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Article

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Suggested Citation: Nussbaumer, Timothy (2017) : A study case on the caveats in the measurement of FTAs effect on trade: Switzerland's free trade agreements, Aussenwirtschaft, ISSN 0004-8216, Universität St.Gallen, Schweizerisches Institut für Aussenwirtschaft und Angewandte Wirtschaftsforschung (SIAW-HSG), St.Gallen, Vol. 68, Iss. 1, pp. 139-167

This Version is available at:

<https://hdl.handle.net/10419/231252>

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A study case on the caveats in the measurement of FTAs effect on trade: Switzerland's free trade agreements

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This paper analyses the effect of 20 of the 31 Swiss free trade agreements (FTAs) on Swiss trade flows, using disaggregated trade data for the period between 1993 and 2014. Applying the standard gravity model of trade, the impact of each individual FTA on Swiss exports and imports is estimated. Although the descriptive evidence suggests a positive impact of most FTAs, the estimation results at the disaggregated level are inconclusive. Taking Switzerland as a case study, this work points towards important methodological difficulties in the measurement of FTA effects on trade at the disaggregated level.

JEL codes: F10, F13, F14, F15

Key words: free trade agreements, Switzerland, trade flows

1 Introduction

Regional trade agreements have proliferated rapidly since the early 1990s. By the end of 2016, over 600 free trade agreements (FTAs) or regional trade agreements (RTAs) had been notified at the WTO (WTO, 2016). In parallel to this international development, Switzerland has built up its own network of FTAs. In 2014, this network covered over 60% of Swiss exports and almost 80% of imports, with the FTA with the EU alone accounting for over 40% of exports and 60% of imports.²

The rapid proliferation of FTAs has raised a lively debate in the literature about the actual effects of FTAs on trade. In the early 2000s, the empirical literature, with the gravity model as its workhorse, incorporated new estimation methods to account for the endogeneity of FTAs (BAIER and BERGSTRAND, 2007) and to incorporate zero trade flows (SANTOS SILVA and TENREYRO, 2006). However, the reported individual effects of FTAs on trade still vary widely and it is not uncommon for insignificant effects to be reported.

In this work, I provide a comprehensive analysis of the individual trade effects of 20 of the 31 Swiss FTAs on Swiss exports and imports of industry goods using disaggregated trade data at the 3-digit SITC level. The applied estimation model is based on the structural gravity model of ANDERSON and VAN WINCOOP

¹ This paper was written as part of the author's Masters thesis to graduate from the University of St. Gallen. The views and opinions expressed in this paper are solely those of the author and do not necessarily reflect the positions of the author's employer.

² Numbers refer to trade without SITC head chapter 9.

(2003) and estimated using the ordinary least square (OLS) estimator, as well as the Poisson pseudo-maximum likelihood (PPML) estimator, to incorporate zero trade flows. The rather inconclusive results provide an interesting case study on the methodological difficulties of the measurement of the effects of FTA on trade.

The remainder of this work is structured as follows. Section 2 summarizes the Swiss foreign trade policy to provide the policy context of the Swiss FTA network. Section 3 gives an overview of the data at hand and some descriptive evidence, while Section 4 presents the empirical framework. Finally, Section 5 discusses the results and implications.

2 Swiss foreign trade policy

Switzerland, as a small and open economy, is dependent on extensive market access. The main pillar of Swiss foreign trade policy for ensuring access to foreign markets is multilateral liberalization through the World Trade Organization (WTO). However, FTAs have been introduced as a complementary instrument, not least as a reaction to the economic integration of its neighbors in the European Union and the proliferation of FTAs in the late 1990s and 2000s (SECO, 2014).

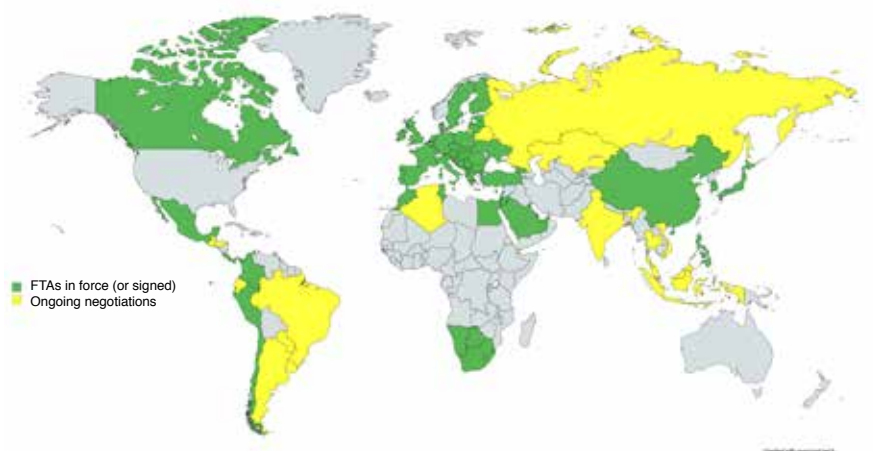
As a founding member of the European Free Trade Association (EFTA), the large majority of Switzerland's FTAs are negotiated within the framework of the EFTA. However, the first FTA concluded by Switzerland was a bilateral FTA with the European Community (EC) signed in 1972, which remains the basis for market access to the European Single Market.

Given that Switzerland is not a member country of the European Union but is geographically located in the middle of Europe, the FTA with the European Union is of particular importance and was complemented by over 100 bilateral agreements in order to facilitate access to the European Single Market. Outside of the European Union, Switzerland concluded most of its agreements, in parallel with the extensive proliferation of FTAs in other countries, during the 2000s. Between 2005 and 2016 alone, 20 of the 31 FTAs with 29 of the overall 39 partner countries (excluding the European Union and EFTA) were signed. Today, Switzerland has an FTA with almost all important trading partners except for the United States and India (see Figure 1).

Switzerland's FTAs vary in their complexity and depth. Modern FTAs include more than just the reduction of tariffs; further provisions to lower barriers to trade in goods, capital and services are frequently included nowadays. A first generation of FTAs included, beside the provisions on tariff and non-tariff barriers,

provisions concerning the protection of intellectual property. These include the FTAs with Mediterranean countries, Canada and the Southern African Customs Union. A second generation of FTAs additionally included provisions on services trade, investor protection or public procurement. These include the FTAs with Chile, the GCC, Hong Kong, Colombia, Mexico, Singapore, the Philippines, South Korea, Peru, the Ukraine, Japan and the Central American States Costa Rica and Panama.

Figure 1: Swiss FTA network (own illustration)



Source: Authors' own illustration.

3 Data

3.1 Dataset

To estimate the effect of Swiss FTAs on Swiss trade flows, I use disaggregated import and export data for industry goods at the SITC 3-digit level (SITC head categories 5-8) covering 78 partner countries³ for the period between 1993 and 2014 sourced from the United Nations Commodity Trade Statistics Database (UN COMTRADE, 2016). To construct the FTA dummies at the product group level, I use tariff data from the UNCTAD Trade Analysis Information System (TRAINS) (UNCTAD, 2016), complemented by information manually coded from the individual agreements provided by the EFTA Secretariat. The resulting tariff dataset provides information for each 3-digit product group regarding the number

³ Together, they account for more than 97% of imports and exports.

of custom lines that benefit from a preferential tariff under the FTA. The FTA dummy variable consequently takes a value of one if the majority of custom lines of the product group in questions profit from tariff reduction. In total, Switzerland had 30 FTAs in force at the end of 2016. Due to missing data⁴ and the limited observation period,⁵ this analysis is limited to 20 out of these 30 FTAs. Table A1 in the appendix provides an overview of all FTAs included in the analysis.

As it is usual for trade data at the disaggregated level, zero trade flows account for a substantial part of the observations (11% of observations for exports and 34% observations for imports). Consequently, the distribution of trade flows is strongly skewed to the right.

3.2 Descriptive evidence

Switzerland's FTAs cover a large part of Swiss trade flows. Together with the old EU countries, the share of trade covered by FTAs in 2014 amounted to 64% of exports and 82% of imports. Figure 2 shows that if the old EU countries are excluded, the share of trade covered by these agreements grew from under 1% of exports and 0.3% of imports in 1993 to 20% of exports and 16.5% of imports in 2014 due to the increase in the number of FTAs.

