Extensive and intensive margins of agri-food trade in the EU

(draft version)

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Abstract

We use 6-digit bilateral trade data to document the evolution on the extensive and intensive product margins of agri-food trade in the EU over the period 2000 and 2015. In line with previous research our results confirm the importance of extensive margin in the EU's agri-food trade. We show that importance of margins may vary according to product differentiations. Econometric analysis reveals that drivers are similar for extensive and intensive margins. In addition, the impacts of trade cost variables differs between extensive and intensive margins according to product differentiations. Our results are relatively robust to alternative definitions of trade margins and product classifications.

Keywords: Extensive margin, intensive margin, the growth of European agri-food trade

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Introduction

An increase in exports of a given product group could be a result of combination of three factors: first, intensive margin, where the same set of product is exported in larger volumes; second, extensive margin, where larger quantities of a larger set of products are exported; and third, higher quality products (Feenstra, 1994). Hummels and Klenow (2005) show that the extensive margin a counts for 60 percent of the increase in exports of larger economies. The importance of the extensive margin in export growth was also documented by; Evenett and Venables (2002) for exports of 23 developing countries; Berthou and Fontagne (2008) for French exports to the euro area countries; Bernard et al. (2009) for US exports; and Dutt et al. (2011) for more than 150 countries' exports. In contrast, several other studies have found that intensive margins played a more important role in export growth than the extensive margin. For example Helpman et al. (2008) show that the rapid growth of trade was mostly driven by the intensive margin for 158 countries over the period 1970 to 1997. Further examples of studies that have shown the importance of the intensive margin in export growth include; Felbermayr and Kohler (2006) for world trade, Amurgo-Pacheco and Pierola (2008) for the export growth of 24 developed and developing countries; Besedeš and Prusa (2011) for manufacturing exports of 46 countries. However, research provides only limited evidence for the importance of extensive or intensive margins for agri-food. Earlier studies focus on the large players of agri-food trade as China (Zhang et al. 2017) and U.S. (Hejazi et al. 2017), but the EU as one the largest exporter has been largely ignored except Scoppola et al. (2018). The closest to this paper is Scoppola et al (2018) investigate the trade creation effects of EU preferential trade agreements in the agriculture and food sectors for developing countries in the period. However our focus is different: we analyze the role of product variety and product diversification in the growth of European agri-food trade to the world markets including both developing and developed countries between 2000 and 2015. Taking into account our time period, we investigate how economic crises influence the product diversification of European agri-food trade. Finally, we concentrate on the impact of product differentiation on trade margins.

Methodology

Measurement of the Extensive and Intensive Margins

Empirical analysis is based on the steps. First, we calculate the extensive and intensive margins for the EU agri-food trade. In most loose discourse about extensive and intensive product markets of trade, the extensive margin is referred to as growth in trade in newly traded goods whereas the intensive margin is growth in trade of already traded goods. In a static model, the "growth" is a comparative statics exercise. This is how Chaney (2008) decomposes his comparative statics of changes in total trade in response to changes in trade barriers. However Dutt et al. (2012) show, in an empirical time-series exercise, these definitions of the extensive and intensive margins are problematic for two reasons. Therefore, in empirical studies, these margins are defined not as growth terms but rather as snapshots, with the extensive margin being the number of goods traded (perhaps weighted) and hence capturing trade diversification, whereas the intensive margin is the average exports per product (perhaps weighted).

