however, we don't observe visible growth patterns when compared to other countries.

Finding 1: While least-traded goods account for around 90 percent of all products, most of their export growth was driven by a very small group of much less than 1 percent of all LT goods.

As shown in Table 1, least-traded goods account for more than 98 percent of all products in Korea and 84 percent in the US.[7] Despite the large number of products being classified as least-traded, most of their export growth is actually driven by a very small portion of products. In fact, when we restrict our attention to those that accounted for the top 50 percent of all least-traded goods export in 2015—which we call "top least-traded" goods (or TLT goods)— they comprise much less than one percent of all least-traded goods. For Korea, this ranged between 0.2 to 0.5 percent of all LT goods. For the US, a single product accounted for more than 50 percent of all LT exports bound for Argentina, Chile and Peru.

[6]The KR methodology is not the only approach to analyze the patterns of the extensive margin. Our decision to follow the KR methodology over other competing techniques is due to 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, trade with small nations—an arbitrary value of $50,000 can have significant implications and can lead to very few goods being treated as actually traded. Since our article deals with trade with many countries—large and small—the country-pair specific nature of the KR methodology seems to be 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.

[7]This feature is also consistent with findings of Krugman (1981) where larger countries will produce and export a wider variety of products.

Figure 2: **Least-Traded Exports (1996–2015)**

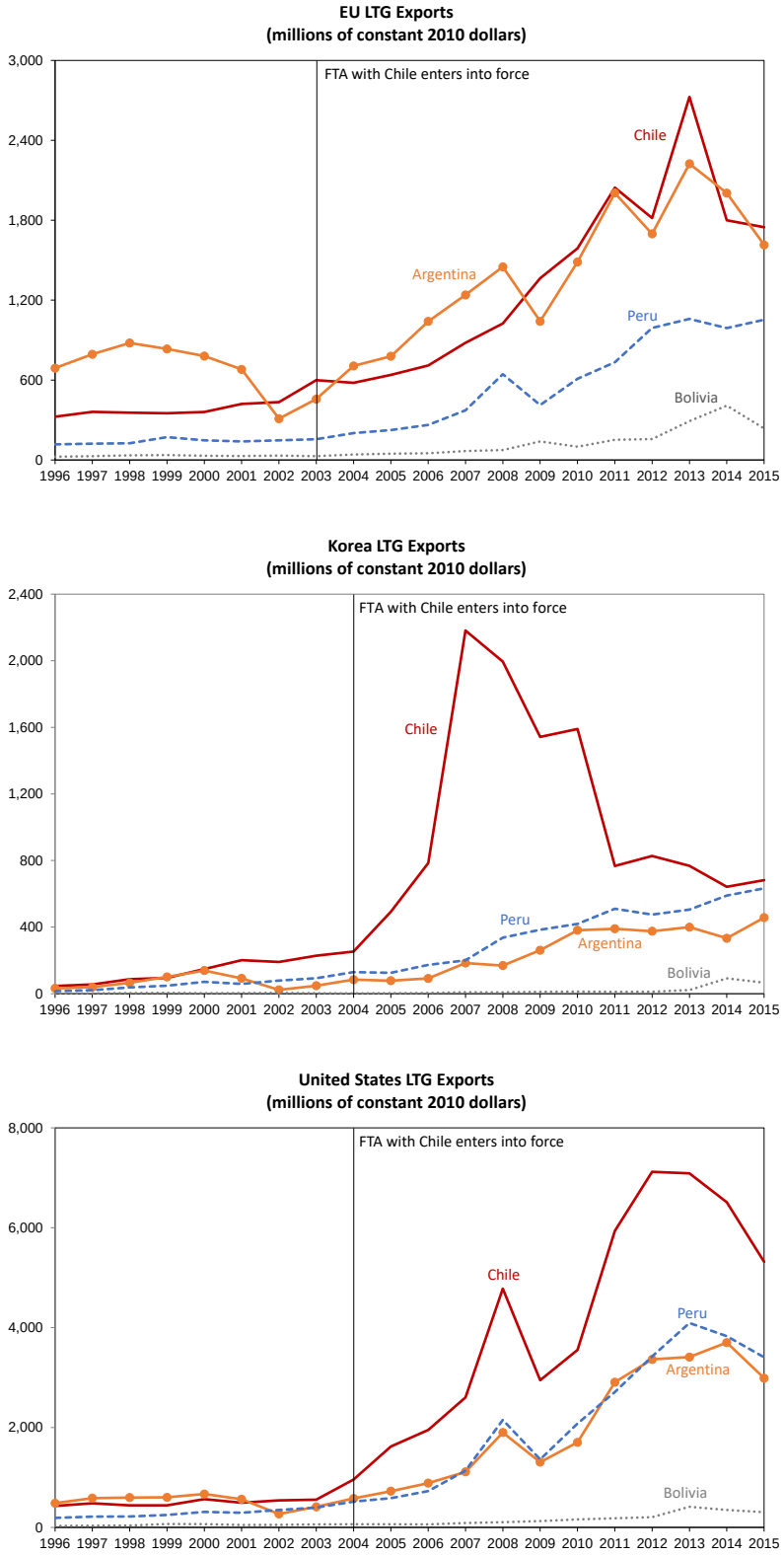


Table 1: **Least-Traded Exports and Top Least-Traded Exports**

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

Notes: The table reports the number/fraction of least-traded goods and top least-traded goods for each bilateral country-pair. By construction, some goods are included only in fractions.

3. Methodology

In this section, we lay out our econometric strategy to analyze the effect of FTAs on the growth of different types of goods—least-traded (LT) or non-least-traded.

A naive regression to estimate the effect of FTAs on new good margins would be as follows:

$$Y_{ict} = \beta_0 + b_1 FTA_{ct} + b'\mathbf{X} + e_{ict} \quad (1)$$

where Y_{ict} is the exports[8] of product i in year t to country c, FTA_{ct} is an indicator dummy for FTA status for country c in year t, $\mathbf{X}$ captures all factors related to determinants of FTAs, and e_{ict} is the error term.