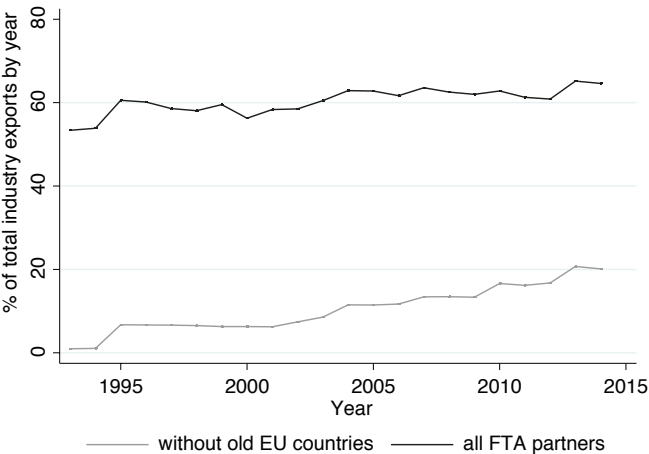
To provide a first insight into the relationship between FTAs and trade flows, Figure 3 shows the indexed development of aggregate trade flows for the years before an FTA came into force and for the years after it came into force. At first sight, the figure indicates a positive relationship for exports and imports.

4 Due to missing values in trade and tariff data, the Faroe Islands, Montenegro, Palestine, the SACU countries (Botswana, Lesotho, Namibia, South Africa and Swaziland) and Serbia could not be included.

5 Due to the use of *country times product group fixed effects* (see Section 4), all FTA dummy variables which do not vary over the observation period are omitted. This includes the FTA with Turkey and all the countries that joined the European Union before 1993. Consequently, the FTA variable for the FTA with the European Union from 1972 includes only Sweden, Finland and Austria (which joined the Union in 1995), Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia (2004), Bulgaria and Romania (2007) and Croatia (2013). Finally, the FTAs with the GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates), China, Panama, Costa Rica and the Philippines are omitted as they came into force after the sample period (2014).

Figure 2: Share of industry trade flows covered by an FTA

a. Exports



b. Imports

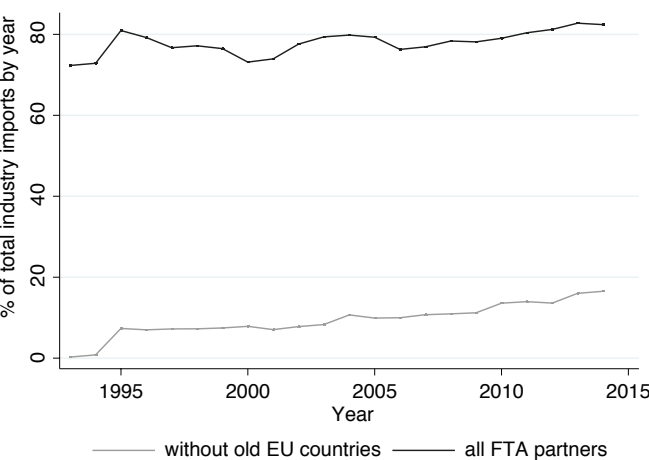
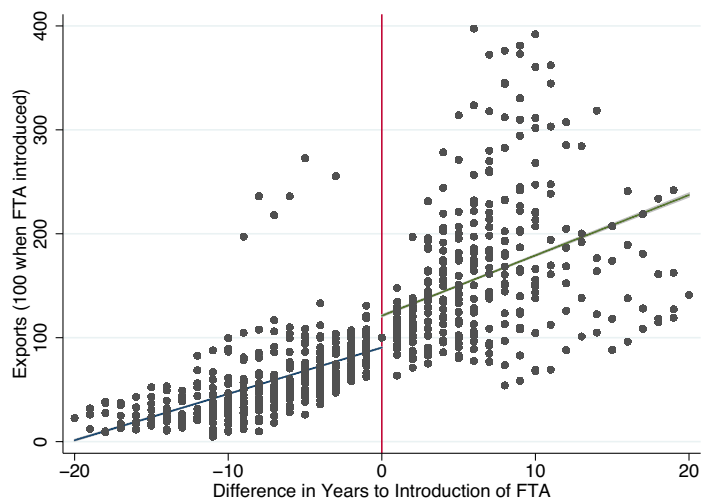
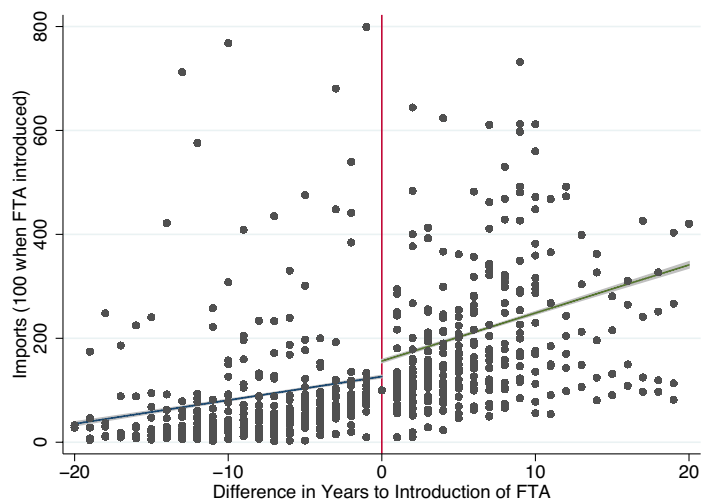


Figure 3: Development of aggregate trade flows before and after an FTA
a. Exports



b. Imports

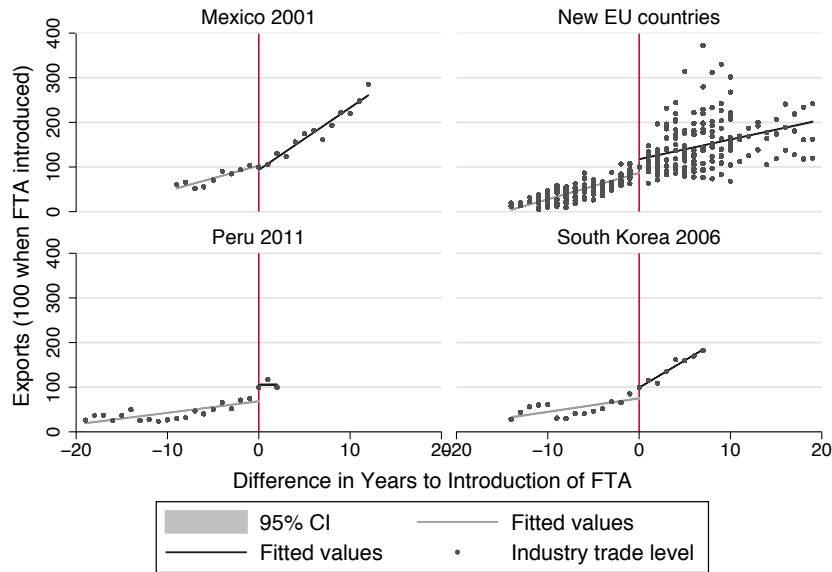


However, the heterogeneous distribution indicates that such a general FTA effect fails to capture the large variety of effects resulting from individual FTAs. Figure 4 therefore shows the development of aggregate trade before and after the FTA came into force in South Korea, Mexico, Peru and the countries that joined the European Union after 1993 (referred to as new EU countries). Figure 4, and Figure A1 in the appendix even more so, reveal that the development of trade flows after the entry into force of the FTA exhibits large differences from country to country. The example of Peru shows that in the case of FTAs with very recent FTA partners, such as Peru but also Colombia, Hong Kong and the Ukraine, results should be interpreted with caution. The same applies for FTA partners whose FTA entered into force just at the start of the observation period, such as Israel. Further, it is noteworthy that some countries indicate a slowdown in trade growth – or even a drop in trade volumes – after the entry into force of the FTA (Albania, Croatia, Japan, the new EU countries, Peru and Ukraine).

