Revisiting the trade effects of services agreements

Shingal, Anirudh

29 September 2013

Revisiting the trade effects of services agreements

Anirudh Shingal*

29 September 2013

Abstract

The proliferation of services trade agreements and improved availability of data on bilateral services trade flows has resulted in a growing literature on the theoretical and empirical assessment of services trade effects. In this paper, we revisit the trade effects of services agreements using an updated database on bilateral services trade flows from the OECD and based on recent developments in the estimation of structural gravity models. Our results suggest a services trade effect of 13.7% at the intensive margin, with significantly higher estimates for intra-EU trade. However, the trade effect becomes weakly significant when the estimation includes zero trade flows. Incorporation of anticipation effects in the analyses accentuates the average treatment effect significantly (and monotonically with time) but only at the intensive margin.

JEL classification: F10, F13, F15

Key words: Services trade, PTAs, gravity model, endogeneity, anticipation effects

*Senior Research Fellow, WTI, University of Bern. I would like to thank the Swiss NCCR in Trade Regulation for financial support and Sebastien Miroudot for generous use of the updated OECD database used in this paper. This paper was presented at the 2013 World Trade Forum in Bern. Address for correspondence: World Trade Institute, Hallerstrasse 6, CH - 3012, Bern. Tel: +41-31-6313270; Fax: +41-31-6313630; Email: anirudh.shingal@wti.org.

1 Introduction

One of the striking features of trade diplomacy in recent years has been the pace of preferential goods trade liberalization and rule-making. More recently, a similar trend is observed regarding services trade. Of the 83 preferential trade agreements (PTAs) notified to the World Trade Organization (WTO) and in force prior to the year 2000, 73 (87.9%) featured provisions dealing exclusively with trade in goods. Since then, another 176 PTAs went into force of which 105 (59.7%) also include provisions on services trade[1]. This development indicates the rising importance of services trade in general, the growing need felt by countries to place such trade on a firmer institutional and rule-making footing, and the attractiveness of doing so on an expedited basis via preferential negotiating platforms (Sauvé and Shingal, 2011).

Economic literature is replete with theoretical models and empirical analyses documenting the impact of PTAs on trade between partner countries. Most of this work, however, traditionally looked at trade in merchandise goods only. An important reason for this was the lack of availability of bilateral services trade data. This lacuna was, however, filled with the publication of the OECD's database on bilateral services trade[2]; since its publication Grünfeld and Moxnes (2003), Mirza and Nicoletti (2004),Ceglowski (2006), Kimura and Lee (2006), Kox and Lejour (2006), Walsh (2006), Lennon (2008), Shingal (2009), Marchetti (2011) and Egger et al. (2012) have used this dataset to examine the trade effect of services accords on aggregate and disaggregated services trade flows.

The earlier papers in this literature were constrained by limited coverage both in terms of the country sample and time period. However, Marchetti (2011) was able to exploit a larger data set comprising 30 OECD exporters and 55 OECD and non-OECD importers over 1999-2006. Egger et.al. (2012), on the other hand, focussed on bilateral services trade among 16 European OECD countries over 1999-2006. This literature is also diverse in terms of the model specifications, estimation methodologies (OLS, IV, Fixed Effects, SUR, Poisson PML, Hausman-Taylor, SFGNLS) and the magnitudes of the estimated trade effects[3]. While

[1] As of 15 August 2013, the total number of STAs in force was 118. These included three alliances (MERCOSUR, EFTA and CARICOM) where an STA was negotiated after 2000 in addition to a pre-existing trade agreement in goods.

[2] In 2002, the OECD Secretariat presented data on total trade in services, broken down by partner country, for 26 OECD member countries over 1999-2002. This has now been extended to cover 35 reporting countries from the OECD, 238 OECD and non-OECD partner countries and 12 years (1999-2010).

[3] For instance, Grünfeld and Moxnes (2003) and Walsh (2006) found the trade effects to be statistically insignificant while Lennon (2008), Shingal (2009) and Marchetti (2011) reported estimates of around 15%. The trade effects were higher in Ceglowski, 2006 (38-68%), Kimura & Lee, 2006 (24.5%) and Kox & Lejour, 2006 (30-62%) though the latter only studied the EU15. Egger et.al. 2012 (219.6%) reported the largest estimates but they only considered services trade among 16 European OECD countries.

Shingal (2009) was the first paper in the services literature to endogenize STA membership and account for its lagged effects on trade empirically, none of the other cited papers have addressed these issues.

In this paper, we revisit the trade effects of services agreements using the OECD's updated database on bilateral services trade flows with greater country (35 exporters and 238 importers) and time coverage (1999-2010). Our empirical analyses are based on recent developments in the estimation of structural gravity models (for instance see Head and Mayer, 2013). In addition to accounting for the phasing-in of STAs empirically and treating STA membership as endogenous, we also examine trade effects of STA membership allowing for zero trade flows.

Our results suggest a (weakly significant) trade effect of 16.1% from having a services accord (13.7% at the intensive margin). This effect rises to 26.1% for the intra-EU trading partners in our sample, with the intensive margin results much higher at 53.4%. The services trade effect is also found to get significantly accentuated once anticipation effects of accession are included in the analysis but only at the intensive margin. These results also suggest that the maximum impact of a services accord is felt the farthest in time from actual accession; thus services agreements seem to have a significant "announcement effect" for firms already engaged in services trade.

The rest of the paper is structured as follows. In the next section, we present the theoretical framework underlying our empirical strategy in Section 3. Section 4 looks at the data while Section 5 discusses estimation issues. Section 6 discusses the results and Section 7 concludes.

