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# Exploring complementarities between goods and services trade in trade agreements

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## Abstract

More than three decades of research on trade costs and goods trade have unveiled fundamental insights into the determinants, the nature and the consequences of goods trade agreements. A cottage literature has also evolved studying similar issues from a services trade perspective, but the two-way interaction between goods and services trade has not been explored formally. We bridge this gap by providing a formal treatment of the inter-linkages between goods and services trade. The model provides insights into how trade agreements impact goods and services trade. We also explore the impact of the complementarities of goods and services agreements on goods and services trade empirically using bilateral goods and services trade data for OECD and BRICS trading partners over 1995-2010.

**JEL classification:** F10, F14, F15

**Key words:** Trade agreements, goods and services trade, complementarities

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# 1 Introduction

The study of complementarities between goods and services trade is not new to the economics and trade literatures. For instance, the role of producer services such as finance, insurance and ICT in facilitating merchandise trade has long been emphasized in both literatures. Such complementarities are now being re-emphasized in wake of the recent recognition of the growing significance of global and regional value chains. Traditionally, global trade was supposed to comprise 75% trade in merchandise goods and 25% trade in services on average. However, the share of services trade in the total rises to nearly 50% once services transactions embodied in merchandise trade are taken into account. Recent statistical databases such as TiVA (Lea, 2014) and WIOD (Timmer et al., 2012) now make it increasingly possible to calculate the amount of goods trade embodied in cross-border services flows and vice versa.

Efforts made to institutionalize trading relationships through preferential trade agreements (PTAs) focussed on goods trade up until 2000. Since then however, there has been a preponderance of services trade agreements (STAs) in the new PTAs entered into force and notified to the WTO. For instance, of the 182 WTO-notified PTAs that entered into force during 1 January 2000 - 1 August 2014, 114 (63%) included provisions on services trade. By comparison, only 8 of the 81 (10%) WTO-notified PTAs that entered into force before 2000 were STAs.

Significantly, the recent proliferation of PTAs since 2000 has witnessed joint (as opposed to sequential) negotiation of both GTAs and STAs. In fact, only 15 STAs over time were negotiated after a GTA was already in effect between a trading partner dyad. In the majority of cases (107), goods and services trade agreements were negotiated jointly. Not suprisingly, this reflects the inherent recognition by trading partners of the strong inter-linkages between goods and services trade.

Even so, the impact assessment of PTA literature has focussed on studying the trade effects of goods and services accords in isolation. To the best of our knowledge, only Lennon (2008) and Shingal (2009) have estimated the joint trade effects of goods and services accords on bilateral services trade, but they did not explore these relationships formally. In this paper, we bridge this gap by providing a formal treatment of the inter-linkages between goods and services trade. Our model also provides insights into how PTAs impact goods and services trade. Finally, we explore the impact of the complementarities of goods and services agreements on goods and services trade empirically using bilateral goods and services trade data for OECD and BRICS trading partners over 1995-2010.

The rest of the paper is structured as follows. Section 2 describes our theoretical framework

and Section 3 looks at the empirical model. Section 4 describes the data while Section 5 discusses estimation issues. Section 6 describes and discusses the results from estimation.

## 2 Theoretical framework

We assume that each country produces a final, non-traded good, that can be used for consumption, an intermediate input used in the production of *goods*, or as an intermediate input used in the production of services; that is,

$$X_j = X_j^c + X_j^G + X_j^S$$

We assume that the production of good  $X_j$  is a composite of goods and services

$$X_j = (G_j)^\alpha (S_j)^{1-\alpha}$$

where goods ( $G_j$ ) (services ( $S_j$ )) are also composites of domestically and internationally produced goods (services). More formally, we assume that the *goods* aggregate is given by

$$G_j = \left\{ \sum_{i=1}^N (g_{ij})^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}}$$

where  $g_{ij}$  are shipments of goods from country  $i$  that arrive in country  $j$ . We assume that trade is subject to iceberg trade costs such that if country  $i$  ships one unit of the *good* to country  $j$  only  $1/t_{ij}^g$  would arrive ( $t_{ij}^g \geq 1$ ). Similarly, we assume that the service aggregate is given by

