Graduate School of Asia-Pacific Studies, Waseda University
Journal of the Graduate School of Asia-Pacific Studies
No.35 (2018.3) pp.77-94

The Impacts of FTAs on Latin America's Agricultural Exports to East Asia: A Gravity Model Analysis

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中南米農産品の東アジアへの輸出における自由貿易協定の影響
―重力モデル分析―

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Abstract

This paper is focused on examining the Free Trade Agreements (FTAs) impacts on Chile, Mexico and Peru's agricultural exports to Japan, China, and Korea by applying a Gravity Model. The results indicate at an aggregate level that Latin America has mixed results from the trade agreements with East Asia, with three out of seven FTAs showing positive effects. At a sectoral level, the conclusion is that only seven out of 28 agricultural subsectors of the seven FTAs have had positive and statistically significant results. At product level, among the agricultural products that Chile, Mexico, and Peru export most to the world, there are diverse results. The agreements positively influenced only certain products. For Chile, fresh grapes, apples, wines and fish flour exports increased owing to the FTAs. Exports of wines mostly beneficiated from the FTAs with EA. For Mexico, the avocados exports show progress in its FTA with Japan. In the case of Peru, coffee exports demonstrate positive effects of the FTA with Korea. Fish oils have positive effects of the FTA with Japan, and fresh asparagus – of the FTA with Japan and Korea. Unexpectedly, some products reveal negative effects of the FTAs with EA. Several factors can explain the reasons: the difficulty to achieve the high standards required by the Sanitary and Phytosanitary Measures (SPS), Technical Barriers to Trade (TBT) for LA agricultural products to enter East Asian markets and the lack of effective export policies in Latin American countries. Additionally, not only tariffs but also non-tariff measures to trade (NTM) such as quotas and subsidies imposed by East Asian countries restrict LA agricultural exports to these countries.

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1. Introduction[1]

In Latin American countries, the agricultural sector is key in terms of employment, production, consumption and international trade. Trade relations between East Asia (EA)[2] and Latin America (LA)[3] have been interindustry where Latin America exports commodities, mainly mining and agricultural products to East Asia (EA), while EA exports products of manufacturing and services to Latin America (LA).

With the creation of the Pacific Alliance in 2011, Chile, Colombia, Mexico, and Peru, aimed to develop a deep regional integration going beyond stimulating the free trade of goods, services, investment, and to establish a platform that allows the promotion of LA into the Asia Pacific region. Agriculture is one of the most important export sectors for these countries, with the major destinations in EA being Japan, China, and Korea. Currently, Chile, and Peru have FTAs with Korea, China, and Japan; Mexico has an FTA with Japan, and Colombia recently enacted an FTA with Korea and is currently pursuing negotiations with Japan.

The objective of this paper is to examine the effects of seven FTAs on Latin America's agricultural exports to EA through a gravity model (GM) analysis. Previous studies have observed the effects of FTAs on trade in general, but the analysis on the agricultural sector and specifically between these two regions has been rather scarce. Furthermore, the paper focuses on the analysis of disaggregated agricultural export data, showing some agricultural subsectors and products that have been beneficiated from the tariff reduction under the FTAs, and others with no impact, thus contributing to the research of elements that can harm the agricultural trade between two regions with high potential to increase trade and consolidate relations.

The remainder of this paper is as follows: section two reviews previous studies that assessed the effects of FTAs on trade using GM econometric methodology. Section three explains Latin American agricultural exports to EA. Section four defines the methodology and results. Section five briefly describes several trade restrictions for the agricultural imports in EA. Section six presents the conclusions.

2. Literature Review

Gravity Models are common quantitative tools that have been proven to be very effective in explaining bilateral trade flows and the impacts of FTAs on trade in terms of certain fundamental variables. They are used to measure the effects of implemented FTAs, and help to improve policy-making (Piermartini & Teh, 2005). Furthermore, it has been shown that the GM may be derived from various trade models including the Heckscher-Ohlin model.

Recent studies have evaluated the trade effects of FTAs or Regional Trade Agreements (RTAs)

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[1] The author would like to thank Professor Shujiro URATA's supervision and Sebastian Gomez and Daniel Canizares for their comments on the econometric analysis.

[2] For this paper, EA only includes: China, Japan, and Korea.

[3] LA includes: Chile, Mexico, and Peru.

using GM. However, only some authors have focused their analysis on the impacts of FTAs on agricultural trade. As a broad example, (Kepaptsoglou, Karlaftis, & Tsamboulas, 2010) reviewed the recent empirical literature on GM from 1999 to 2009. They concluded that despite earlier criticism, the research community has made efforts both in improving the model's theoretical foundation while adopting novel econometric methods for estimating its parameters with more precision.

In a valuable study, (Urata & Okabe, 2013) analyzed trade creation and diversion effects of RTAs at the product level. They found RTAs impacts on trade flows differ by product and type of RTA. Trade creation was found for many products, while the trade diversion effect was presented for fewer products in customs unions (CUs) compared with FTAs.

Ando & Urata (2011) also studied the impacts of the Japan-Mexico Economic Partnership Agreement (EPA) on bilateral trade by using two different approaches; trade statistics and the EPA's utilization rate. They used tariff information at disaggregated level. the earlier study, Ando & Urata (2015) examined the impacts of specific FTAs such as Japan's FTAs with Malaysia, Thailand, and Indonesia on Japan's trade with them. Their results did not show significantly positive impacts at the aggregate/sectoral level however they did find positive impacts for specific products whose tariffs were reduced under FTAs.

More specifically on the agricultural sector, Sun & Reed (2010) looked at the effects of FTAs on agricultural trade creation and trade diversion. They estimated the model using a Poisson pseudo-maximum-likelihood (PPML) estimator. They found that the PPML estimation is preferred to Ordinary least squares (OLS) and that the estimated impacts of FTAs are different if zero trade observations are considered. They also found that the impacts are sensitive to the specification of the fixed effects and that those impacts vary over time.