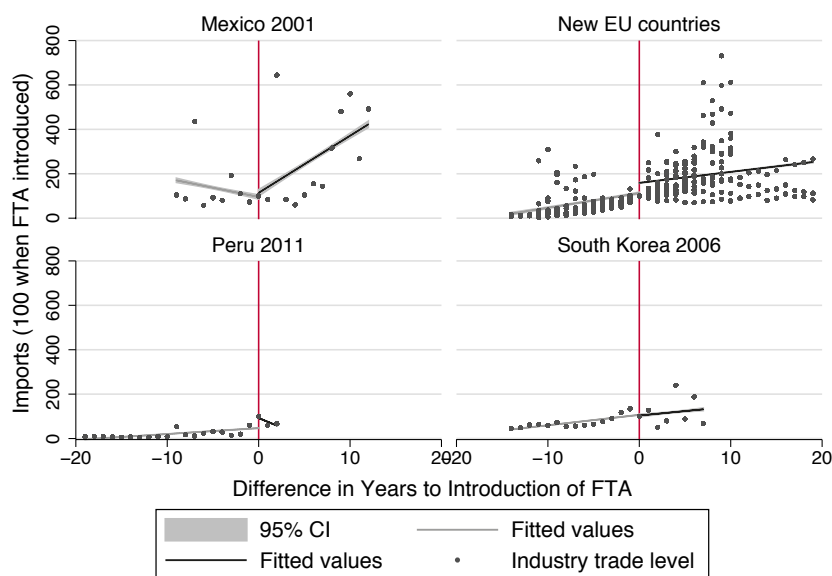
Figures 3 and 4 and the corresponding figures in the appendix (Figure A1) provide some preliminary descriptive evidence. However, there are many other factors that influence trade flows. For instance, it is very likely that the coincidence of the global financial crisis with the conclusion of the FTA with Egypt explains to some extent the slow growth of trade after its entry into force. And vice versa, it may not be the FTA with Chile, which entered into force in 2004, that explains trade growth after 2004 but the strong GDP growth in Chile between 2004 and 2009. Consequently, the next section develops an estimation strategy that controls for the above-mentioned co-affecting factors by applying a structural gravity model.

Figure 4: Development of aggregate trade flows by country

a. Exports



b. Imports



4 Estimation method

The standard empirical model to measure the effects of trade policy is the “gravity model of trade” presented originally by JAN TINBERGEN (1962). His intuitive model postulates, in analogy with Newton’s law of universal gravitation in physics, that the total amount of trade flows from country i to country j , X_{ij} , is proportional to the mass of each country Y_i and Y_j (measured in GDP) and inversely proportional to the distance between the countries, D_{ij} .

$$X_{ij} = \frac{(Y_i Y_j)}{D_{ij}} \quad (1)$$

Indisputably, the strength of the intuitive gravity model is its simplicity and, even more importantly, its empirical validity. Accounting for only two explanatory factors, it can explain about 70% to 80% of the variation in aggregate trade (BALDWIN and TAGLIONI, 2006, 3; VAN BERGEIJK and BRAKMAN, 2010, 5). Tinbergen’s model has been extended to give it a sound theoretical foundation. The most famous extension was provided by ANDERSON and VAN WINCOOP (2003), who underline the importance of incorporating relative trade costs in the gravity model. In other words, they introduce a measure for the relative bilateral trade barrier between two countries relative to the average trade barrier of all their trading partners (called the “multilateral resistance term”).

In log-linear form, the model of ANDERSON and VAN WINCOOP (2003) can be written as follows:

$$\ln X_{ijt}^k = \ln Y_{it}^k + \ln E_{jt}^k - \ln Y_t^k + (1 - \sigma_k) [\ln \tau_{ijt}^k - \ln \Pi_{it}^k - \ln P_{jt}^k] + \varepsilon_{ijt}^k \quad (2)$$

$$\text{where } \Pi_{it}^k = \sum_{j=1}^C \left\{ \frac{\tau_{ijt}^k}{P_{jt}^k} \right\}^{1-\sigma_k} \frac{E_{jt}^k}{Y_t^k} \text{ and } P_{jt}^k = \sum_{i=1}^C \left\{ \frac{\tau_{ijt}^k}{\Pi_{it}^k} \right\}^{1-\sigma_k} \frac{E_{it}^k}{Y_t^k}$$

$$\text{and } \tau_{ijt}^k = \ln FTA_{ijt}^k + \ln(X_\delta)_{ij}$$

For the case of export flows, X_{ijt}^k are the exports of Switzerland (i) to its trade partners (j) by product group (k) and year (t). Y_{it}^k is the output per product group of Switzerland by year. E_{jt}^k is the expenditure per product group in the trade partner countries by year. Y_t^k is the world output or expenditures of product group (k) at time t . σ_k is the intra-product group elasticity of substitution⁶ and Π_{it}^k and P_{jt}^k are the multilateral resistance terms. Finally, τ_{ijt}^k are the trade costs variables, which

6 I assume that the elasticity of substitution is constant over time.

consist of the FTA_{ijt}^k dummy variables and a set of standard gravity variables $(X_\delta)_{ij}$, such as distance between trade partners, time difference or the occurrence of a common language or common border. Note that the latter are constant over time.

To control for the multilateral resistance terms, I use fixed effects in their respective dimensions.⁷ However, because my model includes only one country at the side of exports (or imports), I cannot fully control for the multilateral resistance terms. Otherwise, the fixed effects μ_{jt}^k (included to control for the inward multilateral resistance terms P_{jt}^k) would vary in the same dimensions as the FTA variables FTA_{ijt}^k .⁸ Consequently, I assume that the multilateral resistance terms are constant over time, following DE BROMHEAD, FERNIHOUGH, LAMPE and O'ROURKE (2017). Accordingly, I include *product group times country dummies* μ_j^k to control for the inward multilateral resistance terms P_j^k , and *product group times year dummies* μ_t^k to control for the outward multilateral resistance term Π_t^k . The *product group times country dummies* μ_j^k also control for the elasticity σ_k and the normal gravity control variable $X_\delta)_j$ (such as distance, common language, and so on).

Further, I have to approximate Y_{it}^k , E_{jt}^k , Y_t^k . The most common approach is to approximate these variables with GDP data even though the relationship is not as close as at aggregate data (DE BROMHEAD, FERNIHOUGH, LAMPE and O'ROURKE, 2017; UNESCAP, 2013). The resulting variables are GDP_{it} , GDP_{jt} and GDP_t , of which GDP_{it} and GDP_t are controlled for by year dummies μ_t as i stands for Switzerland and is therefore constant.

In consequence, my model presents itself in log-linear form as follows:

$$\ln X_{ijt} = \beta_0 + \beta_1 \ln GDP_{jt} + \beta_2 FTA_{ijt}^k + \mu_j^k + \mu_t + \varepsilon_{ijt}^k \quad (3)$$

An issue of importance for trade policy analysis focused on FTAs is the endogeneity of such agreements. In an influential paper, BAIER and BERGSTRAND (2007) showed that FTA variables exhibit an important endogeneity bias due to omitted variables related to the self-selection of FTA partner countries. They point out that unobservable policy-related barriers to trade that are correlated with the decision to form a FTA could be an example of such unobserved heterogeneity. BAIER and BERGSTRAND (2007) assume that the unobserved heterogeneity is time-invariant. In consequence, they propose estimating the model with panel data and fixed effects to control for all time-invariant unobservable heterogeneity. For my model, this would imply including *product group times country fixed effects* (μ_j^k).

7 For a structural interpretation, see ROSE and VAN WINCOOP (2001) or REDDING and VENABLES (2004).

8 Note that i is constant as it stands for Switzerland, wherefore it can be omitted.

As these fixed effects are already included to control for the inward multilateral resistance term and as I already use panel data, my model takes account of the endogeneity of FTAs.