$$S_j = \left\{ \sum_{i=1}^N (s_{ij})^{\frac{\eta-1}{\eta}} \right\}^{\frac{\eta}{\eta-1}}$$

where  $s_{ij}$  are the shipments of services from country  $i$  that arrive in country  $j$ . Service trade is also subject iceberg trade costs such that if country  $i$  ships one unit of the *good* to country  $j$  only  $1/t_{ij}^s$  would arrive ( $t_{ij}^s \geq 1$ ).

In country  $i$ , the production of goods uses labor and the the final production good as an intermediate input; that is

$$g_i = A_i^G (X_i^G)^{1-\beta_j} (L_i^G)^{\beta_j} \quad 0 < \beta < 1$$

Similarly, the production of the service goods is given by

$$s_i = A_i^S (X_i^S)^{1-\beta_j} (L_i^S)^{\beta_j} \quad 0 < \beta < 1$$

We assume that markets clear so that

$$g_i = \sum_{j=1}^N t_{ij}^g g_{ij}$$

$$s_i = \sum_{j=1}^N t_{ij}^s s_{ij}$$

$$L_i = L_i^G + L_i^S$$

$$X_i = X_i^c + X_i^G + X_i^S$$

Utility is linear in the final consumption composite and we assume that individuals spend all of their labor income and the consumption composite so that

$$X_i^C \geq w_i L_i$$

Country  $j$ 's demand for goods from country  $i$  is given by

$$g_{ij} = \left( \frac{p_{ij}^g}{P_j^G} \right)^{-\sigma} \frac{w_j L_j \alpha_j}{P_j^G \beta_j}$$

where  $P_j^G = \left( \sum_{i=1}^N (p_{ij}^g)^{1-\sigma} \right)^{1/(1-\sigma)}$ . Similarly, country  $j$ 's demand for services produced by  $i$  are given by

$$s_{ij} = \left( \frac{p_{ij}^s}{P_j^S} \right)^{-\eta} \frac{w_j L_j (1 - \alpha_j)}{P_j^S \beta_j}$$

where  $P_j^S = \left( \sum_{i=1}^N (p_{ij}^s)^{1-\eta} \right)^{1/(1-\eta)}$ .

Market clearing implies

$$p_i^g g_i = \sum_j \left( \frac{p_i^g t_{ij}^g}{P_j^G} \right)^{1-\sigma} \frac{\alpha_j w_j L_j}{\beta_j} = \left( p_i^g \Pi_i^G \right)^{1-\sigma}$$

where  $\Pi_i^G = \left( \sum_{j=1}^N \left( \frac{t_{ij}^g}{P_j^G} \right)^{1-\sigma} \frac{\alpha_j w_j L_j}{\beta_j} \right)$ . From the conditional factor demands for labor and the

intermediate input, we can also express the above market clearing condition as

$$\frac{w_j L_j^G}{\beta_j} = \frac{P_j^X X_j^G}{1 - \beta_j} = \left( p_i^g \Pi_i^G \right)^{1-\sigma}$$

where  $P_j^X = (P_j^G)^\alpha (P_j^S)^{1-\alpha}$ .

Market clearing for services implies

$$p_i^s s_i = \sum_j \left( \frac{p_i^s t_{ij}^s}{P_j^S} \right)^{1-\eta} \frac{(1 - \alpha_j) w_j L_j}{\beta_j} = \left( p_i^s \Lambda_i^S \right)^{1-\eta}$$

where  $\Lambda_i^S = \left( \sum_{j=1}^N \left( \frac{t_{ij}^s}{P_j^S} \right)^{1-\eta} \frac{(1-\alpha_j) w_j L_j}{\beta_j} \right)$ . From the conditional factor demands for services imply,

$$\frac{w_j L_j^S}{\beta_j} = \frac{P_j^X X_j^S}{1 - \beta_j} = \left( p_i^s \Lambda_i^S \right)^{1-\sigma}$$