In addition, Bureau & Jean (2013) tried to measure the effects of RTAs on trade in agricultural products, estimating a difference-in-differences panel, to quantify the benefits of 78 bilateral trade agreements. The found benefits on pre-existing trade flows and increase in the probability of exporting new products. They tried to solve the endogeneity issue, by excluding all the zero exports. This could create bias in the estimations, which could be solved using PPML+Fix Effects (FE).

Additionally, Fulponi & Engler (2012) analyzed the case of the impact of RTAs on Chilean fruit exports, in particular, the effects of preferential tariffs on Chile's fruit exports. They concluded that these agreements have had a positive impact on trade for Chile.

The current study differs from previous ones in the sense that it examines the impacts of FTAs on LA's agricultural exports to EA through a GM analysis by using, aggregate/sectoral level and disaggregated product level trade data explicitly considering the FTAs and the preferential tariff rates on the most exported agricultural products by LA to major agricultural partners in the world. Thus, this analysis would be useful for evaluating FTA policies in both LA and EA regions.

3. Chile, Mexico and Peru's Agricultural Exports to the world and EA

Chile's agricultural exports accounted for 25% of its total worldwide exports in 2015. These exports increased from US$ 6,175 million in 2003 to US$ 15,644 in 2015 (ITC TradeMap, 2016), while its main destinations were: The US, accounting for 25.2% of the total, Japan 9.4%, and China 9.2%. Korea was the ninth destination representing (3.3%) (table 1).

Chile's first FTA with an East Asian country was with Korea (enacted in April, 2004). It was also the pioneer to develop an agreement between EA and the Latin American region. Chile subsequently initiated negotiations with China and later with Japan. The agreements came into effect in October 2006 and in September 2007, respectively (SICE-OAS, 2016a).

It is important to underline, that Japan is the main destination for Chile's agricultural products to EA, exporting in average (2003-2015) US$ 1,429 million. The FTA Chile-Japan covers 1,007 agricultural products, however, 338 among them were excluded accounting for 34% of total negotiated products. Furthermore, 21 products have quotas to access the Japanese market. Japan also imposes some seasonal tariff for products such as fresh grapes. Among products excluded from Japan are: some bovine and pork meat, some fish, dairy products, some vegetables, wheat, rice, sugar cane, cocoa powder, some alcoholic beverages and tobacco (table 2) (SICE-OAS, 2016d).

The second destination for Chile's agricultural products in EA is China, exporting in average

Table 1. Chile's main agricultural export partners (2015) (US$ 000)

Chile Main Partners	Exported value in 2003	Share 2003	Exported value in 2015	Share 2015
US	2,031,397	32.69%	3,961,661	25.21%
Japan	842,147	13.55%	1,472,751	9.37%
China	178,692	2.88%	1,448,518	9.22%
Brazil	117,937	1.90%	913,257	5.81%
Netherlands	218,023	3.51%	619,487	3.94%
Russia	43,488	0.70%	581,093	3.70%
Mexico	286,503	4.61%	568,265	3.62%
UK	277,184	4.46%	560,965	3.57%
Korea	80,844	1.30%	515,274	3.28%
Peru	100,755	1.62%	399,499	2.54%
Colombia	90,128	1.45%	373,288	2.38%
Germany	195,220	3.14%	333,480	2.12%
Canada	90,259	1.45%	328,719	2.09%
Spain	222,309	3.58%	299,177	1.90%
Italy	118,600	1.91%	234,252	1.49%

Note: **Mexico's main agricultural exports partners are**: US, Japan, Canada, Guatemala, Venezuela, Spain, Australia, Netherlands, UK, Germany, Hong Kong, Algeria, Colombia, China and Chile. Korea was also included for the sake of the analysis.
Peru's main agricultural exports partners are: US, China, Netherlands, Spain, Germany, UK, Ecuador, Chile, Canada, France, Belgium, Korea, Colombia, Japan and Denmark. "Detailed information is available from the author on request".
List of the FTAs tariff schedules used in econometric estimations:
Chile-US (2004), Chile- Japan (2007), Chile-China(2006), Chile-Brazil (1996), Chile-Mexico (1999), Chile-Korea (2004), Chile-Peru (2009), Chile-Colombia (2009), Chile-Canada (1997), Chile-EU (2003) (Netherlands, UK, Germany, Spain and Italy).
Mexico-US (1994), Mexico-Japan (2005), Mexico-Canada (1994), Mexico-Guatemala (2013), Mexico-Colombia (1995), Mexico-Chile (1999), Mexico-EU (2000) (Netherlands, UK, Germany, Spain).
Peru-US (2009), Peru-China (2010), Peru-Ecuador (1997), Peru-Chile (2009), Peru-Canada (2009), Peru-Colombia (1997), Peru-Japan(2012), Peru-Korea (2011), Peru-EU (2011) (Netherlands, Spain, Germany, UK, France, Belgium and Denmark).
Data source: ITC Trade Map (2006).

Table 2. Chile, Mexico and Peru's agricultural exports by subsector to Japan, China and Korea. Products included and excluded from each FTA.

	Japan	China	Korea
Chile			
Agricultural exports US$ million (2003-2015)	US$ 1,429	U$ 663	US$ 309
Live animals (HS 01-05)	75%	19%	47%
Fruits and vegetables (HS 06-14)	8%	39%	29%
Animal and vegetables oils (HS 15)	1%	1%	1%
Products of food industry (HS 16-24)	16%	41%	23%
Products included in the FTA	1,007	1,151	1,670
Products excluded from the FTA	215	50	21
Products under category "R"	123	0	0
Products under category "DDA"	0	0	366
Products with quota	21	0	16
Mexico			
Agricultural exports US$ million (2003-2015)	US$ 552	US$ 57	US$ 48
Live animals (HS 01-05)	64%		
Fruits and vegetables (HS 06-14)	24%		
Animal and vegetables oils (HS 15)	1%		
Products of food industry (HS 16-24)	11%		
Products included in the FTA	931		
Products excluded from the FTA	383		
Products with quota	36		
Peru			
Agricultural exports US$ million (2003-2015)	US$ 197	US$ 827	US$ 80
Live animals (HS 01-05)	12%	3%	31%
Fruits and vegetables (HS 06-14)	17%	5%	39%
Animal and vegetables oils (HS 15)	5%	2%	2%
Products of food industry (HS 16-24)	66%	90%	28%
Products included in the FTA	1,057	1,178	1,796
Products excluded from the FTA	256	90	107
Products under category "R"	17		
Products with quota	19	0	0