Finally, SANTOS SILVA and TENREYRO (2006) point out that in the case of a high frequency of zero trade flows and heteroscedasticity in the residuals, the OLS estimation in log-linear form can have significant biases. They therefore suggest estimating the gravity equation in its multiplicative form with the Poisson pseudo-maximum likelihood estimator (PPML). The estimation in the multiplicative form naturally includes observations with zero trade flows and is consistent in the presence of fixed effects, which allows the multilateral resistance terms as described above to be accounted for. As the PPML estimator has proved to perform well in recent papers (DE BROMHEAD, FERNIHOUGH, LAMPE and O'ROURKE, 2017; GÓMEZ-HERRERA, 2013; SANTOS SILVA and TENREYRO, 2011) and because my empirical model builds upon the theoretical model developed by ANDERSON and VAN WINCOOP (2003), I use, besides OLS, the PPML estimation method proposed by SANTOS SILVA and TENREYRO (2006).⁹ For PPML my estimation equations in the multiplicative form for industry export flows can be written as follows:

$$X_{ijt}^k = \exp[\beta_0 + \beta_1 \ln GDP_{jt} + \beta_2 FTA_{jt}^k + \mu_j^k + \mu_t + \varepsilon_{ijt}^k] \quad (4)$$

5 Estimation results

5.1 Baseline results

Table 1 and Figure 5 display the baseline estimation results. Table 1 displays the estimation results for OLS and PPML at the disaggregated level if all FTAs are subsumed to one general FTA variable (fta0). Figure 5 displays the estimation results of the individual FTA effects (OLS and PPML at the disaggregated level) for industry exports and imports.

As is apparent, in both baseline estimations the results are not entirely conclusive. The estimates for the general FTA variable with OLS indicate a statistically significant positive trade effect for exports and imports, but are statistically not different from zero if estimated with PPML. The same applies to the individual FTA estimates. Even though the majority of the FTAs have a significant positive effect on trade in the estimation with OLS, this is hardly the case for the estimations with PPML.

9 For the estimations, the PPML command written by SANTOS SILVA and TENREYRO (2011) or POI2HDFE provided by GUIMARES and PORTUGAL (2010), FIGUEIREDO, GUIMARES and WOODWARD (2015) and CORREIA (2016) are used.

Table 1: Estimation results with one general FTA variable

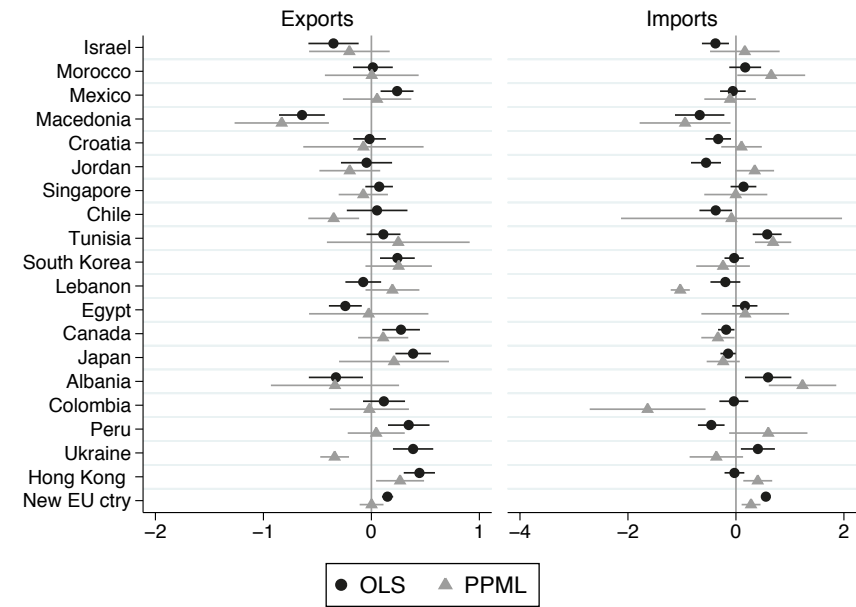
Variables	(1) OLS Exports	(2) PPML Exports	(3) OLS Imports	(4) PPML Imports
lgdp	0.769*** 0.769***	0.602*** (0.0812)	0.612*** (0.0345)	0.602*** (0.188)
fta0	0.0954*** (0.0222)	0.105 (0.0867)	0.276*** (0.0295)	0.0775 (0.0833)
Observations	228,973	254,430	169,568	238,480
R-squared	0.824		0.817	
R-squared within	0.0192	0.0161	0.00967	0.0181
Number of clusters	11471	11565	10326	10840
Pseudo log-likelihood		-6844		-5783
Country*Product Group FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes

Notes: Robust standard errors clustered at the panel ID in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; Note that coefficient estimates for fixed effects are not reported for brevity, singleton groups are dropped by reghdfe and empty cells represent variables that are perfectly collinear or dropped due to singletons. PPML estimated with poi2hdfe, while R-squared within is estimated manually according to Silva Santos & Tenreiro (2006).

The inclusion of zero trade flows through the PPML estimator appears to render most effects insignificant. There are almost no significant trade creation effects if the results from the PPML estimator are considered, and some estimates even indicate a significant negative trade effect, which is at odds with standard trade theory.

The questions that arise are whether the results with PPML or the results with OLS capture the true effect of FTAs, and whether some methodological problems may be the reason for the overall inconclusive results, which contradict the descriptive evidence provided earlier.

Figure 5: Individual FTA estimation results¹⁰



5.2 Robustness

To assess the validity of the results presented, it is useful to perform different robustness tests which may give a hint towards an underlying methodological problem. A first explanation may be that some subcategories of industry goods are driving the insignificant results. Figures 6 and 7 therefore display the estimation results for the subcategories chemicals (SITC head chapter 5), manufactured goods (SITC head chapter 6), machinery goods (SITC head chapter 7) and miscellaneous goods (SITC head chapter 8).¹¹

It is clear that the division in subcategories does not reveal much information; there does not seem to be a single subcategory which is driving the insignificant results in the baseline estimates.

¹⁰ To illustrate the results, coefficient plots by JANN (2014) are used; the coefficient plots display always the 90% confidence interval.

¹¹ Detailed regression tables for all four subcategories are omitted for brevity.

Figure 6: Estimation results for chemicals (top panel) and manufactured goods (bottom panel)