Attempting to empirically estimate the effect of free trade agreement on the extensive margin's growth with equation (1), however, inevitably raises several concerns about the validity of econometric strategies. The main concern is that simple comparisons of the new goods margins for FTA countries and non-FTA countries do not usually offer a right answer to a causal relationship between FTAs and observed increases in the new goods margins due to endogeneity problems. Even after controlling for several determinants of FTAs such as

[8]Since we run separate regressions for Korea and the US, Y_{ict} refers to exports of either Korea or the US.

distance, economic sizes, and so forth, there is still a threat to validity of empirical strategies (see Baier and Bergstrand, 2004). Such endogeneity issues could result in either over- or under-estimating the effect of FTAs on the trade margins.

While the most ideal environment for addressing these concerns is to randomize FTAs among countries, this strategy is clearly not feasible. Therefore, we employ a differences-in-differences (DID) approach pioneered by Card and Krueger (1994). Since FTAs usually begin to take effect on a certain period between the FTA country-pairs, trade volumes before FTAs serve as a key variable to capture the unobserved confounders whose effects are time-invariant. This DID framework helps us to capture an unbiased estimate of the effects of FTAs.

When adopting a DID approach, one novel aspect of our econometric strategy is to select neighboring countries that were not treated by the FTAs as control groups. For Chile, these neighboring countries are Argentina, Bolivia, and Peru. Previous studies (such as Trefler, 2004 and Kehoe and Ruhl, 2013) quantify the effect of trade liberalization by comparing countries signing FTA to the rest of the world. However, there is little justification as for why the rest of the world is a good candidate as a control group to uncover the causal relationship between FTAs and the trade margins.

Our rationale for the specific choice of control group is as follows: As the gravity model demonstrates, the size of bilateral trade flows between any two countries A and B is inversely proportional to the geographical distance between them. This suggests that one of the crucial determinants of trade volumes is the closeness among countries. Suppose that country A shares borders with country B and that Korea (or the US) signs an FTA with country A but not with country B. After the FTA comes into effect, if we observe a surge in the trade volumes between Korea and country A in contrast to those between Korea and country B, then the observed differences in trade volumes would be attributed to the FTA. This strategy allows us to separate the changes in the trade flows due to structural factors like FTAs from other factors not related to FTAs. Another advantage of our selection strategy is that geographical proximity can be translated into similarity in trade costs, infrastructures, and institutional factors that may influence trade flows among countries. This enables us to control for unobserved and time-invariant regional features, which alleviates concerns for an omitted variable bias.

We employ a generalized DID methodology (a two-way fixed effect model) to quantify the effect of FTAs on trade margins. The full-fledged model specification we adopt is as follows:

$$Y_{ict} = \beta_0 + b_1 FTA_{ct} + T_t + m_c + \lambda_i^s + e_{ict} \quad (2)$$

where c refers to the destination country of exports from Korea (and the US) and t is the sample period that covers pre- and post-FTA periods. We specify equation (2) in levels, not in logs, as we want to keep all the zeros in our trade data. Dummy indicator $FTA_{ct} = 1$ if an FTA is in place with country c in year t, and 0 otherwise. T_t is a time dummy to control for any business cycle fluctuations and m_c controls for country fixed effects. We use nominal data for trade flows. However, by including a set of year dummies, we control non-parametrically for time trends such as wage inflation and business cycles, implying that we actually deal with deflated data.

In equation (2), λ_i^s captures industry-specific shocks for product i in sector s. This industry-specific component is included as FTAs can be an outcome of strategical considerations that are sector-specific. For example, there may be rapid rises in productivity and efficiency in certain sectors due to technological innovation. As such, some countries that have advantages in these sectors may attempt to sign a bilateral trade agreement. These sectors would exhibit an upward trend in their exports even in the absence of FTAs. An observed increase in extensive margins may coincide with FTAs, which leads to an upward bias in estimating the effect of FTAs. To address this concern, we include sector-wide shocks (λ_i^s) in the main regression. Finally, m_c captures time-invariant characteristics of countries. This represents factors such as political systems and other legal or social institutions, also known to be one of the possible determinants of FTAs.

4. Results

In this section, we first provide the estimates to quantify the effect of FTAs on the trade margins. We show the average treatment effect of FTAs as well as time-varying (or persistence) effects to understand the dynamic economic effects of FTAs over time. We then follow up with detailed analysis of the least-traded goods and qualitative discussions on their patterns.

4.1. Empirical Analysis

4.1.1. Baseline Results

The DID regression estimates are shown in Table 2 for all products as well as those that are least-traded and non-least-traded. First of all, the estimated coefficients are all statistically significant and different from zero at 1% significance level, which implies that the effect of FTAs on the export growth was strongly visible across all types of goods. Compared to those in the control group, we find that that the FTAs with Korea and the US increased exports of least-traded goods by around \$126,000 and \$441,000, respectively (as shown in the second column). Based on the-back-of-the-envelope calculation, after ten years

of signing the FTAs, the extensive margins account for around 49% (for Korea FTA) and 56% (for the US FTA) of the total export volume growth.[9]

Table 2: **Treatment effect of FTAs on trade volumes**

	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
FTA (EU)	289.508***	89.658***	1103.072***
	(48.357)	(18.812)	(262.611)
R^2	0.049	0.025	0.092
Obs.	401600	338820	62780
FTA (Korea)	220.925***	126.483***	8416.820***
	(41.207)	(36.827)	(1391.195)
R^2	0.018	0.007	0.145
Obs.	401600	395580	6020
FTA (US)	724.003***	425.313***	2226.051***
	(117.701)	(130.859)	(254.781)
R^2	0.026	0.023	0.098
Obs.	401600	346980	54620
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes

Notes: The table reports DID treatment effect of the treated from entering a free trade agreement on the trade volumes (based on equation (2). FTA is an indicator dummy. FEs indicate fixed effects. The data consists of 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