2 Theoretical framework

Following Van Wincoop and Anderson (2003) and Anderson et al. (2011), our structural gravity model is as follows:

$$X_{ijt} = \frac{E_{jt}Y_{it}}{Y_t}\left(\frac{\tau_{ijt}}{P_{jt}\Pi_{it}}\right)^{1-\sigma} \qquad (1)$$

where X_{ijt} is the value of nominal bilateral exports of services between origin i and destination j at time t, E_j is the expenditure on services in the destination market from all origins, Y_i is the sale of services at destination prices from i to all destinations, Y is world services output at delivered prices, τ_{ij} are the bilateral trade costs, σ is the elasticity of substitution amongst services and P_j, Π_i are the (inward and outward, respectively) multilateral resistance (MR) terms as defined in this literature.

The bilateral trade costs in τ_{ijt} are typically proxied by bilateral distance between capitals of the two countries ($DIST_{ij}$), incidence of and heterogeneity between (restrictive) services regulation (REG_{ij}), and indicators for common international borders ($BORD_{ij}$), language ($LANG_{ij}$), colonial origins (COL_{ij}), legal systems (LEG_{ij}) and membership of PTAs (in the context of this paper, services trade agreements or STA_{ijt}).

These proxy variables typically enter τ_{ijt} as follows:

$\tau^{1-\sigma}{}_{ijt} = exp(\beta_1 lnDIST_{ij} + \beta_2 BORD_{ij} + \beta_3 LANG_{ij} + \beta_4 COL_{ij} + \beta_5 LEG_{ij} + \beta_6 lnREG_{ij} + \delta STA_{ijt})$...(2)

Substituting (2) into (1) and adding an error term, yields the following multiplicative model:

$X_{ijt} = exp(Z'_{ij}\beta + \delta STA_{ijt} + \alpha_{it} + \gamma_{jt})\varepsilon_{ijt}$..(3)

where $Z_{ij} = (1, lnDIST_{ij}, BORD_{ij}, ...)$ is a vector with a constant and all bilateral trade costs except STA_{ijt}, β is the coefficient vector corresponding to the elements in Z_{ij} with $\beta_0 = -lnY_t$ and ε_{ijt} is the error term. Following Baier and Bergstrand (2007), the exporter-time (α_{it}) and importer-time (γ_{jt}) fixed effects in (3) account for the time-varying MR terms in a panel setting.

However, (3) does not account for a significant charateristic of most bilateral trade data - the existence of "export zeroes"[4]. This is even more true of bilateral services trade data, which also tend to report a significant number of missing observations.

This dichotomy in bilateral export flows can be represented by an indicator variable Ω_{ij}which takes the value 1 if the aggregate of the representative firm in i can cover the fixed costs (f_{ij}) of entering j and 0 otherwise. For the representative firm, $\Omega_{ij} = 1$ if $p_i x_{ij} \geq \sigma f_{ij}$where p are the mill prices and x denotes firm-level shipments (for instance see Egger et al., 2011).

Thus, (3) can be adjusted to include the possibility of zero export flows as follows:

$X_{ijt} = \Omega_{ij} exp(Z'_{ij}\beta + \delta STA_{ijt} + \alpha_{it} + \gamma_{jt})\varepsilon_{ijt}$.......................................(4)

Finally, (3) and (4) assume that STA membership is exogenous. However, in a significant departure from earlier work, researchers (Magee, 2004; Baier and Bergstrand, 2002, 2004, 2007; Egger et al., 2008) have begun to treat PTA membership as endogenous based on the intuition that if there is a tendency for countries to "self-select[5]" themselves into an accord, then treating PTA membership as exogenous would under-estimate the magnitude of the

[4]For instance see Helpman et al. (2008) and Baldwin and Harrigan (2011).

[5]i.e. countries that enter into an agreement are already those that trade significantly with each other and vice versa.

trade effect[6]. Thus one can allow for possible correlation between ε_{ijt} and the propensity to negotiate a STA essentially making STA membership endogenous. For instance, Egger et. al. (2011) have provided a reduced form estimation of a theory-consistent gravity model that endogenizes the impact of PTA membership and also accounts for trade at both margins.

3 Empirical model

(3) is estimated by taking logs on either side:

$$lnX_{ijt} = \mu_{ij} + \alpha_{it} + \gamma_{jt} + \rho_t + \delta STA_{ijt} + \varepsilon_{ijt} \text{.......} (5)$$

where all the dyadic trade costs in τ_{ij} are captured in the pair-wise fixed effects μ_{ij}. Significantly, the inclusion of pair-wise, importer-time and exporter-time fixed effects also enables an endogenous treatment of the STA variable (Baier and Bergstrand, 2007).

Baier & Bergstrand (2007) also accounted for the phasing-in of PTAs by introducing the lagged effects of PTA on trade. Given that every PTA has a phase-in period, typically over 10 years[7], the entire treatment effect on trade cannot be captured in the concurrent year. They therefore used one or two lagged levels of the PTA variable in their estimation ($PTA_{ij,t-1}$ and $PTA_{ij,t-2}$), which accentuates the average treatment effect (ATE). Since they used a panel of cross-section time series data at five-year intervals from 1960 to 2000, they thus included ten years preceding accession to study the anticipation effects of PTAs on trade.

Following Baier and Bergstrand (2007), we augment (5) to include STA anticipation effects for up to ten years preceding coming into effect of the agreement, thus:

$$lnX_{ijt} = \mu_{ij} + \alpha_{it} + \gamma_{jt} + \rho_t + \delta STA_{ijt} + \sum_{k=1}^{10} \eta STA_{ijt-k} + \varepsilon_{ijt} \text{.......} (6)$$

where η is the coefficient vector corresponding to the elements in STA_{ijt-k}.

Finally, to confirm the absence of any feedback effects from trade changes to changes in STA membership, we also estimated the following specification:

$$lnX_{ijt} = \mu_{ij} + \alpha_{it} + \gamma_{jt} + \rho_t + \delta STA_{ijt} + \sum_{k=1}^{10} \eta STA_{ijt-k} + \sum_{m=1}^{5} \theta STA_{ijt+m} + \varepsilon_{ijt} \text{......} (7)$$

where θ is the coefficient vector corresponding to the elements in STA_{ijt+m}.