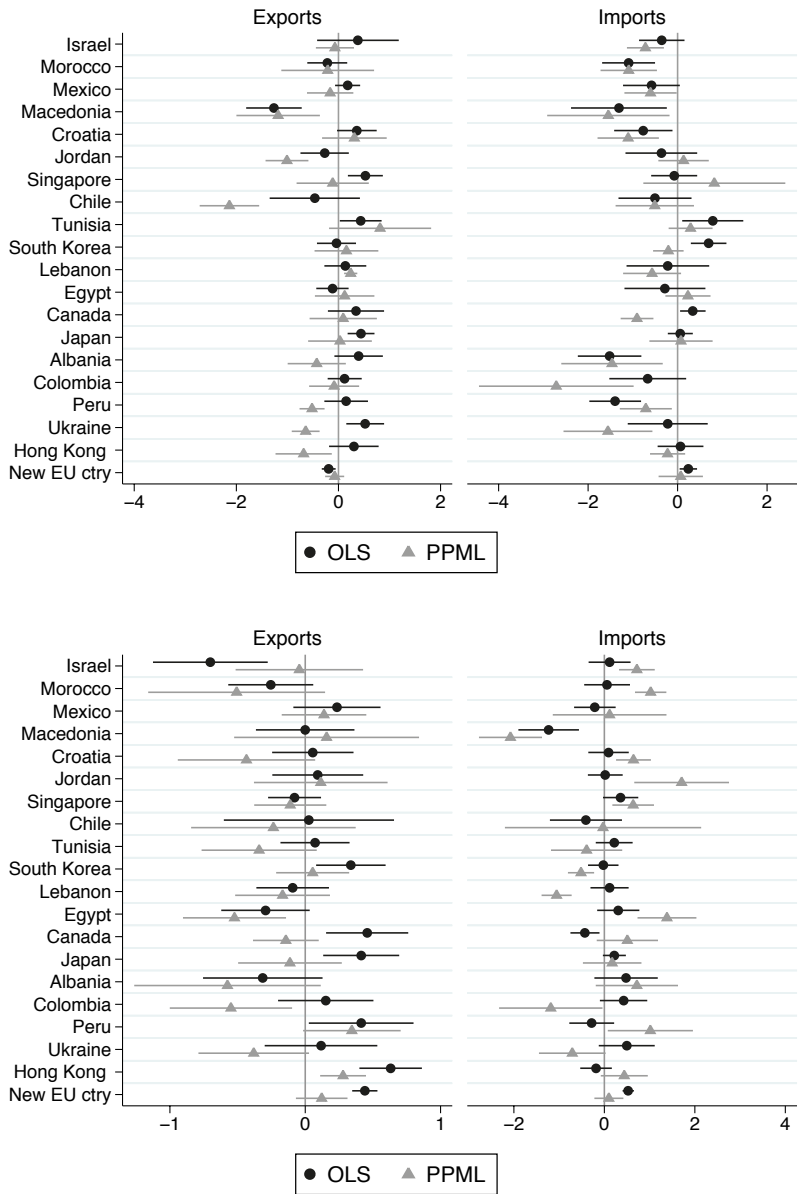
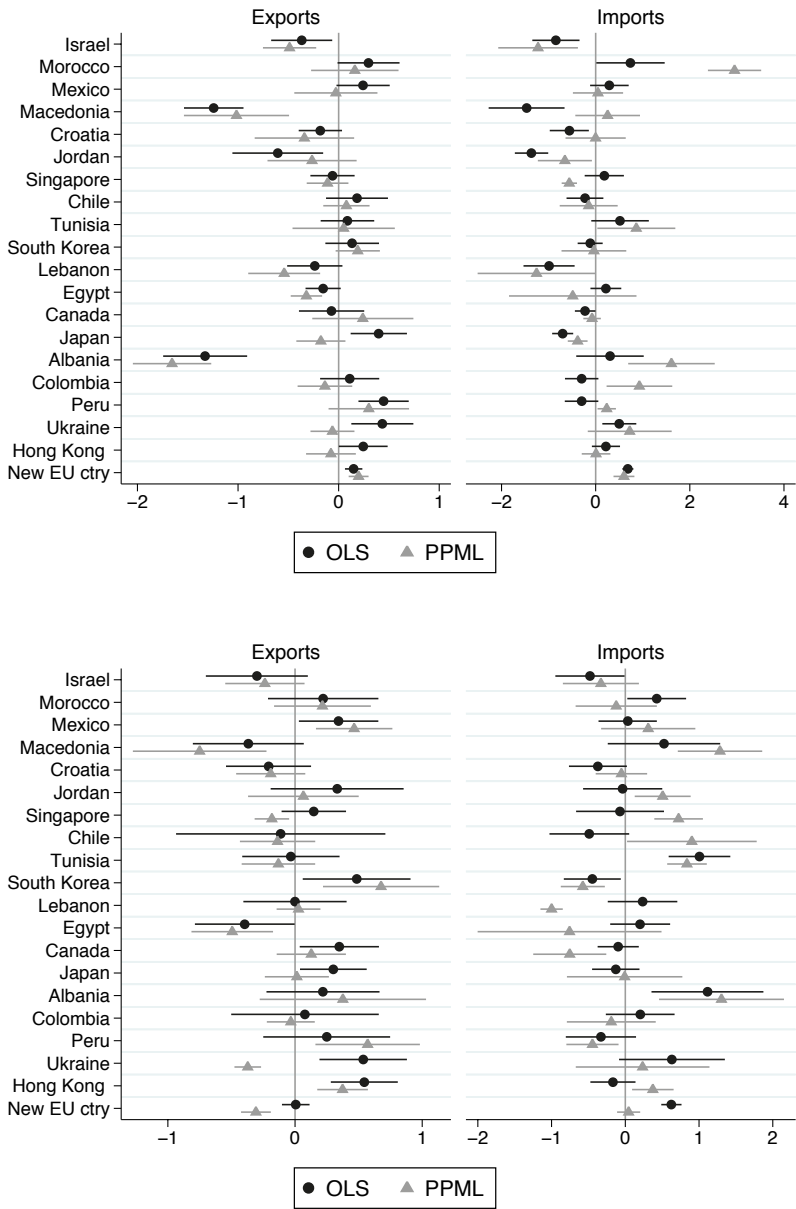
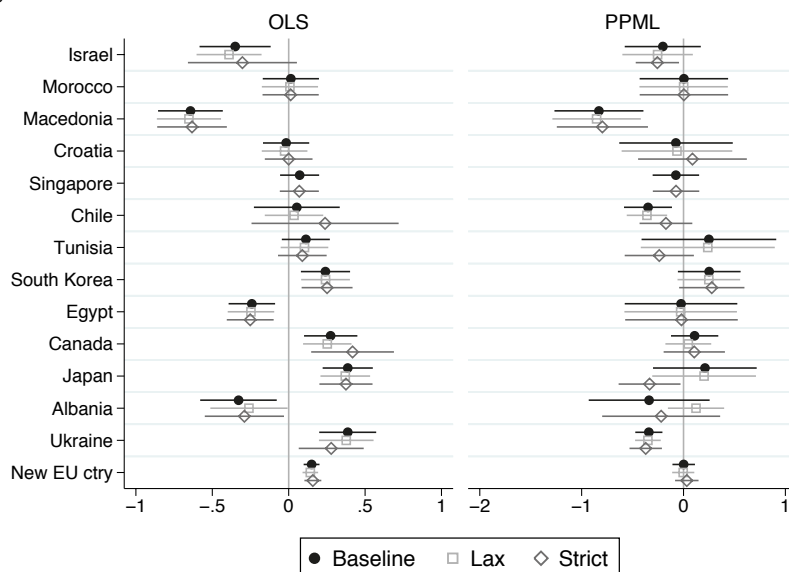


Figure 7: Estimation results for machinery (top panel) and miscellaneous goods (bottom panel)



Another potential problem may be the coding of the FTA dummy variable. In Section 3.1, I defined the FTA dummy variable such that it is assigned a value of one if the majority of tariff lines (>50%) of the specific product group received preferential treatment. Figure 8 reveals that the results are similar with a lax definition of the FTA variable (all product groups which include at least one tariff line where the FTA is applicable are coded as one) or a strict definition (only the product groups for which more than 75% of all tariff lines foresee preference tariffs for the FTA partner are coded as one).

Figure 8: Estimation results with different definitions for the FTA



Note:

Based on estimations for industry exports at the disaggregated level.¹²

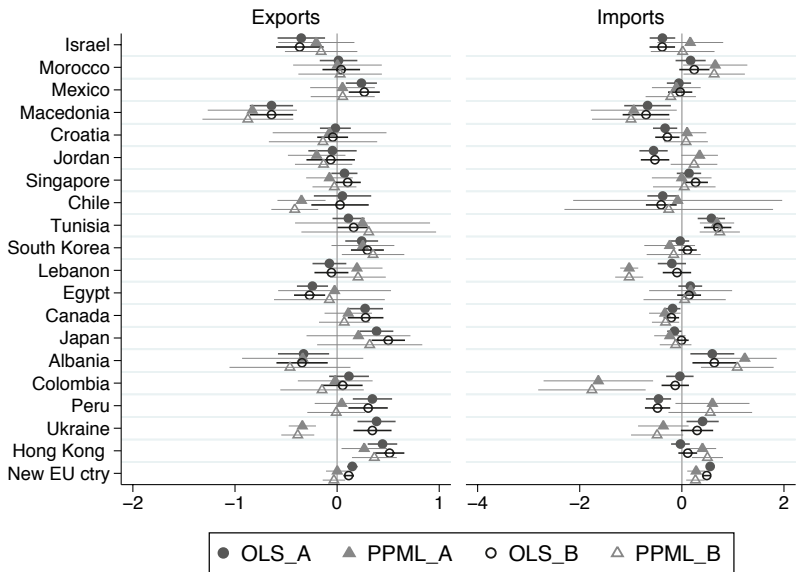
A final test will reveal if nominal price changes may be driving the results. As the estimation includes only year dummies, it controls only for price changes at the global level. To control for price changes at the country level, I re-estimate the baseline estimation in a specification with real GDP¹³ and trade flows scaled by the corresponding GDP deflator (marked as Model B). Figure 9 shows that the

12 Some FTAs had to be excluded because they could not be estimated according to the lax definition as they would have included all industry product groups, which causes problems with my clustered standard errors at the product-group level.