Our finding that the new goods are responsible for nearly half of the increase in the overall trade volume is quantitatively similar to those of Kehoe and Ruhl (2013) who finds that on average after ten years, a 10 percent increase in total trade is accompanied by a 42.9 percent increase in the value of the least-traded goods. Kehoe and Ruhl (2013) also use a decomposition method based on Hummels and Klenow (2005) and report that around 85 percent of the US export growth to Chile between 1975 and 1985—a period during which Chile went through significant structural changes–was attributed to extensive margins. Despite this similarity in the magnitude of the contribution of extensive margins, our methodology provides a more credible causal inference based on a DID methodology for a particular event rather than a simple OLS estimate over a large sample of countries. Second, our methodol-

[9]Our calculation is based on the relative weights between LT and non-LT goods. We first find the average increase of export volume for all goods using the number of LT and non-LT products as relative weights. In Korea, this turns out to be \$125,523 $\times \frac{395,580}{401,600}$ + \$8,477,271 $\times \frac{6,020}{401,600}$ = \$123,641 + \$127,075 = \$250,716. Out of this, around 49.3% or \$123,641 is driven by the least-traded goods. For the US, the weighted average is calculated as \$441,126 $\times \frac{346,980}{401,600}$ + \$2,240,532 $\times \frac{54,620}{401,600}$ = \$381,130 + \$304,726 = \$685.856. Out of this, around 55.6% or \$381,130 is driven by the least-traded goods.

ogy controls for pre-treatment trends by considering neighboring countries that lacked free trade agreements which was not possible in earlier FTA studies (as most of those took place between neighboring countries).

Our findings are also comparable to those of Foster, Poeschl and Stehrer (2011) and Foster (2012), where 59% to 83% (depending on the specification) of increases in imports upon FTAs were due to the extensive margin of trade although their time spans only up to three years. Ours is also consistent with Hummels and Klenow (2005) that finds the contribution of extensive margins to be around 60% based on cross-country data and that the shares are higher for more advanced economies.

4.1.2. Time-Varying Effect of FTAs on Trade Margins

So far we implicitly assumed that the coefficient b in equation (2) is constant, suggesting that we seek for average treatment effects (ATEs) of FTAs during the sample period. However, the impact of FTAs on trade margins could accumulate or decline over time. To explore the dynamics of the margins, we add lags up to 5 years after FTAs being implemented as suggested by Autor (2003). More specifically, we add year dummy variables consisting of up to 4 years after the FTA treatment (set to be one in the relevant years) as well as a dummy that captures all the years 5 years after the FTA (set to be one in the fifth year or forward after the FTAs are signed). Our modified specification is shown below:

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

b_0 captures the immediate effect of FTAs, and b_q represents any additional effects after FTAs take effect. If $b_q > b_0 (> 0)$, this implies that the effect of FTAs on trade margins rises over time. If $b_0 > b_q (> 0)$, this implies that the initial impact of FTAs dissipates over time. In Table 3, we present the regression estimates with lags. For time horizons, we label the first two years from the year of the FTA as "short-run" and the next three years (until 4 years after the FTA) as "medium-run". The "long-run" corresponds to the estimates for 5 years and more. The first column shows the effects on all products, whereas columns two and three split the goods to least-traded and non least-treaded goods, respectively.

For Korea, for all products and for non least-traded products, the coefficients are all significantly different from zero for all time horizons. In particular, the cumulative effect of FTA intensifies for non least-traded goods. However, focusing our attention to the least-traded goods (in column 2), coefficients in the short-run are significantly different from zero (at the 5 percent significance level) but quantitatively not large. For the subsequent years

in the medium-run, the coefficients are not significantly different from zero, while in the long-run, the coefficients become significantly different from zero. For Korean least-traded exports, consequently, we find that our coefficients do not monotonically increase over time as the medium-run effects are muted. Taken together, we find that the initial trade growth upon FTAs is due to increases in existing exports gaining price competitiveness due to lower tariffs. After a few years, new products enter into new markets, which drives the overall trade growth in the longer horizon.

For the exports of the US, we find a better explanation to understand the relationship between total trade volumes and the relative contribution of the two trade margins. For overall products, the coefficients (as shown in column 1) are significantly different from zero in the short run but remains muted in the medium term. Only in the longer horizon do we see the effect of the FTA on the overall trade growth. This contrasts to the fact that the coefficients for the non-LT products (as shown in column 3) are significantly different from zero starting from the year of the FTA and that the effect grows monotonically over time. This implies that the trade growth along the intensive margin (reflected by the non-LT products) alone is not sufficient to drive the overall trade growth. Our conjecture is more validated when we observe the outcome on the least-traded coefficients. The estimated coefficients for the least-traded goods become significant only in the long run, confirming that the driving force of the effect of FTAs is the extensive margin. This result complements observations of Kehoe and Ruhl (2013) that the extensive margin growth is stronger in the medium or longer term rather than in the short term. Figure 3 depicts similar information as Table 3 with the vertical lines indicating the 95% confidence intervals.

Summarizing the dynamic effect of FTAs, we first find that both FTAs drive overall growth in export volumes. However, there were observed differences in the pattern of least-traded exports in the two countries we compare. For Korea, there is an immediate effect of FTAs on extensive margins, which is not observed in the case of the US where an observed change in the margins occur only after five years post-FTA. Comparing the contributions of different trade margins to increases in all traded goods, we observe changes in the trade growth along the intensive margin in the short run, which amplifies over time. On the other hand, trade growth along the extensive margin takes considerable time. This may indicate that it takes time for exporters to prepare for new export markets under a newly implemented FTA. As a result, our result show that in order for an FTA to cause marked increases in the trade volume, it is not sufficient to export more of the existing exports, but rather it is also necessary to be accompanied by increases in the export of new products. Our findings are consistent with Baier, Bergstrand and Feng (2014) which found the effects of FTAs on the extensive margin to follow sequentially after the effect on the intensive margin based on a