[6] For instance, Baier & Bergstrand (2007) find the trade effect from goods agreements to quintuple once PTA membership is endogeneized econometrically.

[7] For instance, both the original EEC agreement of 1958 and the NAFTA had a 10-year phase-in provision.

4 Data

Data on X_{ijt} are taken from the OECD's Bilateral Trade in Services database. These include 6095 trading partner pairs between 35 exporting and 238 importing countries over 1999-2010 (the list of countries is reported in Annex Table A1). Of these, 203 trading partners reported negative services exports and assuming reporting errors, these values were taken as zero[8]. In addition, data on services exports were found unreported for 7147 out of 44322 observations, which, following this literature, were also assumed to be zero[9]. This brought the total number of export zeroes in the sample to 19700 (44.4% of the full sample).

Data on trade agreements are taken from the WTO's Regional Trade Agreements Information System (RTA-IS) database, where $STA = 1$ for agreements notified under Article V of the GATS during 1958-2010 and 0 otherwise. Since our data cover the period 1999-2010, if a services agreement was reached before 1999, the STA variable takes a value 1 over 1999-2010. On the other hand, if the agreement came into effect after 1999, then the variable takes a value 1 in the year the STA entered into force and every year after that and the value 0 otherwise. This treatment also rendered STA_{ijt} time-variant, which, from the perspective of economteric analysis, meant that it could be retrieved in pair-wise fixed-effects specifications.

Annex Table A2 shows the mean value for both variables, along with the minimum, maximum and the standard deviation.

Figure 1 shows trading partner dyads in our sample that had bilateral services exports exceeding \$10 bn over 1999-2010. Looking at these export averages over 1999-2010, we find that 29 trading pairs (0.5% of the 6095 dyads) had bilateral services exports in excess of \$10 bn and interestingly, more than half of these (18) had a services trade agreement in force in 2013.

<Insert Figure 1 here>

Table 1 shows the decile distribution of (positive) bilateral services exports averaged over 1999-2010 and the existence of STAs. The top decile (n = 385, accounting for 6.3% of all trading pairs in the sample) had an average services export value of \$3.7 bn; nearly half of these dyads had a services trade agreement in force in 2013. Table 1 also suggests that the distribution of bilateral services exports over 1999-2010 was highly skewed with the average for the top decile being more than 28000 times greater than that of the last decile!

[8] In our sensitivity analyses, we also ran our regressions without these observations but found the results to be qualitatively similar.

[9] Low thresholds for reporting and measurement errors can be responsible for both unreported flows and for export zeroes.

Significantly, as one goes down the deciles, the propensity to negotiate a services accord also declines, which highlights the endogenous relationship between these two variables. Bilateral services exports are also found to be 5.7 times greater amongst all dyads in our sample in the presence of a services accord than otherwise.

<Insert Table 1 here>

5 Estimation issues

Empirically, (5), (6) and (7) can be estimated log-linearly using OLS. However, this excludes the treatment of export zeroes (as the log of zero is not defined) and the incidence of export zeroes was fairly high in our data (44.4%). Selection of the appropriate estimator in the presence of zeroes is contingent on the process generating the error term. Following Head and Mayer (2013), we found our data to be characterized by a constant variance to mean ratio (CVMR) which suggested the use of the Poisson PML (PPML) for inference. Importantly, PPML[10] estimates remain consistent in the presence of over-dispersion, which was also true of our data (see Colin and Trivedi, 2005; Santos Silva and Tenreyro, 2006).

Unfortunately, the PPML estimation of (5), (6) and (7) with several high dimensional fixed effects led to non-convergence. This did not change even with the application of different work-around strategies suggested by Santos Silva and Tenreyro (2010) such as rescaling the dependent variable, trying different optimisation methods and convergence criteria, and identifying and removing the regressors causing the non-existence of PML estimates using the algorithm from Santos Silva and Tenreyro (2011).

Given the need for at least two-high dimensional fixed effects in estimating these equations, another possibility was the use of the “2WFE” approach developed by Guimaraes and Portugal (2010). This allows for estimating linear regressions model with two high-dimensional fixed effects with minimal memory requirements. Head and Mayer (2013) find the 2WFE estimator to provide identical estimates to the LSDV (Harrigan, 1996) without being subject to arbitrary limits. They also recommend the 2WFE over other estimation strategies such as double-demeaning, Bonus Vetus OLS (Baier and Bergstrand, 2009) and tetrads (Head et al., 2010).

[10] The PPML advocates the use of a simple Poisson Pseudo-Maximum Likelihood because in the presence of heteroskedasticity in the data, the standard log-linearized gravity model yields inconsistent estimates (Silva & Tenreyro, 2006). “An additional problem of log-linearization is that it is incompatible with the existence of zeroes in trade data, which led to several unsatisfactory solutions, including truncation of the sample and further non-linear transformations of the dependent variable.” (Silva & Tenreyro, op.cit., pp 653)

Thus, (5), (6) and (7) were estimated log-linearly using the 2WFE estimator.

However, this strategy would only work at the intensive margin. To include export zeroes in the 2WFE estimation, we followed the approach by Eaton and Kortum (2001) and assumed that there was a minimum level of services exports ϵ such that when gravity-predicted $X_{ijt} < \epsilon$, the observed value of services exports was zero. Although ϵ is unknown, it can be approximated by the minimum observed services exports for each destination market ($minX_j$).

Unlike the practice of adding an arbitrary constant to the export zeroes, this approach is more intuitive as the minimum trade flow for a specific importer would tend to reflect differences in market size, competition, trade barriers, as well as reporting and measurement issues. The approach is also consistent with theory and does not require exclusion restrictions. Furthermore, transforming the dependent variable by adding a minimum observed export value ($X_{ijt} + minX_j$) is not scale dependent.

Thus, the equations were also estimated log-linearly by replacing X_{ijt} with ($X_{ijt} + minX_j$) to incorporate the export zeroes in the analyses.