In our baseline specification, we use unweighted measures. More specifically, the extensive margin is a simple count of the number N_{ij} of products exported from *i* to *j* and the intensive margin:

$$\bar{X}_{ij} = X_{ij}/N_{ij} \quad (1)$$

is the average value of exports per product traded. Therefore, the overall volume of exports is the product of these margins:

$$X_{ij} = \bar{X}_{ij} * N_{ij} \quad (2)$$

As a robustness check, we also use the weighted measures of Hummels and Klenow (2005). They define the intensive margin as follows. Let $K_{ij,t}$ be the set of products exported by *i* to *j* in year *t* and let $K_{Wjt} \equiv \cup_{i,t} K_{ij,t}$ be the set of all products exported to j from any country in any year in our sample. The index *W* stands for "world", i.e., the ensemble of origin (*i*) countries. The extensive margin of exports from country *i* to country *j* is

$$EM_{ij,t} = \frac{\sum_{k \in K_{ij,t}} X_{wjk}}{\sum_{k \in K_{wj,t}} X_{wjk}} \quad (3)$$

where EM_{ijt} denotes the extensive margin of country i to country j in year t. We define the intensive margin of exports from country *i* to country j is following:

$$IM_{ij,t} = \frac{\sum_{k \in K_{ij,t}} X_{ijk}}{\sum_{k \in K_{ij,t}} X_{wjk}} \quad (4)$$

where IM_{ijt} refers to the intensive margin of country *i* exporting to country *j* in year *t*. The numerator represents the total value of all products exported from country *i* to country *j*, whereas the denominator represents the total value of all products exported from world to country *j* within the set of products in category *k*.

Empirical Model of Determinants of the Extensive and Intensive Margins

Second, we employ a gravity framework to investigate the drivers of extensive and intensive margins. Empirical specifications are following:

$$EM_{ijt} = \alpha_0 + \alpha_1 lnPOP_{it} + \alpha_2 lnGDPCAP_{it} + \alpha_3 lnPOP_{jt} + +\alpha_4 lnGDPCAP_{jt} + \delta \boldsymbol{D}_{ijt} + \epsilon_t + u_{ijt} \quad (5)$$

$$IM_{ijt} = \alpha_0 + \alpha_1 lnPOP_{it} + \alpha_2 lnGDPCAP_{it} + \alpha_3 lnPOP_{jt} + +\alpha_4 lnGDPCAP_{jt} + \delta \boldsymbol{D}_{ijt} + \epsilon_t + u_{ijt} \quad (6)$$

Where EM_{ijt} and IM_{ijt} the extensive and intensive margins. We divide the set of dyadic variables, $\boldsymbol{D}_{ijt}$, into two groups: a set of control variables typically used in gravity regressions and a set of indicators that represent trade agreements. The time-invariant controls are distance and common border, common language, colonial linkages and religion. Time-invariant variables are also serving to control for both multilateral resistance and unobservable heterogeneity. Time variants

controls include belonging to a common regional trade arrangement (RTA), belonging jointly to GATT/WTO and joint membership of the European Union. The models include also year fixed effects to control time specific shocks. Finally, we add a time-invariant dummy (Crisis) to control the impacts of food crisis. The description and sources of variables are in Table 1.

Table 1. Description of variables

Variable	Definition	Source
X	Export in current US dollars	World Bank, Comtrade
POP	Number of population	World Bank, WDI
GDPCAP	GDP per capita in current US dollars	World Bank, WDI
Distance	The physical distance between national capitals for country pairs	CEPII
Border	Dummy variable equal to unity for exporting and importing countries with a common land border	CEPII
Colony	Dummy variable equal to unity one if exporting country was the colonizer and the importing colonized or vice versa	CEPII
Language	Dummy variable equal to unity for exporting and importing countries with a common language	CEPII
Religion	Dummy variable equal to unity for exporting and importing countries with a common religion	CEPII
FTA	Dummy variable equal to unity for country pairs that belong to the same regional trade agreement	WTO
WTO	Dummy variable equal to unity for country pairs that belong to the WTO agreement	WTO
EU	Dummy variable equal to unity for country pairs that belong to the European Union	CEPII
Crisis	Dummy variable equal to unity for period after 2007	

Source: Own compilation

Results

Table 2 reports the results from estimating gravity-specifications for our two measures of the extensive and intensive margins. Breusch and Pagan (1980)'s LM test for individual-specific effects is rejected at the l per cent significance level, indicating the unobserved country-specific effects should be taken into account. Having a series of time invariant trade costs variables we employ the random effects estimator. F tests shows that year fixed effects are significantly differing from zero at the l per cent significance level.