Given the market clearing conditions, we can express the price indices for goods and services as

$$P_j^G = \left[ \sum_{i=1}^N \left( \frac{t_{ij}^g}{\Pi_i} \right) w_i L_i^g \right]^{\frac{1}{1-\sigma}}$$

and

$$P_j^S = \left[ \sum_{i=1}^N \left( \frac{t_{ij}^s}{\Lambda_i} \right)^{1-\eta} w_i L_i^s \right]^{1/(1-\eta)}$$

We can therefore express the volume of goods trade between  $i$  and  $j$  as

$$TF_{ij}^G = \left( \frac{t_{ij}^g}{P_j \Pi_i} \right)^{1-\sigma} \frac{\alpha_j w_j L_j}{\beta_j} w_i L_i^G \dots \dots \dots (1)$$

and the volume of bilateral service trade between  $i$  and  $j$  can be expressed as

$$TF_{ij}^S = \left( \frac{t_{ij}^s}{P_j \Lambda_i} \right)^{1-\eta} (1 - \alpha_j) \frac{w_j L_j}{\beta_j} w_i L_i^S \dots \dots \dots (2)$$

### 3 Empirical model

Bilateral trade costs in  $t_{ij}^g$  and  $t_{ij}^s$  are typically proxied by bilateral distance between country capitals ( $DIST_{ij}$ ), and indicators for common international borders ( $BORD_{ij}$ ), language ( $LANG_{ij}$ ), colonial origins ( $COL_{ij}$ ), and legal systems ( $LEG_{ij}$ ). Tariffs on merchandise goods ( $TAR_{ij}$ ) and incidence and heterogeneity of (restrictive) services regulation ( $REG_{ij}$ ) are additional elements in  $t_{ij}^g$  and  $t_{ij}^s$  respectively. Finally, bilateral trade costs also include

variables for institutional membership of GTAs ( $GTA_{ijt}$ ) and STAs ( $STA_{ijt}$ ).

These proxy variables typically enter  $t^g_{ijt}$ :

$$t^{1-\sigma}_{ijt} = \exp(\beta_1 \ln DIST_{ij} + \beta_2 BORD_{ij} + \beta_3 LANG_{ij} + \beta_4 COL_{ij} + \beta_5 LEG_{ij} + \beta_6 \ln TAR_{ij} + \delta_1 GTA_{ijt} + \delta_2 STA_{ijt}) \dots \dots \dots (3)$$

and  $t^s_{ijt}$  as follows:

$$t^{1-\eta}_{ijt} = \exp(\beta_1 \ln DIST_{ij} + \beta_2 BORD_{ij} + \beta_3 LANG_{ij} + \beta_4 COL_{ij} + \beta_5 LEG_{ij} + \beta_6 \ln REG_{ij} + \delta_1 GTA_{ijt} + \delta_2 STA_{ijt}) \dots \dots \dots (4)$$

Substituting (3) and (4) into (1) and (2) respectively and adding error terms, yield the following multiplicative models:

$$TF^g_{ijt} = \delta_3 TF^s_{ijt} \exp(Z'_{ij} \beta + \delta_1 GTA_{ijt} + \delta_2 STA_{ijt} + \alpha_{it} + \gamma_{jt}) \varepsilon_{ijt} \dots \dots \dots (5)$$

$$TF^s_{ijt} = \delta_3 TF^g_{ijt} \exp(Z'_{ij} \beta + \delta_1 GTA_{ijt} + \delta_2 STA_{ijt} + \alpha_{it} + \gamma_{jt}) \varepsilon_{ijt} \dots \dots \dots (6)$$

where  $Z_{ij} = (1, \ln DIST_{ij}, BORD_{ij}, \dots)$  is a vector with a constant and all bilateral trade costs except  $GTA_{ijt}$  and  $STA_{ijt}$ ,  $\beta$  is the coefficient vector corresponding to the elements in  $Z_{ij}$  and  $\varepsilon_{ijt}$  is the error term. Following Baier and Bergstrand (2007), the exporter-time ( $\alpha_{it}$ ) and importer-time ( $\gamma_{jt}$ ) fixed effects in (5) and (6) account for the time-varying MR terms in a panel setting.