6 Results

The intensive margin results from estimating equation (5) are reported in Table 2. In this table, columns I-IV report results for four different samples: all, only-EU, only non-EU, at least one EU. The (services) trade effects range from 13.7%[11] for the full sample to 53.4% amongst the EU member states. As in Shingal (2009), services accords did not seem to enhance bilateral services trade amongst the non-EU trading partners in the sample. On the other hand, even with one of the partners being from the EU, the (services) trade effect again became positive and economically significant (33.4%).

<Insert Table 2 here>

Table 3 reports the results from estimating equation (5) after incorporating the export zeroes in the sample. One would expect these coefficients to have lower magnitudes compared to the baseline results as the regressions now incorporate zero export flows. However, the (services) trade effect for the complete sample seems to be enhanced now though it is weakly significant. The effects for the EU are reduced while those for the non-EU partners are statistical indifferent from zero.

[11] This is calculated as $\{exp(\delta) - 1\} * 100$ where δ is the coefficient on the STA variable.

<Insert Table 3 here>

The lagged effects of STA on trade for all sample countries are reported in Table 4. Like Baier & Bergstrand (2007), we too found the ATE to be accentuated by including such anticipation effects. These results show that the total ATE increases the further back in time one travels from the year of accession of the STA. This suggests that the maximum impact of a services accord may be felt the farthest in time from actual accession and that services agreements seem to have a significant "announcement effect." This said, the respective coefficients retain statistical significance only up to five years preceding the year of accession. Thus, the estimates of the total ATE are arguably more meaningful until $t-5$ and suggest a cumulative trade effect of 157.5%. We also find the coefficients to be more economically significant three to five years preceding accession. Significantly, the (services) trade effect in the actual year of accession also increases monotonically with time with the inclusion of anticipation effects.

<Insert Table 4 here>

Finally, Table 5 reports the results on the post-accession effects of STAs for all sample countries. These estimated coefficients on STA_{ijt+m} are statistically indifferent from zero from one for up to five years after accession, which suggests that changes in STA membership are strictly exogenous to changes in bilateral services trade flows. Significantly, the total ATE is larger in magnitude compared to the results in Table 4, which suggests that the anticipation effects, still statistically significant until $t-5$, get further accentuated in this estimation.

<Insert Table 5 here>

We also estimated equations (6) and (7) for the full sample including the export zeroes. The results, reported in Table 6 and 7, lacked statistical significance in most cases, though STA membership continued to be associated with positive trade effects concurrently in some specifications in Table 6.

<Insert Tables 6 and 7 here>

7 Conclusion

This paper revisits the trade effect of services accords using an updated OECD database on bilateral services trade flows and following recent advancements in the literature on the estimation of structural gravity models. We estimate the trade effects from negotiating services agreements allowing for zero trade flows and the possibility of self-selection into STA membership. Our intensive margin results are somewhat consistent with those found in the earlier services literature but the trade effects are smaller compared to those of goods agreements (for instance see Baier and Bergstrand, 2007). At the same time, we find more pronounced anticipation effects for firms already engaged in services trade once we account for the lagged effects of STA membership, both compared to the results for services in Shingal (2009) and those for goods (Baier and Bergstrand, 2007). The inclusion of zero export flows, on the other hand, led to statistically insignificant results but not for intra-EU services trade.

A shortcoming in the analysis undertaken in this paper is the homogeneity of the STA variables, the calibration of which does not take into account the varying extents of liberalization in different agreements. This could therefore be an agenda for further research. It may also be interesting to examine the results in this paper using alternative estimation stategies such as the Heckman (1979) and the bivariate probit (Egger et.al., 2011).

References

Anderson, J. E., Milot, C. A., and Yotov, Y. V. (2011). The incidence of geography on canada's services trade. Technical report, National Bureau of Economic Research.

Baier, S. L. and Bergstrand, J. H. (2002). On the endogeneity of international trade flows and free trade agreements. Unpublished manuscript.

Baier, S. L. and Bergstrand, J. H. (2004). Economic determinants of free trade agreements. *Journal of International Economics*, 64(1):29–63.

Baier, S. L. and Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of international Economics*, 71(1):72–95.

Baier, S. L. and Bergstrand, J. H. (2009). Bonus vetus ols: A simple method for approximating international trade-cost effects using the gravity equation. *Journal of International Economics*, 77(1):77–85.

Baldwin, R. and Harrigan, J. (2011). Zeros, quality, and space: Trade theory and trade evidence. *American Economic Journal: Microeconomics*, 3(2):60–88.

Ceglowski, J. (2006). Does gravity matter in a service economy? *Review of World Economics*, 142(2):307–329.

Colin, C. A. and Trivedi, P. K. (2005). Microeconometrics: Methods and applications.

Eaton, J. and Kortum, S. (2001). Trade in capital goods. *European Economic Review*, 45(7):1195–1235.

Egger, H., Egger, P., and Greenaway, D. (2008). The trade structure effects of endogenous regional trade agreements. *Journal of International Economics*, 74(2):278–298.

Egger, P., Larch, M., and Staub, K. E. (2012). Trade preferences and bilateral trade in goods and services: A structural approach. Technical report, CEPR Discussion Papers.

Egger, P., Larch, M., Staub, K. E., and Winkelmann, R. (2011). The trade effects of endogenous preferential trade agreements. *American Economic Journal: Economic Policy*, 3(3):113–143.

Grünfeld, L. A. and Moxnes, A. (2003). The intangible globalization: Explaining the patterns of international trade in services. *Norwegian Institute for International Affairs. Working Paper*, (657-2003).

Guimaraes, P. and Portugal, P. (2010). A simple feasible procedure to fit models with high-dimensional fixed effects. *Stata Journal*, 10(4):628.

Harrigan, J. (1996). Openness to trade in manufactures in the oecd. *Journal of international economics*, 40(1):23–39.