Table 3: **Time-varying effect of FTA - Korea (top), US (bottom)**

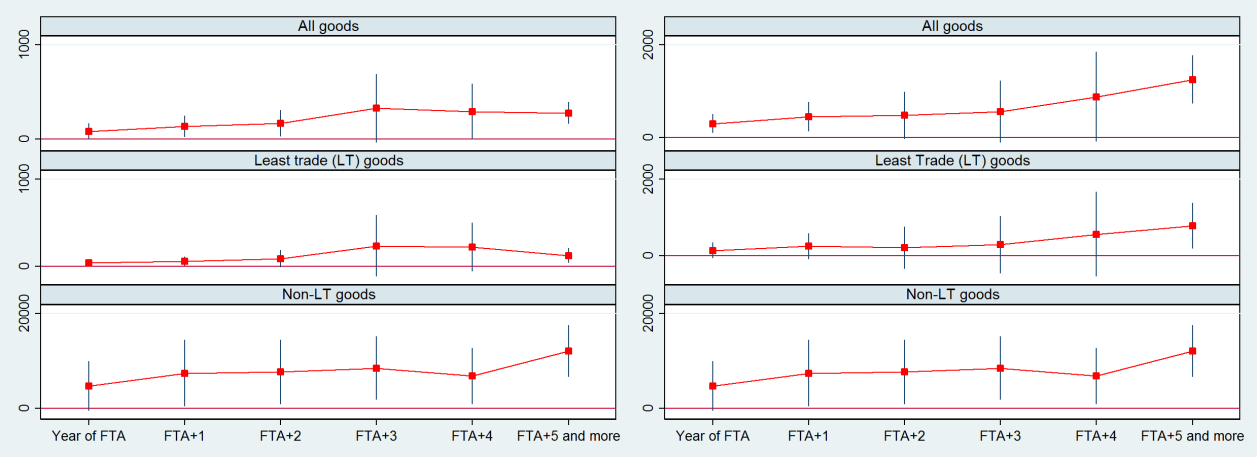
	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
Year of FTA	85.050**	37.761**	4690.834*
	(42.404)	(16.440)	(2678.819)
FTA +1	136.285**	55.595**	7425.658**
	(57.036)	(27.654)	(3588.149)
FTA +2	167.716**	85.753*	7658.970**
	(70.627)	(51.107)	(3468.945)
FTA +3	328.498*	233.039	8492.439**
	(184.562)	(180.359)	(3423.262)
FTA +4	294.472**	219.195	6809.575**
	(148.402)	(143.570)	(3028.129)
FTA +5 and more	276.891***	123.123***	12072.573***
	(58.747)	(42.175)	(2780.256)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
R^2	0.018	0.007	0.145
Obs.	401600	395580	6020

	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
Year of FTA	298.840***	133.540	1256.767***
	(105.586)	(106.183)	(347.021)
FTA +1	446.747***	243.175	1515.184***
	(164.600)	(173.165)	(464.475)
FTA +2	475.306*	206.239	1808.736***
	(262.020)	(281.960)	(661.867)
FTA +3	559.469	283.078	1855.153***
	(340.508)	(382.049)	(628.650)
FTA +4	879.803*	559.708	2347.316***
	(495.268)	(567.643)	(704.904)
FTA +5 and more	1252.441***	784.090***	3442.296***
	(264.716)	(303.790)	(393.266)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
R^2	0.025	0.023	0.099
Obs.	401600	346980	54620

Notes:The table reports DID estimates of the effects of FTAs on trade margins using the regression specification in equation (3). FTA is an indicator dummy. FTA+N indicates N years after the FTA are signed. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). (Non-) LT goods indicate the volume of exports of (non-)least-traded goods. FEs indicates fixed effects. The data consists of 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

large sample of countries covering the 1962–2000 period. These findings make sense because given the fact that LT goods account for a large fraction of total exports, extensive marings help boost total trade volumes. In other words, without significant changes in extensive margins from FTAs, we cannot expect FTAs to make differences.

Figure 3: **Time-Varying Effect of FTAs – Korea (left), US (right)**



Notes: FTA+N indicates N year(s) after the FTAs are signed. All goods indicate the total volume of exports of Korea (or US) to Chile. (Non-) LT goods indicate the volume of exports of (non-) least-traded goods. Each point represents coefficient estimates of lag term in column (1) and (2) of Table 3. The coefficient of before-FTA periods was normalized to zero. Vertical lines indicate the 95% confidence intervals of each point estimate.

Finding 2: Top least-traded export product of the US was petroleum (or refined oil) product, which becomes the top exported product for all the countries. The same product was also the top least-traded exports of Korea to Chile and Peru.

Next, we look at the least-traded product that had the highest export share in 2015. As shown in Table 4, the top US least-traded export was petroleum (or refined oil) product (HS code 271000) across all 4 countries. This least-traded product also became the product with the highest export volume for the US accounting for between 9.1 to 28.3 percent of US exports to these countries. In particular, the share of petroleum product exports to Chile and Peru are the highest, at 28.3 percent and 24.2 percent, respectively.[10] The same petroleum product

[10]In Chile and Peru, the US has a market share of nearly 90 percent of petroleum product imports of these countries by 2015. See `https://atlas.media.mit.edu/en/visualize/tree_map/hs92/import/chl/show/271000/2015/` and `https://atlas.media.mit.edu/en/visualize/tree_map/hs92/import/per/show/271000/2015/` for more information.

was also the highest exported product for Korea to Chile and Peru.[11] For Korea's exports to Argentina, the top exported least-traded product was optical devices and appliances (HS code 901380), while iron and steel structures was the top exported least-traded product to Bolivia (HS code 730890). All of these top least-traded product becomes one of the most intensively traded products by 2015, all ranked in the top 5 export product list.

Table 4: **Top Least-Traded Export Product**

		Export in 2015		
	HS code	Share (% of all LTG)	Share (% of all goods)	Ranking (of all goods)
Export (Korea)				
Argentina	901380	14.1	5.6	2
Bolivia	730890	13.9	9.2	2
Chile	271000	7.3	2.6	5
Peru	271000	6.3	2.9	4
Export (US)				
Argentina	271000	58.0	19.9	1
Bolivia	271000	22.9	9.1	1
Chile	271000	63.7	28.3	1
Peru	271000	59.3	24.2	1

Notes: The table describes the least-traded product that shows the highest export volume in 2015. Columns 2 to 4 reports its export share out of all LT goods as well as the share and ranking out of all goods.