Equations (5) and (6) are estimated by taking logs on either side:

$$\ln TF^g_{ijt} = \mu_{ij} + \alpha_{it} + \gamma_{jt} + \rho_t + \delta_1 GTA_{ijt} + \delta_2 STA_{ijt} + \delta_3 \ln TF^s_{ijt} + \varepsilon_{ijt} \dots \dots \dots (7)$$

$$\ln TF^s_{ijt} = \mu_{ij} + \alpha_{it} + \gamma_{jt} + \rho_t + \delta_1 GTA_{ijt} + \delta_2 STA_{ijt} + \delta_3 \ln TF^g_{ijt} + \varepsilon_{ijt} \dots \dots \dots (8)$$

where all the dyadic trade costs in  $t^g_{ijt}$  and  $t^s_{ijt}$  are captured in the pair-wise fixed effects  $\mu_{ij}$ ; the year effects  $\rho_t$  control for the influence of time-varying unobservables on bilateral trade

flows. Significantly, the inclusion of pair-wise, importer-time and exporter-time fixed effects also enables an endogenous treatment of the GTA and STA variables (Baier and Bergstrand, 2007).

## 4 Data

Data on bilateral services trade flows are taken from the Trade in Services Database (TSD, Francois and Pindyuk, 2013) which has data on aggregate cross-border services flows between 251 reporting and 251 partner countries over 1981-2010. However, the TSD is riddled with “zeroes” up until 1995 and also includes several small and island economies where under- or no-reporting of services transactions is standard practice. For meaningful analyses, we thus restrict our database to bilateral services trade flows for 34 OECD and 5 BRICS countries over 1995-2010 leading to a sample of 21854 observations. Bilateral services trade between the 39 OECD-BRICS countries accounted for 83% of global services trade on average over 1995-2010.

Data on bilateral goods trade are taken from UN Comtrade for the same time period and sample of countries. In this case, bilateral merchandise trade between the 39 OECD-BRICS countries accounted for 81% of global services trade on average over 1995-2010. The evolution of bilateral goods and services trade between the 39 OECD-BRICS countries over time and the share of this trade in global goods and services trade is reported in Table 1.

<Insert Table 1 here>

Data on trade agreements are taken from the WTO’s Regional Trade Agreements Information System (RTA-IS) database, where  $GTA = STA = 1$  for agreements notified under Article XXIV of the GATT or Enabling Clause and Article V of the GATS, respectively, during 1958-2010 and 0 otherwise. Since our data cover the period 1995-2010, if a goods or services agreement was reached before 1995, the GTA/STA variable takes a value 1 over 1995-2010. On the other hand, if the agreement came into effect after 1995, then the variable takes a value 1 in the year the accord entered into force and every year after that and the value 0 otherwise. This treatment also renders  $GTA_{ijt}/STA_{ijt}$  variables time-variant, which, from the perspective of econometric analysis, means that they can be retrieved in pair-wise fixed-effects estimations.



Figure 1 shows the top merchandise goods and services traders in our sample. The left panel shows trading partner dyads that had bilateral goods exports exceeding \$50 bn on average over 1995-2010. The corresponding value of services exports (in \$bn) for each trading dyad is also shown. Trading partners without any trade agreements in 2010 are highlighted in red. Looking at these export averages over 1995-2010, we find that 17 trading pairs (1.1% of 1530 dyads) had bilateral goods exports in excess of \$50 bn and 11 of these 17 dyads had both a GTA and STA in force in 2010. The right panel shows trading partner dyads in our sample that had bilateral services exports exceeding \$10 bn over 1995-2010. The corresponding value of goods exports (in \$bn) for each trading dyad is also shown. Once again, trading partners without any trade agreements in 2010 are highlighted in red. We find that 19 trading pairs (1.2% of 1530 dyads) had bilateral services exports in excess of \$10 bn but only a little over half of these 19 dyads (10) had both a GTA and STA in force in 2010.