We first examine effects of market size and level of income on the EU's trade margins. In line with expectation, the coefficient of the economic size is positive and significant, indicating that a larger economic size lead to more growth in EU's agricultural exports at the dual margins. Similarly, we find that the higher level of incomes of trading partners increase both extensive and intensive margins. Note, that coefficients are considerable larges for intensive margin except importer GDP/capita for HK methods.

Next, the traditional gravity variables have significant explanatory power for the two margins. Distance reduces both the extensive and intensive margin of exports, which is consistent with the role of distance as capturing variable trading costs. Having a common border raises the intensive margins. But contrary to Scoppola et al (2018) contiguity has mixed effect on the extensive margin. Linguistic similarity and colonial links positively influence both export margins. Finally, common religion mainly has no impacts on trade margins. Note, that the size of impacts are consistently higher for intensive margin in HK specifications. Time variant trade costs variables provide less consistent results for each margin.

Table 2 Gravity specification for the extensive and intensive margins – full sample

	Unweighted		Hummels-Klenow	
	extensive margin	intensive margin	extensive margin	intensive margin
$lnPopulation_i$	0.427***	0.591***	0.462***	1.151***
$lnPopulation_j$	0.116***	0.388***	0.883***	0.661***
$lnGDP/capita_i$	0.059***	0.829***	0.111***	1.068***
$lnGDP/capita_j$	0.004*	0.402***	0.720***	0.660***
lndistance	-0.940***	-0.659***	-1.002***	-1.487***
Border	-0.025	1.275***	-0.597***	0.980***
Colony	0.907***	0.280**	0.524***	0.916***
Language	0.438***	0.545***	0.269**	0.972***
Religion	0.148**	-0.108	-0.011	-0.114
FTA	0.004	-0.126***	-0.048***	-0.104**
WTO	-0.002	-0.052	0.010	-0.050
EU	-0.003	0.646***	0.262***	0.615***
Crisis	-0.047***	0.549***	-0.117***	0.099***
constant	9.574***	-5.706***	-10.072***	-21.934***
N	75676	55855	72667	59195
R^2	0.4834	0.3913	0.7191	0.5906
Wald test	5272.03***	6871.74***	14229.30***	11215.51***
BP test	5.3e+05***	95117.70***	3.9e+05***	1.4e+05***
F test	723.14***	406.37***	729.24***	1264.16***

Source: Own calculations
Note: ***,**,* denote significance at 1%, 5% and 10% level,

The coefficients of FTA, WTO and EU are insignificant for extensive margin of unweighted measures. The FTA has negative effects on both extensive and intensive margins contrary to

Scoppola et al. (2018). This fact can be explained partly by different time period and sample. Note that our study cover the intra-EU trade, thus the EU dummy positively influences both trade margins for remaining three specifications. In addition, the EU may absorb some impacts capturing to FTA variable. Finally, the crisis have negative impacts on extensive margin and positive impacts of intensive margins regardless of definitions of trade margins. This implies that the exports performance of the EU after crisis is driven by intensive margin that is exporting same set of products with larger quantities.

Liapis and Fournier (2008) point out that agricultural products have different characteristics and primary agricultural products are insensitive to time, while processed agricultural products can be relatively more sensitive to time. Earlier research confirm that product differentiation may affect on the export performance in agri-food sectors (e.g. Bojnec and Fertő 2012; 2014). Therefore, it is meaningful to examine the effect of each variable on the dual margins regarding to level of product differentiation separately. We classify products into three types, differentiated, reference priced, and homogeneous, following the Rauch (1999) classification. Rauch (1999) classified 4-digit SITC codes into the three types. Homogeneous goods are products traded on organized exchanges (such as commodities markets), resulting in a single price for the product regardless of the identity of the supplier. These goods are basically commodities. Reference priced goods are not traded on organized exchanges, but a single reference price for all suppliers still exists, usually determined by trade publications. While a centralized market does not form the price common to all suppliers, there is no differentiation of the product across suppliers, resulting in a single price common to all suppliers. Differentiated products are those for which there are no organized exchanges and for which there is no single prevailing price common to all producers. These can most easily be identified of as consumer goods, for which there is differentiation across suppliers resulting in different prices. Given the focus on differentiation of exports, data on products not classified by Rauch's classification are omitted. To check the robustness of our results, we employ both conservative and liberal classifications.