Finding 3: The US exports of petroleum product (HS 271000) show visible growth that coincides with the timing of FTAs.

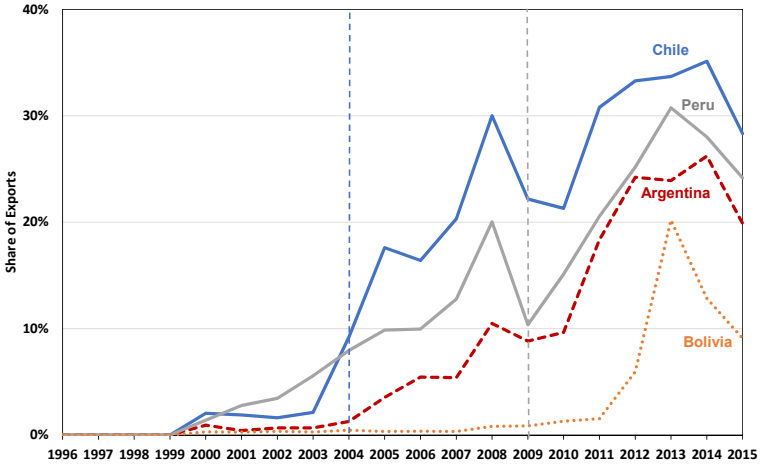
While the petroleum product went on to become not only the top least-traded but also the top exported product of the US to all the four countries in 2015, we see different growth pattern over time. To illustrate this, Figure 4 shows the exports of petroleum product as a share of total exports to each country over time. We see a drastic increase in the exports to Chile—but not in other countries—around 2004. In addition, exports of petroleum product to Peru after 2009 show a sharp upturn which is different from the other countries .

Finding 4: Korea's top LT export product to Chile shows explosive growth post FTA in 2004.

In Figure 5, we show a similar picture for Korea and trace its exports of the top LT product to each country as shown in Table 4. For Chile, we find that the exports of petroleum product shows an explosive growth from 2004 and peaks in 2007 with around 58 percent of Korea's exports to Chile. On the other hand, exports of petroleum products to Peru to does not show visible increase immediately after the FTA with Peru in 2011 and not until 2015.

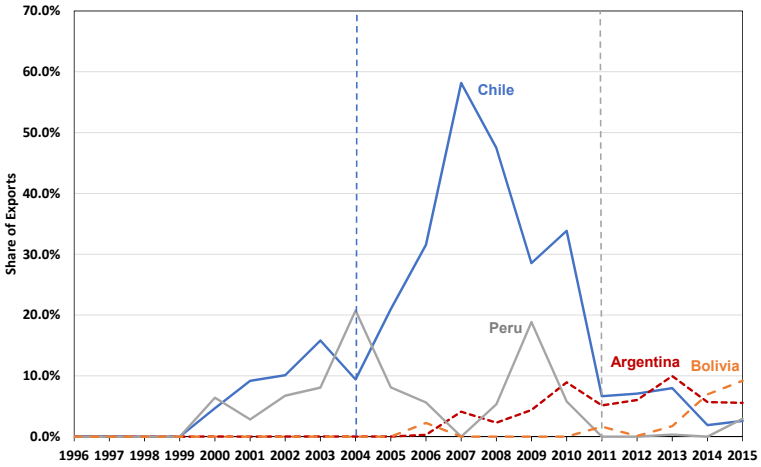
[11] In Chile, the market share of Korean petroleum product reaches its peak in 2007 at around 36 percent, but falls in the subsequent years, which may reflect rising competition from the US. Refer to `https://atlas.media.mit.edu/en/visualize/tree_map/hs92/import/chl/show/271000/2007/` for more information.

Figure 4: **US Exports of Top LT Products**



Notes: Figure shows export volume of the top LT product (as shown in Table 4) as a share of total exports to each country. Vertical dotted lines indicate the FTA years with Chile and Peru in 2004 and 2009, respectively.

Figure 5: **Korea's Exports of Top LT Products**



Notes: Figure shows export volume of the top LT product (as shown in Table 4) as a share of total exports to each country. Vertical dotted lines indicate the FTA years with Chile and Peru in 2004 and 2011, respectively.

Summarizing our qualitative analysis, we find that the growth in the least-traded exports were led by a small number of products, and the top least-traded exports show marked growth around the time of FTAs being implemented.

5. Robustness Checks

5.1. Placebo (falsification) Test

The key identifying assumption of DID is a common trend assumption, implying that trade trends would have been the same in both Chile and its neighboring states in the absence of FTAs. One way to check the validity of this assumption is to look at how the trade volume evolved in the four countries prior to 2004, the year of FTA being implemented (For Peru, the year of FTA implementation is 2011 for Korea and 2009 for the US.) We can first check graphically by comparing the exports of least-traded goods prior to the signing of FTAs. As shown in Figure **??** in Section **??**, before the FTAs were signed, the least-traded goods exports appeared to move in parallel trend, but after FTAs were signed, the least-traded goods exports to Chile appeared to increase by much more. These figures are convincing graphical evidence that the border-sharing countries should be a good control group for Chile.

While a graphical analysis provides a first-hand validation on the common trend assumption, our more generalized DID settings call for a more careful verification as our dataset has multiple time periods and multiple points at which treatment starts. An alternative way to deal with this issue is to include leads in the baseline regression above, which is called a placebo (or falsification) test (Autor, 2003).

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

The basic idea behind the test is that if a variable of interest, say $FTA_{c,t}$, does cause outcome variables, say Y_{ict}, future value of $FTA_{c,t}$ should not have any effect on Y_{ict}. We do a falsification test by simply adding leads of the treatment to a baseline regression as specified in equation 4. This type of a falsification test allows us to check whether there is no effect in years when FTAs did not take effect.