Note: In FTA Chile-Japan and FTA Peru-Japan: Category "R" means that customs duties on originating goods classified under the tariff lines indicated with "R" shall be excluded from any tariff commitment and be subject to negotiation between the Parties in the fifth year from the date of entry into force of this Agreement.
In the FTA Chile-Korea: Category "DDA" means that tariff elimination schedule shall be negotiated after the end of the Doha Development Agenda negotiations of the WTO. Products under category "R" and "DDA" have not been negotatied.
Source: ITC Trade Map 2016, SICE-OAS (2016 b, c, d, e, f, g, h).

(2003-2015) US$ 663 million. Even though the Chilean agricultural exports to China are less than Japan, the Chinese market is rapidly increasing for Chile's agricultural products. In this FTA, 1,151 products were included and only 50 (4.3%) of them excluded. China does not impose either quotas or seasonal tariff to any LA country, and it also excluded products such as wheat, maize, palm oil, sugar and urea (SICE-OAS, 2016c).

Despite the fact that the FTA Chile-Korea is the oldest agreement for Chile, Korea is the third market for the Chile's agricultural products in EA, exporting only in average US$ 309 million. Among the 1,670 products included in the agreement, 387 of them were removed, representing 23%. Additionally, 16 products were subjected to quota to enter the Korean market, furthermore, the fresh grapes and orange have seasonal tariffs. Korea excluded some Chilean products such as rice, pears, apples, frozen peppers and some food preparations made with cocoa (SICE-OAS, 2016b).

Among the most exported by Chile agricultural products to the world (2003-2015) were fresh grapes, wines, apples and fish flour. Those were selected for the product level analysis. The fresh grapes are exported to the three EA markets and subjected to seasonal quota to enter the Japanese and Korean markets. Amongst the three countries, fresh grapes have the highest preferential margin (PM) from Korea (PM is defined as the difference between Most Favored Nation (MFN) tariff rate and the FTA tariff applied). Whereas, the wines are subjected to import quotas into the Japanese market and pay tariffs to enter China and Korea. As for apples, they are exported mainly to China, where their PM is slightly better than in Japan, whose market is difficult for them giving strong SPS restrictions. Finally, fish flour is an important product for three EA countries, being China its main destination and Korea the market with a better PM (table 3).

With regard to Mexico, its agricultural exports accounted for seven percent of total its worldwide exports in 2015. Lately Mexico's worldwide agricultural exports have increased from US$ 9,176 million in 2003 to US$ 26,470 million in 2015 (ITC TradeMap, 2016). By far, The US is the main destination for Mexico's agricultural exports representing 79% of the total, followed by Japan (3%) and Canada (2%). Among EA countries, Japan is the main destination, followed by China and Korea (table 1)

In the EA region, Mexico only has enacted an FTA with Japan, in April 2005. Mexico's agricultural exports to Japan were in average (2003-2015) US$ 552 million. Among the 931 products negotiated in the FTA, 383 (41%) Mexican agricultural products were excluded from the agreement and 36 were subjected to import quotas. Some important agricultural products such as: some bovine and pork, some fish, dairy products, some fruits and vegetables, maize, wheat, rice, soybeans, palm oil and coffee were excluded by Japan (SICE-OAS, 2016e) (table 2).

Among the most agricultural products exported by Mexico to the world are the malt beer, tomatoes, ethyl alcohol (tequila) and avocados. However, only the last two were included in the GM analysis because beer showed not PM and tomatoes did not show effects on the regression (see table 3). The avocados were the most exported product to Japan with PM. The ethyl alcohol (tequila) is exported to Japan and is subjected to import quotas and SPS restrictions (table 3).

Table 3. Selected products with FPM in the Chile, Mexico, and Peru FTAs with EA

Exporter	HS Code	Description	Exports average (2003-2015) to the world (000)	Product share of total agricultural exports to the world (2003-2015)	Export average (2003-2015) to EA (000)	Product share of total agricultural exports to EA (2003-2015)	FTA Preferential Margin (FPM) 2015		
							China 2015	Japan 2015	Korea 2015
Chile	080610	Fresh grapes	1,218,475	10.01%	121,685	5.49%	13.00	7.97	45.00
Chile	220421	Wine of fresh grapes	1,155,679	9.49%	121,358	5.48%	14.00	N. A	15.00
Chile	080810	Fresh apples	581,266	4.77%	9,122	0.41%	10.00	9.56	N. A
Chile	230120	Fish flour	460,543	3.78%	256,769	11.59%	3.50	0.00	5.00
Peru	230120	Fish flour	1,325,197	25.38%	808,719	73.28%	2.70	0.00	4.00
Peru	090111	Coffee (excluding roasted and decaffeinated)	651,069	12.47%	32,161	2.91%	N. A	0.00	2.00
Peru	150420	Fats and oils of fish and their fractions	280,944	5.38%	25,568	2.32%	9.00	7.00	0.60
Peru	070920	Fresh or chilled asparagus	265,847	5.09%	3,277	0.30%	13.00	3.00	27.00
Mexico	220890	Ethyl alcohol (Tequila)	789,967	4.47%	13,400	2.04%	0.00	N.A	0.00
Mexico	080440	Fresh or dried avocados	720,672	4.08%	69,608	10.58%	0.00	3.00	0.00

Note: this table is a summary of the 10 selected products with PM in each of the seven FTA in year 2015. The PM was analyzed for each product in the 15 major agricultural partners in the period (2003-2015). "Detailed information is available from the author on request".
Data source: Chile, Mexico, and Peru's tariff information in the main agricultural export partners was taken from each FTAs annex at SICE-OEA (2016a) and from WITS (2016).