<Insert Figure 1 here>

Table 2 shows the decile distribution of (positive) bilateral goods and services exports for our sample countries averaged over 1995-2010 and the existence of GTAs and STAs. The top decile ( $n = 152$ , accounting for 10% of all trading pairs in the sample) had an average goods export value of \$26.6 bn; more than half of these dyads had a GTA and nearly half of these dyads also had an STA in force in 2010. The top decile also had an average services export value of \$6.8 bn; exactly half of these dyads had an STA and more than half had a GTA in force in 2010. Table 2 also suggests that the distribution of bilateral goods and services exports over 1995-2010 was highly skewed with the export value of the top decile being several times larger than that of the bottom decile. Significantly, as one goes down the deciles, the propensity to negotiate a trade accord also declines, which highlights the endogenous relationship between bilateral trade and the PTA variables especially in the case of services trade.

<Insert Table 2 here>

## 5 Estimation issues

Even with a database reduced to OECD-BRICS countries, “zero incidence” was still a problem with services trade data (21.6%) though not as much with goods trade data (5%). 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<sup>1</sup> 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 (7) and (8) 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 high dimensional fixed effects (HDFE) in estimating these equations, another possibility was to use the “3-way”HDFE (3WHDFE) following Baier et al. (2014). The 3WHDFE allows for estimating linear regressions model with three high-dimensional fixed effects with minimal memory requirements.

Thus, (7) and (8) were estimated log-linearly using the 3WHDFE estimator, but only at the intensive margin.

## 6 Results

The empirical results from estimating equation (7) are reported in Table 3 and those from estimating equation (8) are reported in Table 4. In each case, we begin by including the “concerned PTA” (i.e. GTA for goods trade and STA for services trade), then progressively include the “other PTA” (i.e. STA for goods trade and GTA for services trade), examine complementarities between goods and services trade and in the most complete specification, also control for interaction effects between goods and services accords. All estimations include importer-time, exporter-time and bilateral pairwise fixed effects.

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<sup>1</sup>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)

The results reported in Table 3 suggest that having a goods trade accord increased bilateral goods trade amongst our sample countries by 4.8%<sup>2</sup>, ceteris paribus and on average, in the baseline specification (1). Interestingly, having a services accord in addition to the goods agreement, enhanced the goods trade effect to 10.5% in specification (2), though the STA itself had a negative effect on bilateral goods trade amounting to 7.7%. These results persisted in specifications (3) through (5) even after controlling for complementarities between goods and services trade and the possibility of interaction effects between goods and services accords, though the interaction variable itself dropped out of the estimation in specifications (4) and (5). Significantly, consistent with our theoretical model, our empirical results confirmed complementarities between goods and services trade in specifications (3) and (4). In particular, a 10% rise in bilateral services trade was associated with a 1.8% increase in bilateral goods trade amongst our sample OECD-BRICS countries, ceteris paribus and on average.

<Insert Table 3 here>

The results reported in Table 4 suggest that having an STA increased bilateral services trade amongst our sample countries by 4.1%<sup>3</sup>, ceteris paribus and on average, in the baseline specification (1). Analogous to the results from the goods trade regression, having a goods agreement in addition to the services accord, enhanced the services trade effect to 11.6% in specification (2), though the GTA itself had a negative effect on bilateral services trade amounting to 8.6%. This negative effect increased to 9.5% in specifications (3) and (4) when complementarities between goods and services trade and interaction effects between goods and services accords were included progressively. Like with the goods trade results, the interaction variable itself dropped out of the estimation in specifications (4) and (5). Our empirical results again confirmed complementarities between goods and services trade in specifications (3) and (4). In particular, a 10% rise in bilateral merchandise trade was associated with a 0.7% increase in bilateral services trade amongst our sample OECD-BRICS countries, ceteris paribus and on average.