The estimated leads, running three years prior to FTAs are summarized in Table 5 and plotted in Figure 6. By looking at the estimated leads, we see if there are any possible surges of trade trends for countries that are about to become treated. Given the null effect of pre-treatment, we expect coefficients of the leads not to be significant from zero. We observe no effects for the three years before FTAs, suggesting that the parallel assumption is not violated and that policy intervention occurs before its effect.

5.2. Country-specific Trends

An alternative way to probe the robustness of the DID strategy is to include country-specific time trends to the regression. This allows each country to have distinctive trends.

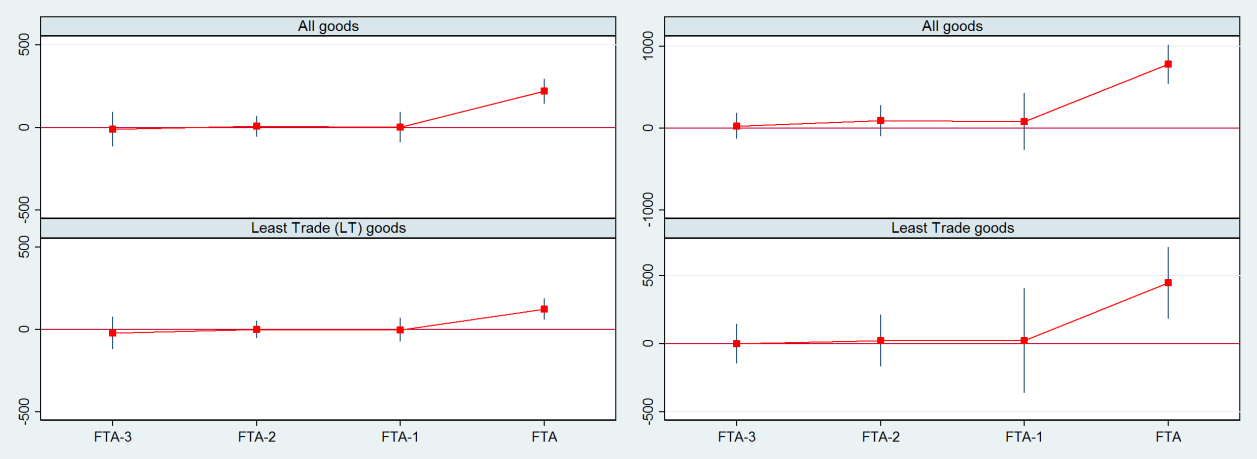
Table 5: **Placebo Tests – Korea (Top), US (Bottom)**

	(1) All goods	(2) Least-traded (LT) goods
FTA-3	-11.100	-20.970
	(53.383)	(50.293)
FTA-2	6.824	-0.844
	(32.150)	(27.094)
FTA-1	1.513	-2.883
	(46.643)	(36.673)
FTA	219.778***	122.441***
	(38.462)	(33.354)
Country FEs	Yes	Yes
Time FEs	Yes	Yes
Industry FEs	Yes	Yes
R^2	0.018	0.007
Obs.	401600	395580

	(1) All goods	(2) Least-traded (LT) goods
FTA-3	28.687	0.035
	(82.012)	(73.371)
FTA-2	92.023	23.613
	(97.214)	(97.113)
FTA-1	84.282	23.063
	(177.437)	(195.565)
FTA	781.535***	447.114***
	(120.866)	(134.293)
Country FEs	Yes	Yes
Time FEs	Yes	Yes
Industry FEs	Yes	Yes
R^2	0.025	0.023
Obs.	401600	346980

Notes: The table reports DID estimates of the effects of FTAs on trade margins using the regression specification in equation (4). FTA is an indicator dummy. FTA-N indicates N years before the FTAs are implemented. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). LT goods indicate the volume of exports of least-traded goods. FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

Figure 6: **Placebo Tests – Korea (Left) and US (Right)**



Notes: FTA-N indicates N year(s) before the FTAs are signed. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). LT goods indicate the volume of exports of least-traded goods. Each point represents coefficient estimates of lead terms in column (1) and (2) of Table 6. Vertical lines indicate the 95% confidence intervals of each point estimates.

As reported in Table 7, we find that the effect of FTA on trade margins (both overall and extensive) is robust to the inclusion of the trends in Korea. However, we find that for the US, the inclusion of the country-specific time trends nullifies the effect of FTAs as shown in the fourth column. This may be due to the fact that the US signed FTA with a country where its trade volumes (both total and least-traded goods) were already increasing, suggesting that FTAs are, to some extent, strategically decided. As Whalley (1998) and Baldwin and Jaimovich (2012) document, among others, there are a variety of motivations which induces countries to seek for regional trade agreements: from traditional trade gains to increased multilateral bargaining powers. Our findings suggest that the economic determinants of the US-Chile FTA correlate with other trends affecting the country's trade volume, and this makes it harder to disentangle the causal effect of the FTA from these underlying trends.

5.3. More Controls

In this section, we further test for the robustness of our results by adding more controls of country-specific nature. As documented by Eaton, Kortum and Kramarz (2011), extensive margins are more likely to increase with the size of a destination market. In addition, Baier and Bergstrand (2004) also finds that the likelihood of a FTA between a pairs of countries as two trading partners are more economically similar. Considering these findings, we include several related proxies for the size of a market such as the level of GDP (both nominal and

Table 6: **Controlling for Country-specific Trends (All goods) – Korea (top), US (bottom)**

	(1) All goods	(2) All goods	(3) All goods	(4) All goods	(5) All goods
FTA	220.123***	216.611***	219.692***	163.316**	220.123***
	(40.743)	(36.034)	(40.766)	(64.539)	(40.742)
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
R^2	0.018	0.018	0.018	0.018	0.018
Obs.	401600	401600	401600	401600	401600

	(1) All goods	(2) All goods	(3) All goods	(4) All goods	(5) All goods
FTA	755.055***	779.095***	752.907***	80.564	755.055***
	(121.938)	(114.139)	(121.808)	(195.312)	(120.753)
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
R^2	0.025	0.025	0.025	0.025	0.047
Obs.	401600	401600	401600	401600	401600