Peru's agricultural exports represented 22.16% of its total exports worldwide. In 2003 total agricultural exports were US$ 1,850 million, and in 2015 they increased up to US$ 7,367 million in 2015. The main recipients of Peruvian agricultural exports were: The US 25%, China 15%, and Netherlands (9%). China was the first export destination in EA, followed by Korea and Japan (ITC Trade Map, 2016), (table 1).

Compared to Chile, Peru is a latecomer for FTA with EA. The first FTA enacted by Peru with any EA country was with China in March 2010. Later, the FTAs with Korea and Japan came into effect in August 2011 and March 2012 respectively (SICE-OAS, 2016a).

China is the main destination for Peru's agricultural products in EA, exporting in average (2003-2015) US$ 827 million. Among the 1,178 agricultural products included in the FTA Peru-China, 90 (7.6%) were excluded from the agreement. Those excluded products from this FTA were some fish, coffee, maize, wheat, vegetable oils, some salmon, sugar, and tobacco (table 2) (SICE-OAS, 2016f).

Japan is the second destination for Peru's agricultural products to EA, exporting in average (2003-2015) US$ 197 million. 1,057 products were included in the FTA, however, 273 (24%) products were excluded. Furthermore, 19 products are subjected to import quotas to enter the Japanese market. Among products excluded from Japan there are: some meat of bovine and pork, some fish and salmons, dairy products, rice, maize, wheat, sugar, cocoa powder, some fruit juices, extract of coffee, and tobacco (SICE-OAS, 2016h).

Korea is the third market for Peru's agricultural products in EA, exporting only (2003-2015) US$ 80 million in average. Among the 1,796 products included in the FTA Peru-Korea, 107 (6%) were dropped. Korea excluded products such as fish, onions, sweet peppers, garlic, apple, and rice (SICE-OAS, 2016g).

Fish flour, coffee, fish oils, and fresh asparagus are the most exported agricultural products by Peru worldwide. The fish flour is the most exported product by Peru to EA. It has a PM to access to the Chinese and Korean market. The coffee is excluded from the Chinese market, and does not pay any tariff to the Japanese market and has a PM from Korea. The fish oils have a PM in all three markets, having the major benefit from China. Finally, fresh asparagus have PM in three countries, obtaining the best benefit from Korea (table 3).

4. Gravity Model Estimation

4. 1 Methodology

This section quantitatively studies the impacts of seven FTAs between LA and EA. More explicitly, its intent is to examine whether LA countries' agricultural exports have expanded because of the FTAs signed with EA by applying a GM controlled by economic conditions such as distance and size of the economy, which are likely to influence bilateral trade.

Given the high explanatory power of the standard variables used in the GM, this model also includes additional ones such as population, agricultural land and preferential margins indicating that these variables are important for trade. The inclusion of the agricultural land variable is novel in the literature, and it is relevant since the analysis is focused on agriculture.

For this purpose, the GM is conducted at the aggregate, sectoral and product levels, with a specific focus on products mentioned in section 3. The sample data pool is derived from the 2003-2015 period, during which the seven FTAs were enacted. PPML + FE model is applied. PPML + FE manages databases better with many zeros in the dependent variable. This is the case for the sectoral and product level, where not all the products are exported to all countries.

The following equation is estimated for the aggregate, sectoral and product levels:

$$(1)\ \ln(Exports_{i,j,t}) = \beta_0 + \beta_1\, ln(Dist_{i,j}) + \beta_2 \ln(GDP_{j,t}) + \beta_3 \ln(P_{j,t}) + \beta_4 \ln(GDP_{i,t}) + \beta_5 \ln(P_{i,t}) + \beta_6\, ln(AgriL_{j,t}) + \beta_7\, FTADummy_{i,j,t} + \beta_8\, (FTADummy_{i,j,t} * FTADummy_{i,Japan}) + \beta_9\, (FTADummy_{i,j,t} * FTADummy_{i,Korea}) + \beta_{10}\, (FTADummy_{i,j,t} * FTADummy_{i,China}) + \varepsilon_t + c_j$$

Where $Exports_{i,j,t}$ is country i's agricultural exports to country j in year t, $Dist_{i,j}$ distance between countries i and country j, $GDP_{j,t}$ ($GDP_{i,t}$), real GDP of country j (i) in year t, $P_{j,t}$ ($P_{i,t}$) population of country j (i) in year t, $AgriL_{j,t}$ is the agricultural land available in countries j. $FTA_{i,j,t}$ is a generic FTA dummy between countries i and j in year t. $FTADummy_{i,j,t} * FTADummy_{i,Japan}$, $FTADummy_{i,j,t} * FTADummy_{i,Korea}$ and $FTADummy_{i,j,t} * FTADummy_{i,China}$ are interactions dummies for country i with Japan, Korea, and China in year t. Countries i represents Chile, Mexico and Peru, while country j represents the 15 major agricultural export partners of each LA country.

Note that FTA dummy variables are used for Chile, Mexico, and Peru, based on the date of the FTA have come into force, which is one if Chile, Mexico, and Peru have an FTA with country j and came effective before year t and 0 otherwise. At product level is 1, when tariff reduction is applied and 0 otherwise.

For a product level analysis, another equation (2) was estimated which replaces the $FTADummy_{i,j,t}$ by $FPM_{j.i,t}$. $FPM_{j.i,t}$ is FTA Preferential Margin (FPM) (FPM= MFN-FTA tariff applied by country j to country i in year t).

It additionally includes the following interaction variables:

$(FPM_{j.i,t} * FTADummy_{i,Japan})$, $(FPM_{j.i,t} * FTADummy_{i,China})$, $(FPM_{j.i,t} * FTADummy_{i,Korea})$, which isolates the effect of trade agreements between country i and China, Japan and Korea. This additional equation is conducted to examine the tariff reduction impact on Chile, Mexico and Peru.