Now we turn to the role of product differentiation in extensive margins. The results are presented in Tables 3 and 4 for both conservative and liberal classifications. For the extensive margin, the results obtained for each product groups are mainly consistent with those obtained for total agricultural products. However, the impacts of importer countries' income (now insignificant) and Border (switching to significantly positive for reference prices goods) are different for unweighted samples. Differences remain the same between unweighted and the HK subsamples by product groups as in total sample. The results differ across product groups only for common border, religion and the FTA in unweighted samples. The common border increase the extensive margins for reference prices and homogenous products and the FTA is more favourable for homogenous goods. Most striking differences are for language, religion, the FTA and WTO by product groups. Common language has a positive impact on extensive margins of differentiated products but does not promote the export growth of reference prices and homogeneous goods. The FTA reduces the extensive margins for differentiated and homogenous items, but it has not impacts on reference prices goods. The WTO helps only for homogenous products, other groups remain unaffected.

Table 3 Estimation results for extensive margin – conservative subsample

	Unweighted			Hummels-Klenow		
	differentiated	reference prices	homogenous	differentiated	reference prices	homogenous
$lnPopulation_i$	0.380***	0.413***	0.318***	0.353***	0.412***	0.552***
$lnPopulation_j$	0.105***	0.101***	0.064***	0.784***	0.794***	0.920***
$lnGDP/capita_i$	0.045***	0.062***	0.050***	0.058**	0.062**	0.187***
$lnGDP/capita_j$	0.007	0.005	0.009	0.750***	0.779***	0.610***
lndistance	-0.772***	-0.856***	-0.775***	-0.821***	-0.838***	-1.325***
Border	-0.020	0.179*	0.240**	-0.475***	-0.262***	-0.760***
Colony	0.738***	0.923***	0.773***	0.339***	0.606***	0.750***
Language	0.397***	0.283***	0.305***	0.323***	0.028	0.127
Religion	0.214***	0.179***	0.112	0.115	0.022	-0.323**
FTA	0.002	0.002	0.009*	-0.042***	-0.015	-0.099***
WTO	-0.007	-0.005	0.005	-0.001	0.031	0.091*
EU	0.004	-0.000	-0.012	0.115***	0.331***	0.406***
Crisis	-0.031***	-0.045***	-0.040***	-0.024**	-0.207***	-0.122***
constant	7.574***	8.122***	7.334***	-11.997***	-12.227***	-9.232***
N	70711	70797	60860	67877	67830	57847
R^2	0.4483	0.4687	0.3991	0.6657	0.7084	0.6034
Wald test	4492.00***	4787.52***	2978.89***	12354.86***	11873.54***	8025.50***
BP test	4.8e+05***	4.8e+05***	4.2e+05***	3.5e+05***	3.2e+05***	3.0e+05***
F test	664.88***	618.55***	456.47***	808.75***	699.70***	467.56***