Notes: The table reports DID estimates of the effects of FTAs on trade margins using regressions allowing for country (or industry)-specific trends. FTA is an indicator dummy. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

Table 7: **Controlling for Country-specific Trends (LT goods) – Korea (top), US (bottom)**

	(1) Least-traded (LT) goods	(2) LT goods	(3) LT goods	(4) LT goods	(5) LT goods
FTA	125.523***	113.195***	125.407***	127.482**	125.520***
	(36.253)	(30.808)	(36.277)	(57.632)	(36.251)
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
R^2	0.007	0.007	0.007	0.007	0.007
Obs.	395580	395580	395580	395580	395580

	(1) Least-traded (LT) goods	(2) LT goods	(3) LT goods	(4) LT goods	(5) LT goods
FTA	441.126***	429.549***	439.783***	4.431	441.119***
	(136.483)	(127.881)	(136.308)	(219.475)	(136.469)
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
R^2	0.025	0.025	0.025	0.025	0.047
Obs.	346980	346980	346980	346980	346980

Notes: The table reports DID estimates of the effects of FTAs on trade margins using regressions allowing for country (or industry)-specific trends. FTA is an indicator dummy. LT goods indicate the volume of exports of least traded goods. FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

real levels as well as in per capita levels, all in natural logs), the growth rate of GDP as well as the population size (in logs) into the baseline regression for further robustness checks.

As Tables 8 and 9 show, main findings—free trade agreements increases overall exports as well as the exports of least-traded goods—are still robust to the inclusion of the country-specific controls. For Korea, all the estimated coefficients are still statistically different from zero for both all goods and least-traded goods at 1% significance level. For the US, on the other hand, FTA coefficients are still statistically significant at 1% level for all products. However, for the least-traded exports, some of the coefficients are only significant at higher significance levels. For example, with inclusion of population size of the export market, the FTA coefficients only remain statistically different from zero at 10% significance level. Quantitatively, the magnitude of the effect of free trade agreements weakens in the presence of market size (such as the GDP growth rate or population size) as the estimated coefficients in columns (4) and (5) are always less than the benchmark estimates for both types of goods and for both countries.

5.4. Clustered Standard Errors

When using a panel data, observations can be related 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, and there is a possibility that observations are correlated with each other at the level of year, country, and industry, which 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 different countries we consider (see Cameron and Miller, 2015). In order to correct for this bias, we re-run our regressions clustering on country, year and industry. This helps us to consider standard errors that can account for clustering of observations.

Table 10 replicates our benchmark results of average treatment effects using the multi-way clustered standard errors. Compared to the benchmark results, we find that the standard errors are larger in general but with different scale depending on the type of goods we consider. For the least-traded goods, the increase in the reported standard errors are negligible, and our estimated coefficients are still significantly different from zero at 5% significance level. However, for the non least-traded goods, the clustered standard errors are approximately 2.8 times larger (for both Korea and the US). For the case of Korea, the coefficients no longer remain significantly different from zero, while for the US, the estimated coefficient is still significantly different from zero at 5% significance level.

Next, Table 11 reports the time-varying effects of FTAs using the clustered standard

Table 8: **Robustness Check – All goods –Korea (top), US (bottom)**

	(1) All goods	(2) All goods	(3) All goods	(4) All goods	(5) All goods
FTA	220.309***	191.805***	232.314***	197.946***	216.756***
	(50.980)	(48.623)	(47.240)	(42.774)	(38.630)
GDP (Per capita)	-1.635				
	(131.230)				
GDP (PPP)		194.978			
		(145.554)			
GDP (2010)			-126.109		
			(118.744)		
Population				-1264.695***	
				(315.984)	
GDP (growth rate)					-2.115
					(2.165)
Country FEs	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes
R^2	0.018	0.018	0.018	0.018	0.018
Obs.	401600	401600	401600	401600	401600

	(1) All goods	(2) All goods	(3) All goods	(4) All goods	(5) All goods
FTA	651.025***	482.127***	821.641***	551.217***	748.663***
	(134.843)	(139.899)	(133.620)	(129.439)	(123.781)
GDP (per capita)	810.700				
	(613.667)				
GDP (PPP)		1766.990**			
		(817.782)			
GDP (2010)			-601.576		
			(651.192)		
Population				-11559.090***	
				(2280.657)	
GDP growth rate					-5.230
					(9.231)
Country FEs	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes
R^2	0.025	0.025	0.025	0.025	0.025
Obs.	401600	401600	401600	401600	401600

Notes:The table reports DID estimates of the effects of FTAs on trade margins using regressions with several controls such as GDP, population, and growth rate. FTA is an indicator dummy. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). LT goods indicate the volume of exports of least traded goods. FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

Table 9: **Robustness Check – Least-traded (LT) goods - Korea (top), US (bottom)**

	(1) Least-traded (LT) goods	(2) LT goods	(3) LT goods	(4) LT goods	(5) LT goods
FTA	139.205***	130.791***	140.783***	115.504***	120.455***
	(47.137)	(43.920)	(43.256)	(37.906)	(33.580)
GDP (Per capita)	-119.941				
	(107.230)				
GDP (PPP)		-36.369			
		(111.084)			
GDP (2010)			-158.330*		
			(88.608)		
Population				-566.256***	
				(145.350)	
GDP growth rate					-3.181*
					(1.866)
Country FEs	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes
R^2	0.007	0.007	0.007	0.007	0.007
Obs.	395580	395580	395580	395580	395580

	(1) Least-traded (LT) goods	(2) LT goods	(3) LT goods	(4) LT goods	(5) LT goods
FTA	471.623***	360.025**	567.936***	278.514*	427.504***
	(150.989)	(154.914)	(151.077)	(144.574)	(138.512)
GDP (Per capita)	-237.108				
	(678.631)				
GDP (PPP)		529.009			
		(923.720)			
GDP (2010)			-1157.708		
			(734.623)		
Population				-8521.784***	
				(2588.819)	
GDP growth rate					-11.112
					(10.254)
Country FEs	Yes	Yes	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes	Yes	Yes
R^2	0.023	0.023	0.023	0.023	0.023
Obs.	346980	346980	346980	346980	346980

Notes:The table reports DID estimates of the effects of FTAs on trade margins using regressions with several controls such as GDP, population, and growth rate. FTA is an indicator dummy. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). LT goods indicate the volume of exports of least traded goods. FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Robust standard errors in parentheses.

errors. Compared to the case with robust standard errors, we still find that for both Korea and the US, the effect of the FTAs on the extensive margins is significant and positive in the long-run, albeit under a weaker significance level at 5%. In addition, the non-monotonicity of Korean exports of least-traded goods are still robust. However, for the non least-traded goods, the estimated coefficients are no longer statistically significant across different time horizons for Korea.