4. 2 Data section

The Agricultural exports from LA to major export agricultural partners were taken from ITC TradeMap (2016) and INTRADE-IDB (2017).

Agricultural exports:

- Aggregated level comprises chapter 01-24 from the Harmonized System (HS)
- Sectorial level includes four groups: live animals (HS01-05), fruits and vegetables (HS06-14), animal and vegetables oils (HS15) and products of food industry (HS15-24)
- Product level comprises products at HS 6-digit level.

The tariff information from the major export partners to LA was taken from WITS (2016) at HS 10-digit level and it was converted at HS 6-digit level using simple average to compare tariff information with agricultural exports at the same disaggregation level.

For better reliability, tariff information was taken from each trade agreement of Chile, Mexico, and Peru from their FTAs annex at SICE-OAS (2016a) and also from WITS (2016), from the importers' side (See also list of FTAs in table 1).

Each FTA's annex contains information at different digit level at the HS. For negotiations with Japan at HS (6-digit level), with Korea HS (10) and for China at HS (8). Japan Customs Tariff contains tariff information for Japan at HS (9-digit level). The number of products in table 2 was carefully counted manually from each FTA annex.

The wholesale price index in the US was used as a proxy for the deflator to convert nominal export values into real terms. Data on the wholesale price index in the US, real GDP, agricultural land and population are accessible from the World Bank (2016), and distance measures were obtained from the Centre d'etudes prospective et d'informations internationals (CEPII, 2016).

4. 3 Criteria for identifying products with preferential margin

The most exported products from LA to the world were selected and analyzed with their major 15 agricultural export partners in two variables: the FTA dummy from the year of the product was enacted and, FPM for the period 2003-2015 since the first FTA was enacted in 2004.

1. When MFN = FTA tariff applied = 0, then FPM = 0 and FTA dummy = 1 in the year when the product came into effect, and 0 otherwise.
2. When MFN is 0, then FTA dummy = 0
3. When the product does not have a tariff reduction but has a quota, then FPM = N.A (missing observation) and FTA dummy = 1 in the year of enactment, and 0 otherwise.
4. When MFN is positive but the product is excluded from the negotiation, then FPM = N.A and FTA dummy = 0

4. 4 GM Results

Table 4 shows the results of the GM estimations at the aggregate level. According to PPML+ FE, Chile and Mexico's agricultural exports to countries with large economies (GDP coefficient positive) are significant. Peru's agricultural exports grow with the increase of the Peruvian GPD. Additionally, the increase of population in Mexico and Peru have a positive impact on Mexican agricultural exports and a negative impact on those of Peru. The results also reveal that the inclusion of the variable agricultural land is not significant to explain agricultural exports.

The GM outcomes indicate at an aggregate level that LA countries have mixed results from the trade agreements with EA on their agricultural exports. Generally speaking, LA FTAs with major agricultural partners demonstrate negative effects for Mexico and no significant effects for Chile and Peru. The results of specific dummies show that three out of seven FTAs have progress (FTA Chile-Korea, FTA Peru-Korea, and FTA Mexico-Japan). The FTA Peru-Japan and FTA Chile-China indicate negative results. FTA Chile-Japan and FTA Peru-China show non-statistically significant results (table 4).

At the sectoral level, results indicate that seven out of 28 agricultural subsectors, of the seven FTAs, have positive effects and five out of 28 have negative ones. For Chile, the agreement with Korea has been by far the most beneficial because PPML+FE suggests a positive impact on three subsectors (HS06-14), (HS15), and (HS16-24). For Mexico, two subsectors (HS01-05) and (HS16-24) have a positive impact of the FTA with Japan, which can be explained by the fact that Mexico is an important pork supplier to the Japanese market. Finally, FTA Peru-Korea shows positive impact for (HS15) and (HS16-24). Some negative results are reflected in the case of FTA Chile-Japan for (HS15) and FTA Chile-China for (HS01-05) and (HS16-24). The negative impact of the FTA Peru-Japan was spread across (HS15) and (HS16-24) subsectors. The outcomes of some subsectors are consistent with the aggregated level results (table 5).

At the product level, the results are also diverse for LA. The results related to FTAs and FPM are shown in table 6 and those of the other variables estimation are omitted. In the case of Chile, its four

Table 4. Gravity model estimation for Chile, Mexico and Peru's agricultural exports to Japan, China and Korea at aggregate level (2003−2015)

	Chile	**Mexico**	**Peru**
PPML + FE			
lnGDPi	0.00160	0.0107	0.142***
	(0.0271)	(0.0294)	(0.0372)
lnPopi	0.140	0.202***	−0.340**
	(0.139)	(0.0567)	(0.163)
lnGDPj	0.112***	0.0394***	0.0269
	(0.0251)	(0.0127)	(0.0359)
lnPopj	−0.100	0.113	0.171
	(0.161)	(0.0960)	(0.125)
lnagri_land	0.00670	−0.0476	−0.00162
	(0.0330)	(0.0398)	(0.0517)
FTADummy	−0.00425	−0.0271**	−0.00456
	(0.00721)	(0.0130)	(0.00338)
FTAJPN	−0.00497	0.0526***	−0.0312***
	(0.0126)	(0.0148)	(0.00854)
FTAKOR	0.0227***		0.0220***
	(0.00832)		(0.00615)
FTACHN	−0.0276**		−0.0193
	(0.0133)		(0.0182)
Observations	195	208	195
Number of id	15	16	15
OLS R−squared	0.739	0.710	0.678

Note: Year fixed effects included in all equations. Figures in parentheses are t-statistics/robust z-statistics. *$p<0.05$, **$p<0.01$, ***$p<0.001$. PPML + FE does not show the distance variable results because distance is constant in all years.
Data Source: authors estimation.

most exported products to the world, in general terms grow in presence of FTAs. Specifically, the FTA Chile-Japan has positive and significant effects on the exports of wines (0.544+0.183 = 0.727) and the fish flour (0.345+0.478 = 0.823). The grapes demonstrate negative effects and the apples have non-statistically significant effects. The FTA Chile-Korea show a positive effect for the exports of grapes (1.24) and wines (1.43). Fish flour shows net negative effects from the FTA Chile-Korea. Finally, The FTA Chile-China beneficiates the exports of wines (1.615), apples (0.729) and grapes (0.019) and has a negative effect for the fish flour (table 6).