Source: Own calculations

Note: ***,**,* denote significance at 1%, 5% and 10% level,

Table 4 Estimation results for extensive margin – liberal subsample

	Unweighted			Hummels-Klenow		
	differentiated	reference prices	homogenous	differentiated	reference prices	homogenous
$lnPopulation_i$	0.367***	0.404***	0.344***	0.328***	0.406***	0.531***
$lnPopulation_j$	0.102***	0.103***	0.067***	0.786***	0.760***	0.897***
$lnGDP/capita_i$	0.043***	0.066***	0.046***	0.071***	0.049*	0.162***
$lnGDP/capita_j$	0.007	0.007	0.007	0.764***	0.760***	0.624***
lndistance	-0.739***	-0.848***	-0.841***	-0.804***	-0.852***	-1.190***
Border	-0.006	0.176*	0.162	-0.471***	-0.194**	-0.687***
Colony	0.710***	0.922***	0.860***	0.314***	0.635***	0.673***
Language	0.390***	0.250***	0.306***	0.289***	-0.038	0.039
Religion	0.230***	0.157**	0.091	0.190*	0.120	-0.185
FTA	0.002	0.001	0.007	-0.062***	-0.001	-0.113***
WTO	-0.008	-0.006	0.002	0.006	0.038	0.077*
EU	0.006	-0.005	-0.012	0.097***	0.275***	0.448***
Crisis	-0.031***	-0.054***	-0.032***	-0.003	-0.180***	-0.132***
constant	7.246***	7.961***	8.123***	-12.434***	-11.909***	-9.730***
N	70179	70007	64594	64871	64711	59385
R2	0.4449	0.4608	0.4253	0.6736	0.6811	0.6413
Wald test	4378.05	4742.10	3549.54	12642.57	10284.90	9399.97
BP test	4.8e+05	4.8e+05	4.4e+05	3.5e+05	3.2e+05	3.0e+05
F test	635.73	575.58	497.34	808.75	699.70	467.56

Source: Own calculations

Note: ***,**,* denote significance at 1%, 5% and 10% level

Table 5 Estimation results for intensive margin – conservative subsample

	Unweighted			Hummels-Klenow		
	differentiated	reference prices	homogenous	differentiated	reference prices	homogenous
$lnPopulation_i$	0.626***	0.662***	0.449***	1.116***	1.206***	0.867***
$lnPopulation_j$	0.352***	0.370***	0.288***	0.602***	0.597***	0.468***
$lnGDP/capita_i$	0.965***	0.734***	0.956***	1.257***	0.977***	1.161***
$lnGDP/capita_j$	0.398***	0.490***	0.165***	0.628***	0.733***	0.376***
lndistance	-0.720***	-0.533***	-0.881***	-1.374***	-1.260***	-1.550***
Border	1.528***	1.454***	1.762***	1.318***	1.434***	1.825***
Colony	0.140	0.406***	0.319**	0.683***	1.096***	0.967***
Language	0.910***	0.473***	0.182	1.231***	0.719***	0.502***
Religion	0.325***	-0.130	-0.525***	0.406***	-0.123	-0.588***
FTA	-0.090*	-0.091*	-0.144**	-0.063	-0.057	-0.130**
WTO	-0.013	0.029	-0.119	-0.001	0.053	-0.109
EU	0.436***	0.627***	0.976***	0.426***	0.646***	1.056***
Crisis	0.537***	0.498***	0.808***	0.125***	0.053	0.375***
constant	7.139***	-6.964***	-3.139***	-25.925***	-24.755***	-20.901***
N	48666	48744	37247	51354	51490	39771
R^2	0.3668	0.3820	0.2690	0.5315	0.5515	0.4324
Wald test	6065.84***	5180.57***	3865.69***	7795.41***	8717.76***	5872.43***
BP test	94820.16***	79286.26***	45385.75***	1.2e+05***	1.1e+05***	67960.67***
F test	366.73	326.84	317.52	855.75	1018.20	723.93