Head, K. and Mayer, T. (2013). Gravity equations: Toolkit, cookbook, workhorse. *Handbook of International Economics*, 4.

Head, K., Mayer, T., and Ries, J. (2010). The erosion of colonial trade linkages after independence. *Journal of International Economics*, 81(1):1–14.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica: Journal of the econometric society*, pages 153–161.

Helpman, E., Melitz, M., and Rubinstein, Y. (2008). Estimating trade flows: Trading partners and trading volumes. *The Quarterly Journal of Economics*, 123(2):441–487.

Kimura, F. and Lee, H. (2006). The gravity equation in international trade in services. *Review of world economics*, 142(1):92–121.

Kox, H. and Lejour, A. (2006). The effects of the services directive on intra-eu trade and fdi. *Revue Economique*, 57(4):747–769.

Lennon, C. (2008). Trade in services and trade in goods: Differences and complementarities. *WIIW Working Papers 53*.

Magee, C. S. (2004). Endogenous preferential trade agreements: an empirical analysis. *Contributions in Economic Analysis & Policy*, 2(1):1–17.

Marchetti, J. (2011). Do economic integration agreements lead to deeper integration of services markets? *International Handbook on the Economics of Integration: Factor, Mobility, Agriculture, Environment and Quantitative Studies*, 3:435.

Mirza, D. and Nicoletti, G. (2004). What is so special about trade in services. research paper 2004/02. *University of Nottingham*.

Santos Silva, J. and Tenreyro, S. (2006). The log of gravity. *The Review of Economics and Statistics*, 88(4):641–658.

Santos Silva, J. and Tenreyro, S. (2010). On the existence of the maximum likelihood estimates in poisson regression. *Economics Letters*, 107(2):310–312.

Santos Silva, J. and Tenreyro, S. (2011). Poisson: some convergence issues. *Stata journal*, 11(2):207–212.

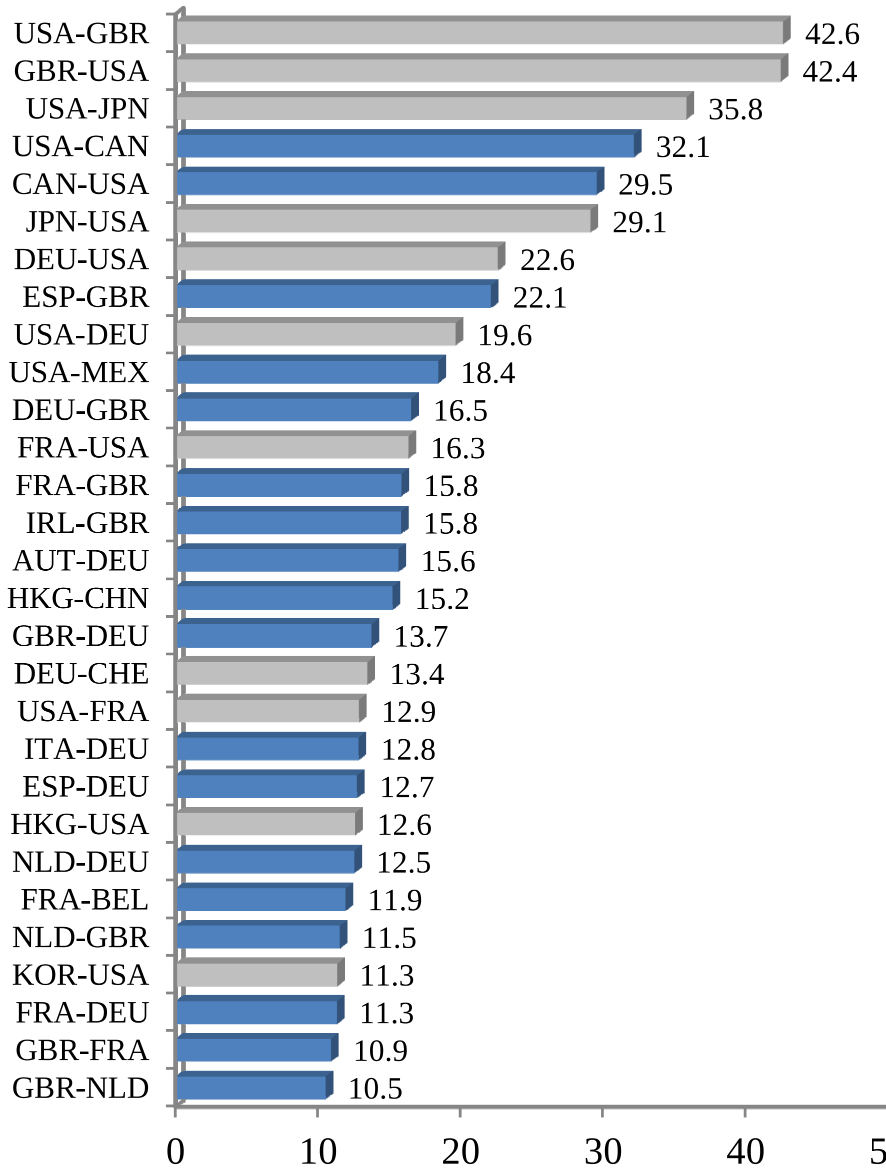
Sauvé, P. and Shingal, A. (2011). Reflections on the preferential liberalization of services trade. *Journal of World Trade*, 45(5):953.

Shingal, A. (2009). How much do agreements matter for services trade? *MPRA paper 32815*.

Van Wincoop, E. and Anderson, J. E. (2003). Gravity with gravitas: a solution to the border puzzle. *American Economic Review*, 93(1):170–192.

Walsh, K. (2006). Trade in services: Does gravity hold? a gravity model approach to estimating barriers to services trade. Technical report, IIIS.

Figure 1: Top services export flows ($ bn, avg. 1999-2010)



Source: OECD; own calculations

Note: Dyads shaded in blue had a services trade agreement in force in 2013; those shaded in grey did not.