The results of Chile from equation (2) show that commonly the increase of an FPM of the major agricultural partners positively impact the export of grapes and wines, whilst have a negative effect on exports of apples and fish flour. More specifically, in the case of the FTA Chile-Japan, the results reflect that the growth of the FPM given by Japan to Chile positively impact the exports of grapes (0.047) and apples (0.040). Additionally, FPM results show that with the increase of one unit of the FPM given by Korea from its imports from Chile, increase the Chilean exports of grapes (0.037),

Table 5. Gravity model estimation for Chile, Mexico and Peru's agricultural exports to Japan, China, Korea at sectoral level (2003-2015)

	Chile				Mexico				Peru			
	HS01-05	**HS06-014**	**HS15**	**HS16-24**	**HS01-05**	**HS06-014**	**HS15**	**HS16-24**	**HS01-05**	**HS06-014**	**HS15**	**HS16-24**
PPML + FE												
lnGDPi	0.0238	−0.0772***	0.802***	0.0347	−0.130	−0.0272	−0.421	−0.0419	0.0238	0.139**	0.262	0.149***
	(0.0648)	(0.0278)	(0.227)	(0.0452)	(0.200)	(0.0858)	(0.359)	(0.0905)	(0.103)	(0.0637)	(0.183)	(0.0431)
lnPopi	0.0770	0.431***	−1.352*	−0.0276	0.411	0.243	1.568**	0.218*	0.360	−0.308	−0.515	−0.496**
	(0.290)	(0.132)	(0.728)	(0.162)	(0.322)	(0.164)	(0.611)	(0.130)	(0.440)	(0.304)	(0.811)	(0.233)
lnGDPj	0.180***	0.179***	−0.251***	0.0532	0.0284	0.0538**	0.183	0.103**	−0.0397	0.229***	0.0126	0.0408
	(0.0547)	(0.0242)	(0.0692)	(0.0332)	(0.0509)	(0.0237)	(0.203)	(0.0417)	(0.0473)	(0.0487)	(0.0979)	(0.0497)
lnPopj	−0.287	−0.184	0.578**	0.0611	0.632**	0.152	−0.0313	0.0448	0.316*	−0.132	0.263	0.191
	(0.306)	(0.143)	(0.256)	(0.133)	(0.277)	(0.254)	(0.795)	(0.118)	(0.165)	(0.167)	(0.269)	(0.196)
lnagri_land	−0.00901	−0.0441	−0.0499	0.0104	0.0572	−0.0818	0.180	−0.00568	0.0447	−0.145	−0.258*	−0.0481
	(0.0733)	(0.0315)	(0.123)	(0.0271)	(0.0947)	(0.0899)	(0.238)	(0.0217)	(0.0718)	(0.115)	(0.154)	(0.0576)
FTADummy	0.000838	−0.0272***	0.0215	0.00856	−0.0864***	−0.0305	−0.0606	−0.0126	−0.00331	−0.00630	−0.0118	−0.00716
	(0.0147)	(0.00959)	(0.0305)	(0.00807)	(0.0320)	(0.0238)	(0.0562)	(0.0106)	(0.0132)	(0.00687)	(0.0161)	(0.00602)
FTAJPN	−0.0146	0.0125	−0.0806**	−0.00942	0.137***	0.0386	0.0688	0.0272**	−0.0228	−0.000513	−0.0474**	−0.0395***
	(0.0235)	(0.0120)	(0.0363)	(0.0129)	(0.0376)	(0.0265)	(0.0805)	(0.0138)	(0.0184)	(0.0107)	(0.0187)	(0.0122)
FTACHN	−0.0749**	0.0155	0.0505	−0.0252*					0.0129	0.00364	0.0278	−0.0213
	(0.0311)	(0.0119)	(0.0411)	(0.0138)					(0.0182)	(0.0260)	(0.0512)	(0.0247)
FTAKOR	−0.00655	0.0565***	0.300***	0.0284***					−0.00109	0.00113	0.0452**	0.0393***
	(0.0182)	(0.00658)	(0.0314)	(0.00701)					(0.00993)	(0.00849)	(0.0214)	(0.00945)
Observations	195	195	194	195	189	208	186	205	195	195	192	195
Number of id	15	15	15	15	15	16	15	16	15	15	15	15
OLS R−squared	0.708	0.694	0.535	0.550	0.648	0.501	0.483	0.889	0.484	0.760	0.232	0.724

Note: Year fixed effects included in all equations. Figures in párentheses are t-statistics/robust z-statistics. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.
PPML + FE does not show the distance variable results because distance is constant in all years.
"Detailed information is available from the author on request"
Data Source: authors estimation.