Source: Own calculations

Note: ***,**,* denote significance at 1%, 5% and 10% level,

Table 6 Estimation results for intensive margin – liberal subsample

	Unweighted			Hummels-Klenow		
	differentiated	reference prices	homogenous	differentiated	reference prices	homogenous
$lnPopulation_i$	0.648***	0.690***	0.418***	1.119***	1.213***	0.873***
$lnPopulation_j$	0.361***	0.350***	0.343***	0.606***	0.573***	0.539***
$lnGDP/capita_i$	0.919***	0.965***	0.743***	1.222***	1.218***	1.002***
$lnGDP/capita_j$	0.421***	0.497***	0.261***	0.651***	0.745***	0.466***
lndistance	-0.741***	-0.593***	-0.614***	-1.352***	-1.294***	-1.292***
Border	1.500***	1.564***	1.758***	1.283***	1.542***	1.789***
Colony	0.152	0.609***	0.171	0.694***	1.313***	0.881***
Language	0.927***	0.379***	0.294**	1.240***	0.588***	0.561***
Religion	0.395***	0.029	-0.461***	0.502***	0.003	-0.480***
FTA	-0.102**	-0.042	-0.181***	-0.078	-0.024	-0.161***
WTO	-0.026	0.016	-0.049	-0.004	0.039	-0.053
EU	0.379***	0.499***	1.020***	0.360***	0.513***	1.090***
Crisis	0.504***	0.577***	0.691***	0.078**	0.136***	0.279***
constant	6.740***	-9.237***	-3.682***	-26.058***	-27.387***	-21.742***
N	48059	47452	41867	49136	48656	43087
R^2	0.3712	0.4068	0.2668	0.5284	0.5620	0.4436
Wald test	6141.05	5340.58	4295.56	7402.39	7969.61	6711.24
BP test	97335.70	74703.34	62671.26	1.2e+05	1.0e+05	85244.35
F test	352.27	336.04	351.51	774.58	1049.90	798.75

Source: Own calculations
Note: ***,**,* denote significance at 1%, 5% and 10% level,

The results are presented in Tables 5 and 6 for intensive margins using both conservative and liberal classifications. Similarly, results for the intensive margin by each product groups are considerably consistent with estimations based on the total sample. However, the effects of colonial relationships and religion are different for unweighted samples. We find more differences in the HK samples including language, religion and the FTA.

The results differ across product groups for colonial relationships in both unweighted samples. The colony increase the intensive margins for reference prices in both conservative and liberal subsamples, whilst it is insignificant for differentiated groups. We find the most striking differences for religion. The religion has positive impacts on differentiated products, it reduces the intensive margins for homogenous goods, leaving references prices items unaffected. Similarly to extensive margins, the FTA mainly reduces the intensive margins for differentiated and homogenous items, but it has not impacts on reference prices goods.

Conclusions

Although the importance of extensive and intensive margins in the growth of international trade is

already well documented, the research on the agri-food trade is limited especially for the EU. In addition, the impact of economic crisis on the agri-food trade is also unexplored. The aim of the paper is to investigate the drivers of dual trade margins of the EU's agri-food trade. In line with previous research our results confirm the importance of extensive margin in the EU's agri-food trade (Liapis 2009, Zhang et al 2017, Scoppola et al. 2018). Main findings from the econometric analysis are following. Market size and income positively influences the dual trade margins regardless to product classifications and definitions of margins except importer's income in some cases. Market access variables have stronger effects on intensive margins. In line with Scoppola et al (2018) time invariant trade costs variables confirm the theoretical predictions. Product differentiations are partly matters for trade margins especially for time invariant trade costs variables on extensive margins. Crisis has negative impacts on extensive margins, and increase the intensive margin.. Our results are relatively robust to alternative definitions of margins.

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References

Amurgo-Pacheco, A., & Pierola, M. D. (2008). *Patterns of export diversification in developing countries: intensive and extensive margins*. *Policy Research Working Paper*. http://doi.org/10.1016/j.jss.2009.03.020

Baier, S. L., Bergstrand, J. H., & Feng, M. (2014). Economic integration agreements and the margins of international trade. *Journal of International Economics*, *93*(2), 339–350. http://doi.org/10.1016/j.jinteco.2014.03.005

Besedeš, T. (2011). Export differentiation in transition economies. Economic Systems, 35(1), 25-44. doi:10.1016/j.ecosys.2010.11.001

Besedeš, T., & Prusa, T. J. (2011). The role of extensive and intensive margins and export growth. *Journal of Development Economics*, *96*(2), 371–379. http://doi.org/10.1016/j.jdeveco.2010.08.013

Bojnec S, Fertő I. (2012). Complementarities of trade advantage and trade competitiveness measures, *Applied Economics*, 44, 399–408 http://doi.org/10.1080/00036846.2010.508725

Bojnec S, Fertő I. (2014). Export competitiveness of dairy products on global markets. *Journal of Dairy Science*, 97(10), 6151–6163.