<Insert Table 4 here>

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<sup>2</sup>This is calculated as  $\{exp(\delta) - 1\} * 100$  where  $\delta$  is the coefficient on the GTA variable.

<sup>3</sup>This is calculated as  $\{exp(\delta) - 1\} * 100$  where  $\delta$  is the coefficient on the STA variable.

While the positive effect of a GTA on bilateral merchandise trade and that of an STA on bilateral services trade is confirmed in our empirical results, the magnitude of the goods trade effect in particular is much smaller than that reported in this literature (for instance see Baier and Bergstrand, 2007). This can be attributed in part to our restricted sample of countries compared to that in Baier and Bergstrand (2007). However, our choice of sample period (1995-2010) is perhaps even more responsible for the much smaller magnitude of the goods trade effect than that reported in Baier and Bergstrand (2007), where the sample period is 1960-2005. In fact, our results on the magnitude of the goods trade effect confirm the intuition that most of the recently negotiated trade agreements may not be that trade-creating after all. Putting it differently, most of the “more” trade-creating GTAs (NAFTA and the EC15 enlargement for instance) were already negotiated before 1995, which possibly accounts for the smaller magnitude of the goods trade effect in our empirical results. To incorporate the effect of agreements that entered into effect before 1995, we included two additional indicator variables in estimation (GTA\_pre95 and STA\_pre95) which take the value 1 if a goods or services accord was in force between a trading dyad in our sample prior to 1995. The estimated coefficients on these pre95 PTAs supported this hypothesis.

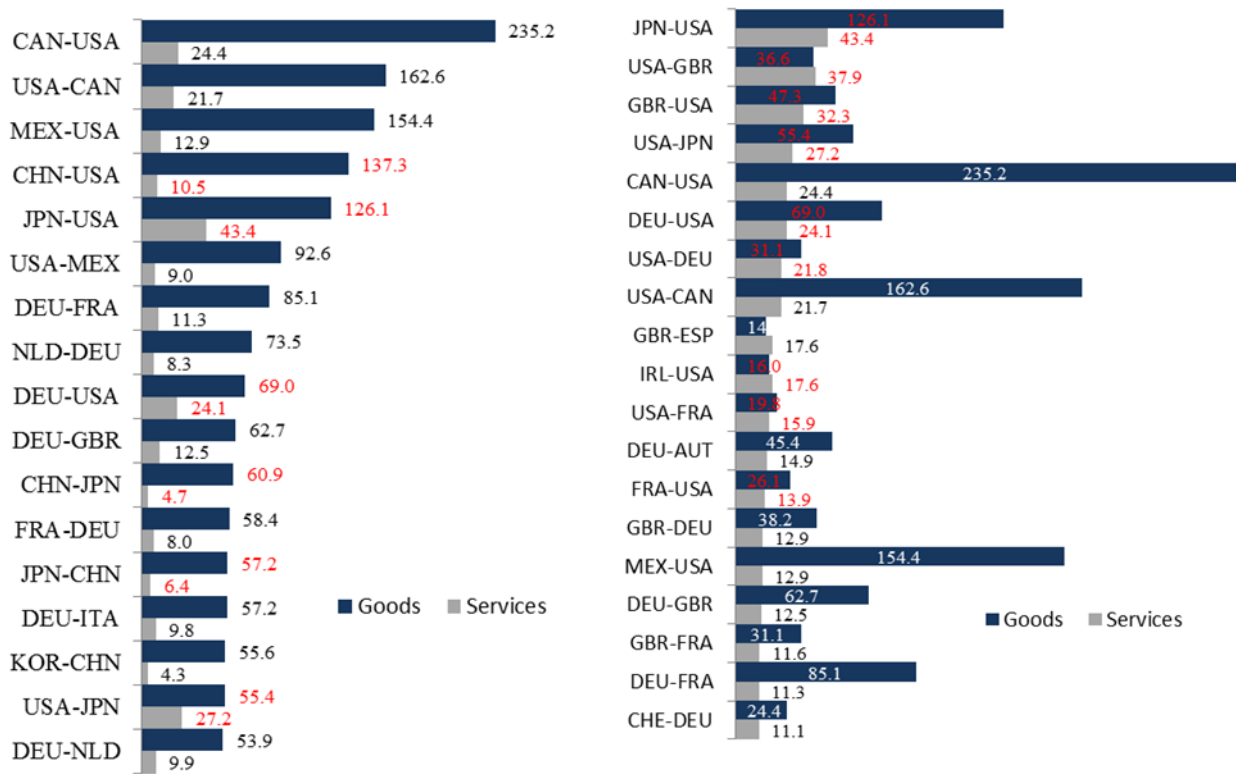
The negative trade effect of a GTA on bilateral services trade and of an STA on bilateral merchandise trade is also not hard to explain (though it runs counter to negotiating realities wherein 107 out of 122 STAs were entered into effect jointly with GTAs between the same partner countries). As a GTA makes both partners produce and export more goods to each other, this draws domestic resources away from services in each economy, leading in turn to reduced services production and exports (in the absence of any services-augmenting technological change). Similar logic would explain an STA reducing bilateral goods exports.