13 Real GDP using national account growth rates at constant 2011 national prices from Penn World Tables 9.0 is used (RGDP^{NA}) (FEENSTRA, INKLAAR and TIMMER, 2015).

estimates are very similar to the baseline estimates (marked as Model A) albeit less precise in the most cases.¹⁴

Figure 9: Estimation with real GDP (B) and nominal GDP (A (baseline))



Note: Based on estimations for industry exports and imports at the disaggregated level.

5.3 Critical evaluation

To sum up, the robustness tests did not reveal clear answers. There was no single subcategory which rendered the PPML estimates insignificant, rather the differences between OLS and PPML remained in all estimates for the different subcategories. Further, the results are robust to changes in the definition of the FTA variable and the use of real GDP and real trade flows. However, there are at least two methodological issues which could not be included in any robustness test.

First, it is worth considering that FTAs always imply a certain cost of usage (administrative costs for certificates of origin, cost of information about the

¹⁴ It is also conceivable that price changes vary from product group to product group. It is highly likely, for instance, that fluctuations in oil prices included in the GDP deflator do not correspond to price changes of certain machinery components. However, the baseline specification is also robust to a specification with time-varying product-group fixed effects to control for such differences in price changes at the product-group level.

applicable tariff, longer transportation time due to non-standard custom clearance, and so on). Given such costs, a company will use the FTA only if the costs related to its usage are lower than the benefits associated with lower tariffs. This cost-benefit ratio is likely to be positive for product groups for which average trade volumes are higher.

This could explain why OLS tends to have more positive and significant trade effects. In contrast to PPML, OLS truncates the zero trade flows and therefore has a bias towards trade flows with higher volume and, consequently, better cost-benefit ratios.

Taking into account the cost-benefit ratio, it can further be expected that significant trade effects appear in particular for FTAs with the largest trade partners, as the trade volumes per product group and firm tend to be higher. Consequently, this could explain the rather inconclusive results for smaller trade partners in the panel. Unfortunately, the FTA with Switzerland's largest trade partners – namely, the FTA with the European Union – was concluded in 1972, so my panel cannot measure the effect of this FTA. This argument seems also to be congruent with the fact that OLS results for exports indicate significant effects for all of Switzerland's large trade partners in the panel (Mexico, South Korea, Canada, Japan, Hong Kong, and the new EU countries).

Further, the costs of using an FTA may explain why the effects on imports are overall less positive than the effects on exports, as Switzerland already has very low import tariffs on products that are included in the FTAs, especially for industrial products. Consequently, the actual trade effect on the product group level may be rather small.

The second methodological issue that renders the measurement of trade effects of FTAs difficult is the fact that the FTA dummy at the disaggregated level may not be a good proxy for the whole FTA effect on trade. As mentioned in Section 2, modern FTAs consist of much more than just a reduction in tariffs which is measured by the FTA dummy variable. Product groups affected by further provisions in the FTA (such as provisions regarding government procurement) may be different to the product groups benefiting from a tariff reduction. This would render the estimation less precise and mask the real effect.¹⁵ Moreover, most FTAs foresee for each tariff line transitional periods of several years to reduce the tariffs. Even though the reduction at the start is normally the most relevant, this blurs the trade effect and renders the measurement with a dummy variable difficult. A solution might be to use the actual applicable tariffs and the

15 An estimation at the aggregated level would circumvent this problem but could not exploit the variation at the product-group level.

actual reduction in each year instead of a FTA dummy variable, and to decode other provisions of the FTA for each product group, to render the estimates more precise.

Further research could therefore follow several paths. Concerning the Swiss FTAs, it seems most promising to take a look at a longer observation period in order to include the FTA with the European Union concluded in 1972, but also to obtain more precise results for the other FTAs.¹⁶ Such research would also allow an analysis of whether FTAs with “second priority trade partners” do indeed exhibit lower trade creation effects than FTAs among major trade partners due to the costs for firms linked to the use of such agreements. Such work seems highly relevant given the continuous proliferation of FTAs worldwide. On the other hand, the use of the actual tariff reductions at each product group over the transitional period and the inclusion of further provisions of FTAs in the coding of the FTA dummy variable would certainly render the estimates more precise and reliable.

6 Conclusion

This work sheds light on various caveats in the measurement of FTA effects on trade, and thus provides several possible explanations for why the effects of FTAs reported in the literature vary substantially depending on the FTA.

The focus on Swiss trade flows allowed the effect of each individual FTA to be analyzed in depth. Using a dataset covering exports and imports between 1993 and 2014, this work analyzed 20 of the 30 Swiss FTAs currently into force. Following the literature, the effect of these FTAs on trade have been estimated using a standard gravity model with a set of fixed effects to control for country-, time- and product group-specific characteristics. The resulting model was estimated with standard OLS and the popular PPML estimator, which allows zero trade flows to be incorporated into the estimation.

The estimated trade effects are not entirely conclusive and strongly contradict the descriptive evidence. The further analysis showed that there may be important methodological caveats to consider, even though the results are robust to an analysis of different subcategories of industry goods, to changes in prices, and to other definitions of the FTA dummy variable.

¹⁶ Unfortunately, as yet disaggregated data back to 1972 are not available electronically.

First, it was argued that the inconclusive results might be partly explained by the fact that the usage of FTAs implies costs for companies. Hence, OLS – which truncates zero trade flows – might tend to overestimate the trade creation effect. For the same reason, it seems more likely that positive trade creation effects will be found for FTAs with larger trade partners than for FTAs with smaller trade partners. It was stated that this might explain the inconclusive results of this work, which could not include – due to data limitations – the most important FTA (i.e. the FTA with the European Union. Second, it was argued that FTA dummy variables may not be precise enough to capture the real trade effect, as preferential tariffs enter into force over transitional periods and because modern FTAs include more than just tariff reductions. Instead of FTA dummy variables, a continuous variable which measures the actual reduction in the tariff rates and the FTA variables which control for further provisions of an FTA seem necessary to render estimates more precise, especially at the disaggregated level.

This work shows that even though the empirical literature on the effect of FTAs is already quite exhaustive, there remain important methodological difficulties that may explain the heterogeneity in FTA effects reported.