In sum, in terms of the effect of FTA on the trade growth and extensive margin, we find that the significance level changes from 1% to 5% but our main results are still validated. For dynamics over time, we still find that the effect of FTAs manifests over longer horizons and that this outcome is mainly driven by the extensive margin, not the intensive margin.

Table 10: **Baseline Results Clustered Standard Errors – Korea (top), US (bottom)**

	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
FTA	220.123**	125.523**	8477.271
	(68.729)	(36.917)	(3918.297)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
R^2	0.018	0.007	0.144
Obs.	401600	395580	6020

	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
FTA	755.055*	441.126**	2240.532**
	(262.152)	(138.372)	(702.660)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
R^2	0.025	0.023	0.098
Obs.	401600	346980	54620

Notes: The table reports DID estimates of the effects of FTAs on trade margins using the regression specification in equation (2). FTA is an indicator dummy. All goods indicates the total volume of exports of Korea (or US) to Chile (or Peru). (Non-) LT goods indicates the volume of exports of (non-) least-traded goods. FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Clustered standard errors in parentheses.

Table 11: **Time-varying effect Clustered Standard Errors – Korea (top), US (bottom)**

	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
Year of FTA	85.050	37.761	4690.834
	(60.934)	(28.487)	(3745.999)
FTA +1	136.285	55.595***	7425.658
	(59.093)	(8.121)	(4570.211)
FTA +2	167.716*	85.753**	7658.970
	(57.015)	(18.484)	(4334.528)
FTA +3	328.498*	233.039*	8492.439
	(120.569)	(91.822)	(4614.679)
FTA +4	294.472	219.195	6809.575
	(125.781)	(99.826)	(3479.268)
FTA +5 and more	276.891**	123.123**	12072.573
	(66.363)	(30.552)	(5130.276)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
R^2	0.018	0.007	0.145
Obs.	401600	395580	6020

	(1) All goods	(2) Least-traded (LT) goods	(3) Non-LT goods
Year of FTA	298.840	133.540	1256.767
	(154.603)	(120.336)	(620.234)
FTA +1	446.747*	243.175*	1515.184**
	(148.097)	(93.170)	(457.115)
FTA +2	475.306*	206.239	1808.736**
	(187.163)	(121.415)	(543.785)
FTA +3	559.469	283.078	1855.153*
	(239.008)	(163.272)	(625.909)
FTA +4	879.803	559.708	2347.316*
	(426.127)	(393.120)	(739.432)
FTA +5 and more	1252.441**	784.090***	3442.296**
	(257.909)	(52.558)	(752.224)
Country FEs	Yes	Yes	Yes
Time FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
R^2	0.025	0.023	0.099
Obs.	401600	346980	54620

Notes:The table reports DID estimates of the effects of FTAs on trade margins using the regression specification in equation (3). FTA is an indicator dummy. FTA+N indicates N years after the FTA are signed. All goods indicate the total volume of exports of Korea (or US) to Chile (or Peru). (Non-) LT goods indicate the volume of exports of (non-)least-traded goods. FEs indicates fixed effects. The data consist of a 6-digit product-level data for the period 1996 to 2015. * $p < .1$, ** $p < .05$, *** $p < .01$. Clustered standard errors in parentheses.

6. Conclusion

This paper aims to present new estimates of the effect of FTAs on the new goods margins growth using two specific FTA episodes involving Chile in 2004. Using highly-disaggregated product-level data and DID regressions, we empirically investigate the role extensive margins play in overall trade growth following trade liberalization. By selecting three Chile's neighboring countries rather than the rest of world as control groups, we can offer a microscopic view of FTA dynamics and an unbiased estimate of FTA effects, thereby enhances our understandings of relationship between trade liberalization and growth in trade margins. More importantly, our data cover a relatively long time window- 10 year pre-and post-FTA period, thereby can capture not only short-term but also medium(or long)-term FTA effects.

Our DID estimates show that over the period between 2004 and 2015, the extensive margins account for 49% and 56% of export growth for Korea and the US, respectively. We also find that the effect of the FTAs on extensive (and trade) margins is on the rise over time and becomes significantly visible after five years which is supportive of findings of Kehoe and Ruhl (2013) that the extensive margin growth is stronger in the medium and long run rather than in the short term. Our main findings are robust to inclusions of various economic variables and error structures.

Overall findings presented in this paper suggest that trade liberalization via FTAs raises overall trade volume by increasing both margins of trade but new goods margins play a dominant role over a long period of time. Given that more FTAs with similar characteristics as the ones explored in this paper came into force in recent years, our methodology can potentially be expanded to incorporate them and analyze new trends in trade liberalization reforms. Finally, we do not present.... One possible explanation is that this observed differences is attributable to .... This has the potential to be a promising topic of future research.

To be elaborated...

References

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

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.

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 .

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.

Hillberry, R., McDaniel, C., 2002. A decomposition of North American trade growth since NAFTA. Working paper. U.S. ITC International Economic Review.

Hummels, D., Klenow, P.J., 2005. The variety and quality of a nation's exports. American Economic Review 95, 704–723.

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

Krugman, P.R., 1981. Intraindustry specialization and the gains from trade. Journal of Political Economy 89, 959–973.

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

Rose, A., 2004. Do we really know that the WTO increases trade? American Economic Review 94, 98–114.

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.