Table 6. Summary of GM estimation at product level results for Chile, Mexico and Peru's agricultural exports to Japan, China and Korea (2003-2015)

PPML + FE	Variables		Chile				Mexico		Peru			
			HS080610	HS080810	HS220421	HS230120	HS220890	HS080440	HS090111	HS150420	HS070920	HS230120
(1)	FTA Dummy		0.190^{***}	0.461^{***}	0.183^{***}	0.478^{***}	-0.0540^{***}	-0.667^{***}	-0.834^{***}	-0.535^{***}	-0.00806^{**}	-0.520^{***}
			(0.00166)	(0.00226)	(0.00240)	(0.0179)	(0.0209)	(0.00822)	(0.00150)	(0.00218)	(0.00317)	(0.00169)
	FTA Dummy * FTA Specific Dummy	Japan	-0.285^{***}	14.69	0.544^{***}	0.345^{***}	-0.0343	0.793^{***}	-0.295^{***}	0.283^{***}	0.181^{***}	-0.0935^{***}
			(0.00511)	(477.2)	(0.00387)	(0.0194)	(0.0225)	(0.00900)	(0.00706)	(0.00716)	(0.0106)	(0.00225)
		Korea	1.050^{***}		1.254^{***}	-0.751^{***}			0.934^{***}	1.025^{***}	1.601^{***}	0.802^{***}
			(0.00884)		(0.0153)	(0.0178)			(0.00388)	(0.0144)	(0.0502)	(0.00853)
		China	-0.171^{***}	0.268^{***}	1.432^{***}	-0.660^{***}				0.729^{***}	-0.163^{*}	0.796^{***}
			(0.00395)	(0.0184)	(0.0144)	(0.0180)				(0.00911)	(0.0990)	(0.00229)
		Observations	195	182	195	182	195	169	195	195	195	195
		Number of id	15	14	15	14	15	13	15	15	15	15
		OLS R-squared	0.531	0.629	0.398	0.383	0.739	0.487	0.724	0.178	0.556	0.370
(2)	FPM		0.00133^{***}	-0.0703^{**}	0.0155^{***}	-0.116^{***}	0.0369^{*}	-0.209^{***}	-0.206^{***}	-0.120^{***}	0.0444^{***}	0.980^{***}
			(0.000340)	(0.000422)	(0.000228)	(0.00139)	(0.0189)	(0.00516)	(0.00117)	(0.000484)	(0.000764)	(0.00504)
	FPM *FTA Specific Dummy	Japan	0.0457^{***}	0.11043^{**}		-0.06358^{***}		0.234^{***}		0.0957^{***}	-0.0201^{***}	
			(0.000782)	(0.0458)		(0.000465)		(0.00522)		(0.0011)	(0.00377)	
		Korea	0.0361^{***}		0.0386^{***}	0.233^{***}			0.443^{***}	0.427^{***}	0.0155^{***}	-0.7553^{***}
			(0.000322)		(0.000595)	(0.00172)			(0.00220)	(0.00596)	(0.00193)	(0.00570)
		China	-0.327^{***}	0.08854^{**}	-0.0165^{***}	-0.00536^{***}				-0.153^{***}	-0.106^{***}	-1.248^{***}
			(0.00281)	(0.00259)	(0.000109)	(6.59e − 05)				(0.00233)	(0.00772)	(0.00538)
		Observations	182	182	95	182	93	158	189	182	169	195
		Number of id	14	14	8	14	8	13	15	14	13	15
		OLS R-squared	0.428	0.565	0.893	0.256	0.886	0.675	0.712	0.182	0.568	0.356

Note: Year fixed effect included in all equations. Figures in párentheses are t-statistics/robust z-statics. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
*this table is a summary of the PPML+FE results of four different equations. Both OLS and PPML+FE were run in the four equations . The results of the estimation of other variables such as GDP, population, distance and arable land are as expected, and they were omitted. "Detailed information is available from the author on request"
Data Source: authors estimation.

wines (0.054) and fish flour (0.117) and there are no effects on the apples because they are excluded from the agreement. FPM results also show that only the exports of apples have a positive benefit with an increase of the FPM given from China to Chile in (0.018) and a negative effect for the other products. Finally, the positive results from the FTA Chile-Korea can be attributed to the fact that Chile's agreement with Korea is the oldest one among the seven FTAs.

In the case of Mexico, tequila and avocados exports, have a negative impact from the agreement with its major agricultural partners. However, exports of avocados reflect a net positive effect of the FTA Mexico-Japan of (0.126). Furthermore, the results also show that the increase the FPM 1 unit given by Japan to Mexico for the avocados generates a positive effect (0.025) on the exports of avocados to Japan.

Regarding Peru, the four products have a negative impact from the FTAs with major agricultural exports partners. Nevertheless, in the FTA with Japan, only the exports of fresh asparagus show a net positive effect of (0.172), the other three products show negative effect. From the FTA with Korea, the exports of the four products have positive impacts of the agreement: coffee (0.10), fish oils (0.49), fresh asparagus (1.592), and fish flour of (0.282). From the FTA with China, the exports of Peruvian fish oils (0.194) and fish flour (0.276) have a positive impact too.

The results of Peru including the PM reflect that in general terms the increase of a PM of the major agricultural partners has positive effects on the export of fresh asparagus and fish flour, but have a negative effect for the coffee and the fish oils. To be more specific, in the case of the FTA Peru-Japan, the results show that the growth of the PM given by Japan to Peru has a negative effect for the fish oils and fresh asparagus, and those results corroborate the previous ones at aggregate and sectoral levels of the negative effect from the agreement. In contrast, the four products show a positive effect of the FTA with Korea and finally, the FTA Peru-China indicate a negative effect on the agreement for fish oils, fresh asparagus, and fish flour.

Even though, table 4, 5 and 6 demonstrate that the GM parameters are not statistically significant in many instances, the OLS R squared indicator results show the goodness of fit for the estimated equations.

There are three reasons to explain the negative impact of the Peru-Japan FTA: one because the agreement was enacted recently (in 2012), so the implementation period is short. Two, trade between two countries is still low and limited because Japan excluded some agricultural product from Peru. And three, since Peruvian exporters might be affected by the large agricultural product rejection from Japan. According to UNIDO, Norad and IDS study, "Some of the reasons for Japanese food rejection of agricultural imports from Peru are: food and feed additives, bacterial contamination, pesticide residues and mycotoxins" (2015, p. 28).