Table 1: Decile distribution of bilateral services exports (avg. 1999-2010)

Deciles (n = 3850)	Avg. X_{ij} (\$ mn)	STA
D1	3776.8	0.49
D2	395.0	0.35
D3	133.1	0.32
D4	53.7	0.26
D5	24.8	0.27
D6	11.5	0.17
D7	5.3	0.20
D8	2.2	0.16
D9	0.7	0.15
D10	0.1	0.07
D1/D10	28072.4	7.3

Source: OECD; own calculations

Table 2: Results (2WFE) from estimating equation (5) on positive exports

Dep var: lnX_{ijt}	(1) All	(2) Only EU	(3) Only non-EU	(4) One EU
STA_{ijt}	0.128**	0.428***	-0.157*	0.288***
	(0.041)	(0.046)	(0.077)	(0.050)
ATE	13.7%	53.4%	-14.5%	33.4%
N	24622	4790	3003	21619
df_m	5981	909	1760	5378
r2	0.968	0.978	0.996	0.963
Fixed effects:				
Year	Yes	Yes	Yes	Yes
Bilateral	Yes	Yes	Yes	Yes
Country-and-time	Yes	Yes	Yes	Yes

Note: (1) Legend: # p<.1; * p<.05; ** p<.01; *** p<.001 (2) Robust standard errors reported in brackets (3) ATE = Average treatment effect

Table 3: Results (2WFE) from estimating equation (5) on all exports

Dep var: $\ln(X_{ijt}+\min X_j)$	(1)	(2)	(3)	(4)
	All	Only EU	Only non-EU	One EU
STA_{ijt}	0.149#	0.232**	-0.035	0.237*
	(0.089)	(0.086)	(0.118)	(0.119)
ATE	16.1%	26.1%	-3.4%	26.7%
N	44310	5211	4880	39430
df_m	8662	950	2425	7664
r2	0.946	0.939	0.990	0.942
Fixed effects:				
Year	Yes	Yes	Yes	Yes
Bilateral	Yes	Yes	Yes	Yes
Country-and-time	Yes	Yes	Yes	Yes

Note: (1) Legend: # p<.1; * p<.05; ** p<.01; *** p<.001 (2) Robust standard errors reported in brackets (3) ATE = Average treatment effect

Table 4: Results (2WFE) from estimating equation (6) on positive exports

Dep var: lnX_{ijt}	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All	All	All	All	All	All	All	All	All	All
STA_{ijt}	0.138**	0.140**	0.156***	0.169***	0.184***	0.194***	0.199***	0.206***	0.203***	0.206***
	(0.042)	(0.043)	(0.044)	(0.044)	(0.045)	(0.045)	(0.046)	(0.046)	(0.046)	(0.047)
STA_{ijt-1}	0.101	0.105	0.137	0.161#	0.197*	0.218*	0.229*	0.246**	0.240*	0.246**
	(0.085)	(0.086)	(0.088)	(0.089)	(0.090)	(0.091)	(0.092)	(0.093)	(0.094)	(0.095)
STA_{ijt-2}		0.018	0.055	0.081	0.117	0.143#	0.157#	0.177*	0.169*	0.177*
		(0.074)	(0.076)	(0.078)	(0.079)	(0.082)	(0.083)	(0.084)	(0.086)	(0.087)
STA_{ijt-3}			0.163*	0.190*	0.232**	0.257**	0.272**	0.294***	0.285**	0.294**
			(0.078)	(0.080)	(0.082)	(0.084)	(0.085)	(0.087)	(0.089)	(0.091)
STA_{ijt-4}				0.110	0.152*	0.180*	0.195*	0.220**	0.211*	0.220**
				(0.072)	(0.074)	(0.077)	(0.078)	(0.080)	(0.082)	(0.085)
STA_{ijt-5}					0.181*	0.211**	0.228**	0.252**	0.241**	0.251**
					(0.077)	(0.080)	(0.082)	(0.084)	(0.086)	(0.090)
STA_{ijt-6}						0.106	0.123	0.150#	0.141#	0.152#
						(0.080)	(0.081)	(0.084)	(0.086)	(0.089)
STA_{ijt-7}							0.095	0.125	0.113	0.123
							(0.096)	(0.098)	(0.101)	(0.104)
STA_{ijt-8}								0.139	0.127	0.140
								(0.101)	(0.104)	(0.108)
STA_{ijt-9}									-0.052	-0.039
									(0.107)	(0.111)
STA_{ijt-10}										0.050
										(0.117)
Total ATE	14.8%	15.0%	37.6%	43.2%	157.5%	188.6%	207.4%	303.5%	285.4%	303.1%
N	24622	24622	24622	24622	24622	24622	24622	24622	24622	24622
df_m	5982	5983	5984	5985	5986	5987	5988	5989	5990	5991
r2	0.968	0.968	0.968	0.968	0.968	0.968	0.968	0.968	0.968	0.968
Fixed effects:										
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-and-time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Legend: # p<.1; * p<.05; ** p<.01; *** p<.001 (2) Robust standard errors reported in brackets (3) Total ATE = Sum of the STA coefficient estimates statistically significant at 5%