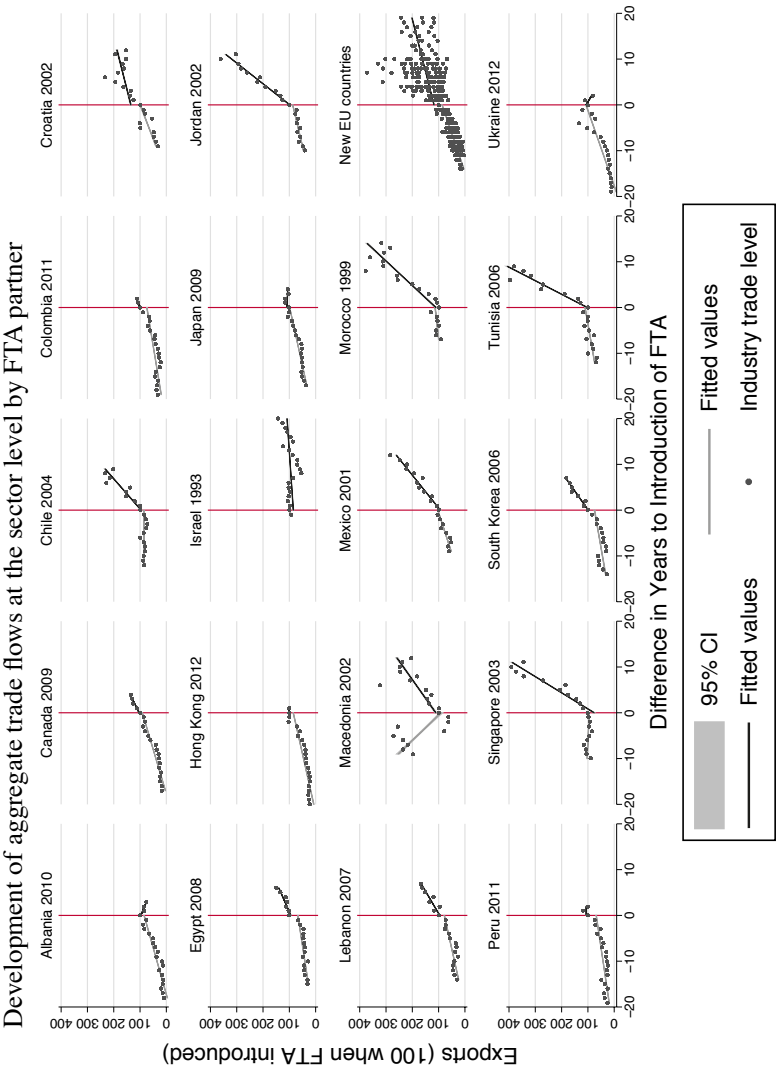
References

- ANDERSON, JAMES E. and ERIC VAN WINCOOP (2003), Gravity with Gravitas : A Solution to the Border Puzzle, *The American Economic Review* 93 (1), pp. 170–192.
- BAIER, SCOTT L. and JEFFREY H. BERGSTRAND (2007), Do free trade agreements actually increase members' international trade?, *Journal of International Economics* 71 (1), pp. 72–95.
- BALDWIN, RICHARD and DARIA TAGLIONI (2006), Gravity for Dummies and Dummies for Gravity Equations, NBER Working Paper No. 12516, Cambridge, MA.
- DE BROMHEAD, ALAN, ALAN FERNIHOUGH, MARKUS LAMPE and KEVIN H. O'ROURKE (2017), When Britain turned inward: Protection and the shift towards Empire in interwar Britain, QUCEH Working Paper Series No. 2017-02.
- CORREIA, SERGIO (2016), REGHDFE: Stata module to perform linear or instrumental-variable regression absorbing any number of high-dimensional fixed effects, Statistical Software Components series, Department of Economics, Boston College.
- FEENSTRA, ROBERT C., ROBERT INKLAAR and MARCEL P. TIMMER (2015), The next generation of the penn world table, *American Economic Review* 105 (10), pp. 3150–3182.

- FIGUEIREDO, OCTÁVIO, PAULO GUIMARÃES and DOUGLAS WOODWARD (2015), Industry localization, distance decay, and knowledge spillovers: Following the patent paper trail, *Journal of Urban Economics* 89, pp. 21–31.
- GÓMEZ-HERRERA, ESTRELLA (2013), Comparing alternative methods to estimate gravity models of bilateral trade, *Empirical Economics* 44 (3), pp. 1087–1111.
- GUIMARAES, PAULO and PEDRO PORTUGAL (2010), A Simple Feasible Alternative Procedure to Estimate Models with High-Dimensional Fixed Effects, *Stata Journal* 10 (4), pp. 628–649.
- JANN, BEN (2014), Plotting regression coefficients and other estimates, *The Stata Journal* 14 (4), pp. 708–737.
- REDDING, STEVEN and ANTHONY J. VENABLES (2004), Economic geography and international inequality, *Journal of International Economics* 62 (1), pp. 53–82.
- ROSE, ANDREW K. and ERIC VAN WINCOOP (2001), National Money as a Barrier to International Trade: The Real Case for Currency Union, *The American Economic Review* 91 (2), pp. 386–390.
- SANTOS SILVA, J.M.C. and SILVANA TENREYRO (2006), The Log of Gravity, *The Review of Economics and Statistics* 88 (4), pp. 641–658.
- SANTOS SILVA, J.M.C. and SILVANA TENREYRO (2011), Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator, *Economics Letters* 112 (2), pp. 220–222.
- SECO (2016), *Die wirtschaftlichen Auswirkungen von Freihandelsabkommen*, Bern.
- TINBERGEN, JAN (1962), *Shaping the world economy; suggestions for an international economic policy*, Twentieth Century Fund, New York.
- UN COMTRADE. (2016), United Nations Commodity Trade Statistics Database, Geneva (<http://comtrade.un.org/>).
- UNCTAD (2016), Trade Analysis Information System (TRAINS), Geneva (<http://unctad.org/en/Pages/DITC/Trade-Analysis/Non-Tariff-Measures/NTMs-trains.aspx>).
- UNESCAP (2013), *The Gravity Model of International Trade: A User Guide*, United Nations, Geneva.
- VAN BERGEIJK, PETER A. G. and STEVEN BRAKMAN (Editors) (2010), *The gravity model in international trade: Advances and applications*, Cambridge University Press, Cambridge, UK.
- WTO (2016), Regional trade agreements, Geneva (https://www.wto.org/english/tratop_e/region_e/region_e.htm).

Appendix

Figure A1:



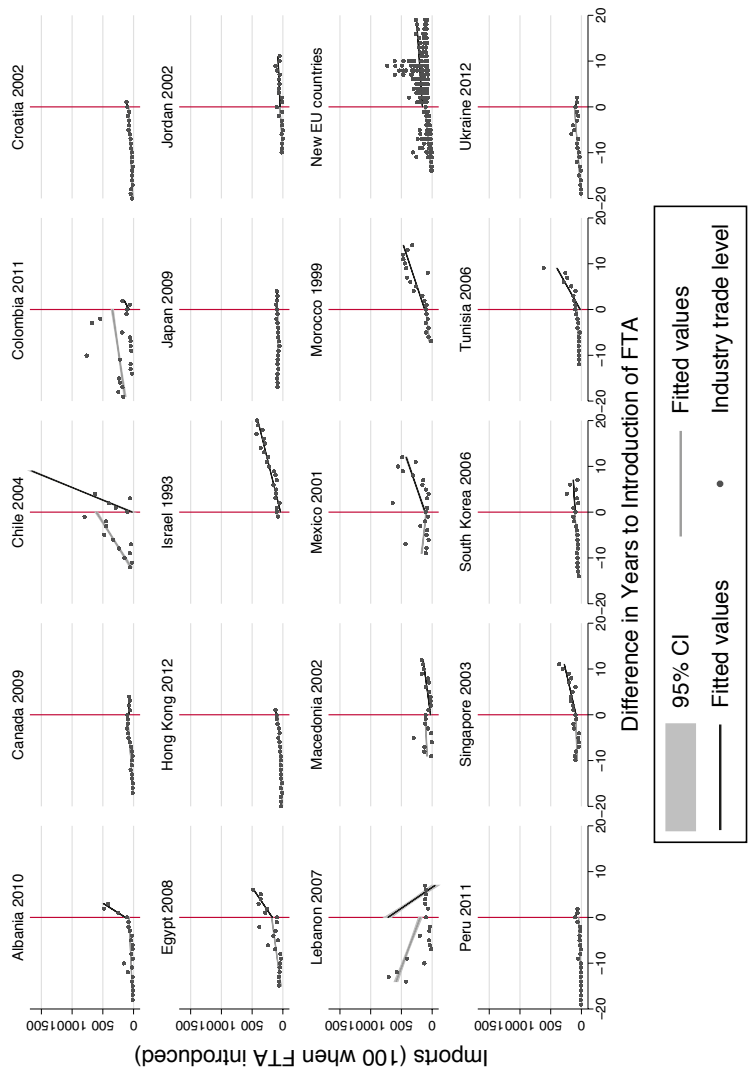


Table A1: List of FTAs included in the estimation

FTA partner	Date of entry into force	Dummy variable
General FTA variable	-	<i>fta0</i>
New EU members	1995, 2004, 2007 and 2013	<i>eu_n</i>
Israel	1st July 1993	<i>fta_isr</i>
Morocco	1st December 1999	<i>fta_mar</i>
Mexico	1st July 2001	<i>fta_mex</i>
Macedonia	1st May 2002	<i>fta_mkd</i>
Jordan	1st September 2002	<i>fta_jor</i>
Croatia	1st January 2002 – 1st July 2013 (accession of Croatia to the EU)	<i>fta_hrv</i>
Singapore	1st January 2003	<i>fta_sgp</i>
Chile	1st December 2004	<i>fta_chl</i>
Tunisia	1st June 2006	<i>fta_tun</i>
South Korea	1st September 2006	<i>fta_kor</i>
Lebanon	1st January 2007	<i>fta_lbn</i>
Egypt	1st September 2008	<i>fta_egy</i>
Canada	1st July 2009	<i>fta_can</i>
Japan	1st September 2009	<i>fta_jpn</i>
Albania	1st November 2010	<i>fta_alb</i>
Colombia	1st July 2011	<i>fta_col</i>
Peru	1st July 2011	<i>fta_per</i>
Ukraine	1st June 2012	<i>fta_ukr</i>
Hong Kong	1st October 2012	<i>fta_hkg</i>