Chaney, T. (2008). Distorted gravity: The intensive and extensive margins of international trade. *American Economic Review*, *98*(4), 1707–1721. http://doi.org/10.1257/aer.98.4.1707

Cheong, J., Kwak, D. W., & Tang, K. K. (2016). The distance effects on the intensive and extensive margins of trade over time. *Empirical Economics*, *50*(2), 253–278. http://doi.org/10.1007/s00181-015-0927-x

Crozet, M., & Koenig, P. (2010). Structural gravity equations with intensive and extensive margins. *Canadian Journal of Economics*, *43*(1), 41–62. http://doi.org/10.1111/j.1540-5982.2009.01563.x

Dutt, P., Mihov, I., & Van Zandt, T. (2013). The effect of WTO on the extensive and the intensive margins of trade. *Journal of international Economics*, *91*(2), 204-219.

Feenstra, R. C. (1994). New product varieties and the measurement of international prices. *American Economic Review*. http://doi.org/10.2307/2117976

Feenstra, R. C., & Ma, H. (2014). Trade facilitation and the extensive margin of exports. *Japanese Economic Review*, *65*(2), 158–177. http://doi.org/10.1111/jere.12031

Felbermayr, G. J., & Kohler, W. (2006). Exploring the intensive and extensive margins of world trade. *Review of World Economics*, *142*(4), 642–674. http://doi.org/10.1007/s10290-006-0087-3

Felbermayr, G., & Kohler, W. (2010). Modelling the extensive margin of world trade: New evidence on GATT and WTO membership. *World Economy*, *33*(11), 1430–1469. http://doi.org/10.1111/j.1467-9701.2010.01292.x

Helpman, E., Melitz, M., & Rubinstein, Y. (2008). Estimating Trade Flows: Trading Partners and Trading Volumes *. *Quarterly Journal of Economics*, *123*(2), 441–487. http://doi.org/10.1162/qjec.2008.123.2.441

Hejazi, M., Grant, J. H., & Peterson, E. (2017). Tariff changes and the margins of trade: A case study of U.S. agri-food imports. Journal of Agricultural and Resource Economics, 42(1), 68–89.

Hummels, D., & Klenow, P. J. (2005). The variety and quality of a nation's exports. *American Economic Review*. http://doi.org/10.1257/0002828054201396

Lawless, M. (2010). Deconstructing gravity: trade costs and extensive and intensive margins. *Canadian Journal of Economics/Revue Canadienne D'économique*, *43*(4), 1149–1172. http://doi.org/10.1111/j.1540-5982.2010.01609.x

Liapis, P. (2009). Extensive Margins in Agriculture. *OECD Food, Agriculture and Fisheries Working Papers*, (17). http://doi.org/10.1787/224422031753

Santos Silva, J. M. C., Tenreyro, S., & Wei, K. (2014). Estimating the extensive margin of trade. *Journal of International Economics*, *93*(1), 67–75. http://doi.org/10.1016/j.jinteco.2013.12.001

Scoppola, M., Raimondi, V., & Olper, A. (2018). The impact of EU trade preferences on the extensive and intensive margins of agricultural and food products. *Agricultural Economics*. http://doi.org/10.1111/agec.12413

Zhang, X., Zhou, Y., Geng, X., & Tian, X. (2017). The Intensive and Extensive Margins of China's Agricultural Trade. *Canadian Journal of Agricultural Economics/Revue canadienne d'agroeconomie*.