Table 5: Results (2WFE) from estimating equation (7) on positive exports

Dep var: lnX_{ijt}	(1) All	(2) All	(3) All	(4) All	(5) All
STA_{ijt}	0.212***	0.212***	0.214***	0.211***	0.209***
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
STA_{ijt-1}	0.231*	0.231*	0.222*	0.233*	0.237*
	(0.096)	(0.096)	(0.097)	(0.098)	(0.098)
STA_{ijt-2}	0.163#	0.163#	0.157#	0.167#	0.172#
	(0.088)	(0.089)	(0.089)	(0.090)	(0.090)
STA_{ijt-3}	0.276**	0.276**	0.270**	0.279**	0.284**
	(0.091)	(0.092)	(0.092)	(0.093)	(0.093)
STA_{ijt-4}	0.207*	0.207*	0.202*	0.212*	0.215*
	(0.085)	(0.086)	(0.086)	(0.087)	(0.087)
STA_{ijt-5}	0.238**	0.238**	0.233*	0.241**	0.244**
	(0.090)	(0.090)	(0.091)	(0.091)	(0.091)
STA_{ijt-6}	0.139	0.139	0.135	0.142	0.144
	(0.089)	(0.090)	(0.090)	(0.090)	(0.091)
STA_{ijt-7}	0.112	0.112	0.109	0.114	0.116
	(0.104)	(0.104)	(0.104)	(0.105)	(0.105)
STA_{ijt-8}	0.130	0.130	0.127	0.133	0.135
	(0.108)	(0.108)	(0.108)	(0.108)	(0.108)
STA_{ijt-9}	-0.048	-0.048	-0.051	-0.046	-0.045
	(0.112)	(0.112)	(0.112)	(0.112)	(0.112)
STA_{ijt-10}	0.041	0.041	0.039	0.043	0.045
	(0.117)	(0.117)	(0.117)	(0.117)	(0.117)
STA_{ijt+1}	-0.190#	-0.191#	-0.202#	-0.184	-0.175
	(0.112)	(0.114)	(0.116)	(0.118)	(0.119)
STA_{ijt+2}		-0.001	-0.014	0.004	0.013
		(0.120)	(0.123)	(0.124)	(0.125)
STA_{ijt+3}			-0.065	-0.042	-0.033
			(0.121)	(0.123)	(0.124)
STA_{ijt+4}				0.135	0.148
				(0.133)	(0.135)
STA_{ijt+5}					0.069
					(0.123)
Total ATE	220.3%	220.3%	213.0%	224.1%	228.4%
N	24622	24622	24622	24622	24622
df_m	5992	5993	5994	5995	5996
r2	0.968	0.968	0.968	0.968	0.968
Fixed effects:					
Year	Yes	Yes	Yes	Yes	Yes
Bilateral	Yes	Yes	Yes	Yes	Yes
Country-and-time	Yes	Yes	Yes	Yes	Yes

Note: (1) Legend: # p<.1; * p<.05; ** p<.01; *** p<.001 (2) Robust standard errors reported in brackets (3) Total ATE = Sum of the STA coefficient estimates statistically significant at 5%

Table 6: Results (2WFE) from estimating equation (6) on all exports

Dep var: $\ln(X_{ijt}+minX_j)$	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	All	All	All	All	All	All	All	All	All	All
STA_{ijt}	0.160#	0.162#	0.174#	0.176#	0.196*	0.203*	0.194#	0.199*	0.189#	0.180#
	(0.092)	(0.094)	(0.095)	(0.097)	(0.098)	(0.099)	(0.100)	(0.100)	(0.101)	(0.101)
STA_{ijt-1}	0.078	0.084	0.104	0.108	0.151	0.165	0.149	0.159	0.139	0.121
	(0.159)	(0.163)	(0.167)	(0.169)	(0.174)	(0.176)	(0.177)	(0.178)	(0.179)	(0.180)
STA_{ijt-2}		0.022	0.045	0.049	0.091	0.108	0.090	0.101	0.077	0.057
		(0.149)	(0.154)	(0.157)	(0.162)	(0.165)	(0.166)	(0.168)	(0.170)	(0.171)
STA_{ijt-3}			0.102	0.106	0.154	0.170	0.148	0.161	0.134	0.110
			(0.161)	(0.164)	(0.170)	(0.173)	(0.175)	(0.177)	(0.179)	(0.181)
STA_{ijt-4}				0.019	0.064	0.083	0.062	0.079	0.047	0.020
				(0.154)	(0.160)	(0.164)	(0.166)	(0.169)	(0.173)	(0.174)
STA_{ijt-5}					0.173	0.192	0.168	0.183	0.147	0.119
					(0.158)	(0.162)	(0.165)	(0.168)	(0.172)	(0.174)
STA_{ijt-6}						0.074	0.052	0.065	0.041	0.017
						(0.138)	(0.140)	(0.143)	(0.145)	(0.147)
STA_{ijt-7}							-0.138	-0.123	-0.156	-0.179
							(0.170)	(0.173)	(0.177)	(0.178)
STA_{ijt-8}								0.108	0.064	0.024
								(0.221)	(0.227)	(0.230)
STA_{ijt-9}									-0.213	-0.255
									(0.235)	(0.238)
STA_{ijt-10}										-0.229
										(0.211)
Total ATE	0.0%	0.0%	0.0%	0.0%	21.7%	22.5%	0.0%	22.0%	0.0%	0.0%
N	44310	44310	44310	44310	44310	44310	44310	44310	44310	44310
df_m	8652	8653	8654	8655	8656	8657	8658	8659	8660	8661
r2	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.946	0.947	0.947
Fixed effects:										
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bilateral	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-and-time	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: (1) Legend: # p<.1; * p<.05; ** p<.01; *** p<.001 (2) Robust standard errors reported in brackets (3) Total ATE = Sum of the STA coefficient estimates statistically significant at 5%