Table A2: Summary statistics

VARIABLES	N	mean	sd	min	max
exports	398,112	7.234e+06	7.946e+07	0	1.187e+10
gdp_exp	398,112	4.286e+11	1.526e+11	2.637e+11	7.010e+11
gdp_imp	398,112	5.749e+11	1.620e+12	1.228e+09	1.742e+13
fta_isr	398,112	0.00665	0.0813	0	1
fta_mar	398,112	0.00738	0.0856	0	1
fta_mex	398,112	0.00536	0.0730	0	1
fta_mkd	398,112	0.00493	0.0700	0	1
fta_hrv	398,112	0.00588	0.0764	0	1
fta_jor	398,112	0.00289	0.0537	0	1
fta_sgp	398,112	0.00455	0.0673	0	1
fta_chl	398,112	0.00186	0.0431	0	1
fta_tun	398,112	0.00352	0.0592	0	1
fta_kor	398,112	0.00400	0.0631	0	1
fta_lbn	398,112	0.00324	0.0568	0	1
fta_egy	398,112	0.00331	0.0574	0	1
fta_can	398,112	0.00139	0.0373	0	1
fta_jpn	398,112	0.00142	0.0376	0	1
fta_alb	398,112	0.00167	0.0408	0	1
fta_col	398,112	0.00154	0.0393	0	1
fta_per	398,112	0.00168	0.0410	0	1
fta_ukr	398,112	0.00122	0.0349	0	1
fta_hkg	398,112	0.000754	0.0274	0	1
eu_n	398,112	0.0766	0.266	0	1
fta0	398,112	0.265	0.441	0	1

VARIABLES	N	mean	sd	min	max
imports	398,112	6.747e+06	6.846e+07	0	1.019e+10
gdp_exp	398,112	5.749e+11	1.620e+12	1.228e+09	1.742e+13
gdp_imp	398,112	4.286e+11	1.526e+11	2.637e+11	7.010e+11
fta_isr	398,112	0.00992	0.0991	0	1
fta_mar	398,112	0.00705	0.0836	0	1
fta_mex	398,112	0.00611	0.0779	0	1
fta_mkd	398,112	0.00620	0.0785	0	1
fta_hrv	398,112	0.000944	0.0307	0	1
fta_jor	398,112	0.00561	0.0747	0	1
fta_sgp	398,112	0.00561	0.0747	0	1
fta_chl	398,112	0.00472	0.0686	0	1
fta_tun	398,112	0.00460	0.0676	0	1
fta_kor	398,112	0.00462	0.0678	0	1
fta_lbn	398,112	0.00378	0.0613	0	1
fta_egy	398,112	0.00331	0.0574	0	1
fta_can	398,112	0.00236	0.0485	0	1
fta_jpn	398,112	0.00235	0.0484	0	1
fta_alb	398,112	0.00191	0.0437	0	1
fta_col	398,112	0.00148	0.0384	0	1
fta_per	398,112	0.00148	0.0384	0	1
fta_ukr	398,112	0.00142	0.0376	0	1
fta_hkg	398,112	0.000949	0.0308	0	1
eu_n	398,112	0.0888	0.284	0	1
fta0	398,112	0.309	0.462	0	1

Regression tables

Table A3: Baseline estimates disaggregated level

VARIABLES	(1) OLS Exports	(2) PPML ¹ Exports	(3) OLS Imports	(4) PPML ¹ Imports
fta_isr	-0.351** (0.141)	-0.204 (0.227)	-0.380** (0.152)	0.165 (0.392)
fta_mar	0.0142 (0.112)	0.00354 (0.264)	0.172 (0.179)	0.654* (0.382)
fta_mex	0.238** (0.0926)	0.0530 (0.193)	-0.0568 (0.144)	-0.108 (0.290)
fta_mkd	-0.643*** (0.129)	-0.830*** (0.266)	-0.672** (0.278)	-0.942* (0.512)
fta_hrv	-0.0169 (0.0920)	-0.0736 (0.339)	-0.328** (0.144)	0.104 (0.228)
fta_jor	-0.0452 (0.144)	-0.200 (0.171)	-0.555*** (0.169)	0.348 (0.218)
fta_sgp	0.0715 (0.0777)	-0.0749 (0.139)	0.139 (0.145)	-0.00270 (0.355)
fta_chl	0.0532 (0.171)	-0.349** (0.143)	-0.374** (0.183)	-0.0817 (1.244)
fta_tun	0.112 (0.0955)	0.249 (0.402)	0.578*** (0.163)	0.689*** (0.204)
fta_kor	0.241** (0.0978)	0.253 (0.187)	-0.0339 (0.108)	-0.239 (0.302)
fta_lbn	-0.0752 (0.101)	0.195 (0.152)	-0.196 (0.168)	-1.031*** (0.107)
fta_egy	-0.241*** (0.0925)	-0.0246 (0.336)	0.165 (0.142)	0.172 (0.494)
fta_can	0.275*** (0.106)	0.109 (0.141)	-0.180* (0.0923)	-0.333* (0.188)
fta_jpn	0.386*** (0.0998)	0.209 (0.309)	-0.145* (0.0861)	-0.236 (0.186)
fta_alb	-0.329** (0.152)	-0.337 (0.361)	0.597** (0.261)	1.233*** (0.380)
fta_col	0.117 (0.118)	-0.0184 (0.223)	-0.0386 (0.163)	-1.636** (0.652)

VARIABLES	(1) OLS Exports	(2) PPML¹ Exports	(3) OLS Imports	(4) PPML¹ Imports
fta_per	0.346*** (0.117)	0.0450 (0.161)	-0.457*** (0.150)	0.599 (0.441)
fta_ukr	0.386*** (0.113)	-0.340*** (0.0809)	0.407** (0.192)	-0.363 (0.301)
fta_hkg	0.444*** (0.0880)	0.266** (0.135)	-0.0277 (0.111)	0.404** (0.163)
eu_n	0.150*** (0.0315)	0.00184 (0.0671)	0.556*** (0.0419)	0.280*** (0.106)
lgdp	0.774*** (0.0260)	0.623*** (0.0773)	0.556*** (0.0352)	0.579*** (0.195)
Observations	228,973	254,430	169,568	238,480
R-squared	0.825		0.818	
R-squared within	0.0209	0.0155	0.0140	0.0171
Number of clusters	11471	11565	10326	10840
Pseudo log-likelihood		-6843		-5781
Country*Product Group FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes

Notes:

Robust standard errors clustered at the panel ID in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Note that coefficient estimates for fixed effects are not reported for brevity, singleton groups are dropped by reghdfe and empty cells represent variables that are perfectly collinear or dropped due to singletons. 1 Estimated with poi2hdfe, while R-squared within is estimated manually according to Silva Santos & Tenreiro (2006).

Table A5: Estimates for the general FTA variable

VARIABLES	(1) OLS Exports	(2) PPML¹ Exports	(3) OLS Imports	(4) PPML¹ Imports
lgdp	0.769*** (0.0256)	0.602*** (0.0812)	0.612*** (0.0345)	0.602*** (0.188)
fta0	0.0954*** (0.0222)	0.105 (0.0867)	0.276*** (0.0295)	0.0775 (0.0833)
Observations	228,973	254,430	169,568	238,480
R-squared	0.824		0.817	
R-squared within	0.0192	0.0161	0.00967	0.0181
Number of clusters	11471	11565	10326	10840
Pseudo log-likelihood		-6844		-5783
Country*Product Group FX	Yes	Yes	Yes	Yes
Year FX	Yes	Yes	Yes	Yes

Notes:

Robust standard errors clustered at the panel ID in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Note that coefficient estimates for fixed effects are not reported for brevity, singleton groups are dropped by reghdfe and empty cells represent variables that are perfectly collinear or dropped due to singletons.
¹ Estimated with poi2hdfe, while R-squared within is estimated manually according to Silva Santos & Tenreiro (2006).