According to some interviews with government trade representatives in LA,[4] the low utilization of

[4] Julio Chan. Peru's APEC Director. (APEC ASCC, May 8, 2016, Peru); Diego Torres. Asia Pacific (DIRECON, October 9, 2016, Chile); Samantha Atayde. Mexico's economic secretariat (August 17, 2016, Mexico).

the FTAs in LA countries could explain the poor estimation results. Several factors can explain the reasons, such as: the lack of knowledge about FTAs by exporters, the difficulty to achieve the high standards of SPS and TBTs for LA agricultural products and the absence of effective export policies across the region. Additionally, not only tariff restrict trade, there are other NTM such as quotas and subsidies difficult to quantify.

5. Some Trade Restrictions for the Agricultural Imports in East Asia

Even though agriculture represents a relatively small part of the economy and employment for Japan and Korea, in contrast to China, it plays an important role for them all from historical, cultural and food security perspectives. While these three countries are net importers of agricultural products, they also seek to protect their domestic market from imports. Generally, their import duties on agricultural products are higher than those applied to non-agricultural products. For Japan and China (2015), the simple average tariff for agricultural products was 14.9% and 14.8% respectively, compared with 3.7% and 9.5% for non-agricultural products. For Korea, the simple average tariff for agricultural products (60%) remained much higher than the tariff rate for non-agricultural products at 6.6% (WTO, 2016).

Success in the Japanese market can be a warranty of competitiveness in other EA markets. The Japanese system of food import control (article 27 of the Japanese Food Sanitation Law -Act No. 233 of 1947) mandates importers to submit an import notification to the Ministry of Health, Labor and Welfare of Japan (MHLW) Quarantine Station previously to importation. Subsequently, the MHLW carries out different types of inspection. Furthermore, article 8 encourages importers to provide education and guidance on Japanese food hygiene regulations, even sending technicians abroad to ensure the accomplishment of such regulations (UNIDO-IDE-JETRO, 2013)

Seafood, fruits, and vegetables represent the largest proportions of Japanese import rejections. Coffee, cocoa beans, rice, wheat, and other grains are the dominant products to be rejected because of improper hygiene conditions (UNIDO-IDE-JETRO, 2013).

Among the most exported agricultural products from LA to the world selected for the analysis, Japan imposes restrictive SPS and TBT measures for all, especially for fruits and vegetables subsector. The Japanese Basic Policy for Fruit Industry promotion revised in 2015, aims to increase the domestic production and consumption of profitable fruits or highly valued varieties, promoting economic assistance to local farmers to transform their production. Fruits such as peaches, oranges, mangoes, and apples are included in this program (WTO, 2016).

In Korea, direct export subsidies are maintained to reduce marketing costs for certain agricultural products. Rice remains heavily protected through a combination of border measures, and domestic support, and it is excluded from the FTAs. Additionally, Korea also imposes some seasonal preferential on grapes and oranges imported from Chile and Peru (WTO, 2016).

The Korean Ministry of food and drug safety (MFDS) modified the regulation for agrochemicals and animal drugs in agricultural and livestock products in 2010. Because of this, regular Chilean products that used agrochemicals locally, but are not registered in Korea are rejected. Such is the case of some meats, fruits, and vegetables. Moreover, the certification process and phytosanitary authorization for the entry of agricultural products is excessively long and complex. Korea admits the phytosanitary authorization processing of one product at a time, which can take several years before the next product begins, it makes time lapses long. It is a system that prevents from taking advantage of the FTAs (DIRECON, 2015).

As an example of the strict SPS impose from Korea to Chilean imports, the 8% of Chilean salmon shipments are subject to laboratory tests to confirm the absence of violet crystal. The analysis usually takes 10 days, which complicates the product sale due to its perishability (DIRECON, 2017).

China also protects its most important agricultural products such as cereals, sugar, and fertilizers. However, China did not apply import quotas to LA. In contrast, China imposes strict SPS and TBTs to its agricultural imports from LA. As examples of TBT, since 2014, Individual Quick Freezing (IQF) products have been banned from China. Moreover, in the case of wines, some customs offices in China do not allow the ink jet system use to print the bottling date on the counter labels of the wines and the Chinese customs authority only allows two bottles of wine shipment as samples without commercial value from Chile to a potential buyer in China (DIRECON, 2017).

In October 2015, a new food law was implemented in China, generating additional requirements. As an example, at its Northern ports such as Tianjin, Dalian and Qingdao, China conducts inspections of almost all the containers coming from Chile, and therefore, it takes several days to release shipments of Chilean fruit. This has resulted in importers preference to transport their fruit by land from Shanghai and Guangzhou, thereby making products more expensive (DIRECON, 2015).

6. Concluding Remarks

A general challenge is that the agricultural exports from LA to EA are still low. Among the three countries in LA, Chile is the one with the largest value of agricultural exports. From the importers' point of view, Japan has more agricultural products excluded in the agreements with LA and imposes more complex quotas to its imports.

The regression analysis shows diverse results at an aggregate, sectoral and product level. Even though the study of the seven FTAs evidences a decline in tariff for some agricultural products, the results suggest that despite the overall reduction in tariff, LA countries have not been able to substantially increase their agricultural exports to East Asian markets. Potential gains from tariff reductions have not been enough due to the use of NTB to trade and the low utilization of the FTAs in LA countries.

Thus, the results presented in the GM are a different application of a standard methodology in the literature because they include tariff information as an independent variable combined with FTA's specific dummies. However, some points of caution must be highlighted. First, literature has suggested endogeneity between exports and agreement dummies (Bureau & Jean, 2013), (Piermartini & Teh, 2005). Although this might be the case for total exports, where a large trade increases the probability of agreement, it is not the case for agricultural exports. Because a large trade in agricultural products might not be enough for countries to have FTA, making the endogeneity between these kinds of exports and the probability of having a FTA weaker than the one between total exports and FTA dummy variables. Second, the results presented here at the product level are only for limited products. This might cause some bias on the results. Hence, future work can be focused on changing product selection criteria to overcome the bias. Finally, the GM could be run for the same products selected from the importer's side in order to see the impacts of those products in the East Asian agricultural imports.

(Received 31th October, 2017)
(Accepted 29th January, 2018)

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