Table 7: Results (2WFE) from estimating equation (7) on all exports

Dep var: $\ln(X_{ijt}+\min X_j)$	(1)	(2)	(3)	(4)	(5)
	All	All	All	All	All
STA_{ijt}	0.185#	0.186#	0.190#	0.189#	0.183#
	(0.102)	(0.102)	(0.102)	(0.103)	(0.103)
STA_{ijt-1}	0.113	0.111	0.098	0.100	0.108
	(0.181)	(0.181)	(0.183)	(0.183)	(0.184)
STA_{ijt-2}	0.050	0.047	0.039	0.040	0.049
	(0.171)	(0.172)	(0.173)	(0.173)	(0.174)
STA_{ijt-3}	0.102	0.099	0.092	0.093	0.100
	(0.182)	(0.182)	(0.182)	(0.183)	(0.183)
STA_{ijt-4}	0.015	0.013	0.007	0.009	0.013
	(0.175)	(0.175)	(0.175)	(0.176)	(0.176)
STA_{ijt-5}	0.114	0.112	0.105	0.106	0.111
	(0.174)	(0.175)	(0.175)	(0.175)	(0.175)
STA_{ijt-6}	0.014	0.013	0.010	0.010	0.013
	(0.147)	(0.147)	(0.147)	(0.147)	(0.147)
STA_{ijt-7}	-0.182	-0.183	-0.186	-0.185	-0.183
	(0.178)	(0.178)	(0.178)	(0.178)	(0.178)
STA_{ijt-8}	0.021	0.020	0.017	0.017	0.020
	(0.230)	(0.230)	(0.230)	(0.230)	(0.230)
STA_{ijt-9}	-0.258	-0.259	-0.262	-0.261	-0.259
	(0.238)	(0.238)	(0.239)	(0.239)	(0.239)
STA_{ijt-10}	-0.231	-0.231	-0.233	-0.232	-0.232
	(0.211)	(0.211)	(0.211)	(0.211)	(0.211)
STA_{ijt+1}	-0.111	-0.119	-0.141	-0.137	-0.113
	(0.221)	(0.226)	(0.229)	(0.232)	(0.235)
STA_{ijt+2}		-0.041	-0.070	-0.064	-0.038
		(0.236)	(0.241)	(0.245)	(0.248)
STA_{ijt+3}			-0.133	-0.125	-0.088
			(0.226)	(0.235)	(0.241)
STA_{ijt+4}				0.029	0.071
				(0.239)	(0.246)
STA_{ijt+5}					0.155
					(0.231)
Total ATE	0.0%	0.0%	0.0%	0.0%	0.0%
N	44310	44310	44310	44310	44310
df_m	8662	8663	8664	8665	8666
r2	0.947	0.947	0.947	0.947	0.947
Fixed effects:					
Year	Yes	Yes	Yes	Yes	Yes
Bilateral	Yes	Yes	Yes	Yes	Yes
Country-and-time	Yes	Yes	Yes	Yes	Yes

Note: (1) Legend: # p<.1; * p<.05; ** p<.01; *** p<.001 (2) Robust standard errors reported in brackets (3) Total ATE = Sum of the STA coefficient estimates statistically significant at 5%

Table A1: Sample countries

Exporters: AUS AUT BEL CAN CHL CZE DEU DNK ESP EST FIN FRA GBR GRC HKG HUN IRL ISL ISR ITA JPN KOR LUX MEX NLD NOR NZL POL PRT RUS SVK SVN SWE TUR USA

Importers: ABW AFG AGO AIA ALB AND ANT ARE ARG ARM ASM ATA ATF ATG AUS AUT AZE BDI BEL BEN BFA BGD BGR BHR BHS BIH BLR BLZ BMU BOL BRA BRB BRN BTN BVT BWA CAF CAN CCK CHE CHL CHN CIV CMR COD COG COK COL COM CPV CRI CUB CXR CYM CYP CZE DEU DJI DMA DNK DOM DZA ECU EGY ERI ESP EST ETH FIN FJI FLK FRA FRO FSM GAB GBR GEO GGY GHA GIB GIN GMB GNB GNQ GRC GRD GRL GTM GUF GUM GUY HKG HMD HND HRV HTI HUN IDN IMN IND IOT IRL IRN IRQ ISL ISR ITA JAM JEY JOR JPN KAZ KEN KGZ KHM KIR KNA KOR KWT LAO LBN LBR LBY LCA LIE LKA LSO LTU LUX LVA MAC MAR MDA MDG MDV MEX MHL MKD MLI MLT MMR MNE MNG MNP MOZ MRT MSR MUS MWI MYS MYT NAM NCL NER NFK NGA NIC NIU NLD NOR NPL NRU NZL OMN PAK PAN PCN PER PHL PLW PNG POL PRI PRK PRT PRY PSE PYF QAT ROU RUS RWA SAU SCG SDN SEN SGP SGS SHN SLB SLE SLV SMR SOM SRB STP SUR SVK SVN SWE SWZ SYC SYR TCA TCD TGO THA TJK TKL TKM TLS TON TTO TUN TUR TUV TWN TZA UGA UKR UMI URY USA UZB VAT VCT VEN VGB VIR VNM VUT WLF WSM YEM YUG ZAF ZMB ZWE

Table A2: Summary statistics

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
STA_{ijt}	44322	0.13	0.34	0	1
STA_{ijt-1}	44322	0.01	0.10	0	1
STA_{ijt-2}	44322	0.01	0.10	0	1
STA_{ijt-3}	44322	0.01	0.10	0	1
STA_{ijt-4}	44322	0.01	0.11	0	1
STA_{ijt-5}	44322	0.01	0.11	0	1
STA_{ijt-6}	44322	0.01	0.10	0	1
STA_{ijt-7}	44322	0.01	0.09	0	1
STA_{ijt-8}	44322	0.004	0.07	0	1
STA_{ijt-9}	44322	0.004	0.06	0	1
STA_{ijt-10}	44322	0.003	0.05	0	1
STA_{ijt+1}	44322	0.002	0.05	0	1
STA_{ijt+2}	44322	0.002	0.04	0	1
STA_{ijt+3}	44322	0.002	0.05	0	1
STA_{ijt+4}	44322	0.002	0.05	0	1
STA_{ijt+5}	44322	0.002	0.05	0	1
X_{ijt}	44322	385.07	2068.71	0	63564.5
$\ln X_{ijt}$	24622	3.77	2.62	-13.8155	11.05981
$X_{ijt}+\min X_j$	44322	385.49	2068.64	0	63564.5
$\ln(X_{ijt}+\min X_j)$	44310	0.07	5.24	-13.8155	11.05981