Finally, while the magnitude of complementarities between goods and services trade in our results does not appear to be large, let us not forget that the direction of trade is bilateral in each case. It is very likely that the impact of aggregate goods imports on bilateral services exports and aggregate services imports on bilateral goods exports would be much larger. In that sense, our empirical model perhaps employs a stricter definition of “complementarities” and evidence of complementarities in our results is thus both encouraging and consistent with our theoretical framework.

## References

- Baier, S., Bergstrand, J., and Feng, M. (2014). Economic integration agreements and the margins of international trade. *Journal of International Economics*.
- 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.
- Colin, C. A. and Trivedi, P. K. (2005). Microeconometrics: Methods and applications.
- Francois, J. and Pindyuk, O. (2013). Consolidated data on international trade in services. IIDE Discussion Papers 20130101, Institutue for International and Development Economics.
- Head, K. and Mayer, T. (2013). Gravity equations: Toolkit, cookbook, workhorse. *Handbook of International Economics*, 4.
- Lea, R. (2014). The oecd-wto trade in value-added research: a break-through in analysing world trade. *Arbuthnot Banking Group*, 17.
- Lennon, C. (2008). Trade in services and trade in goods: Differences and complementarities. *WIIW Working Papers* 53.
- 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.
- Shingal, A. (2009). How much do agreements matter for services trade? *MPRA paper 32815*.
- Timmer, M., Erumban, A., Gouma, R., Los, B., Temurshoev, U., de Vries, G., and Arto, I. (2012). The world input-output database (wiod): contents, sources and methods. *WIOD Background document available at [www.wiod.org](http://www.wiod.org)*.

Figure 1: Top merchandise goods and services exporters (values in \$ bn, avg. 1995-2010)



Source: UNComtrade and TSD; own calculations

Note: Left panel shows top goods exporters (value exceeding \$50 bn) and right panel shows top services exporters (value exceeding \$10 bn). Figures highlighted in red belong to trading dyads with no trade agreement in force in 2010.

Table 1: Evolution of bilateral goods and services exports for 39 OECD-BRICS countries over 1995-2010

Year	OECD & BRICS		Share in global exports (%)	
	Services exports (\$ bn)	Goods exports (\$ bn)	Services	Goods
1995	340.2	2737.1	98.1	85.1
1996	364.1	2781.5	95.9	88.5
1997	383.9	2928.8	95.9	85.7
1998	386.1	3051.1	92.9	87.9
1999	945.4	3622.2	83.5	85.6
2000	1047.7	4034.7	82.0	81.9
2001	1037.9	3924.1	81.6	82.4
2002	1142.1	4138.1	80.5	80.5
2003	1485.9	4814.8	79.4	79.8
2004	1703.0	5747.5	77.0	79.7
2005	2129.3	6507.0	73.8	75.5
2006	2059.8	7287.7	76.2	77.1
2007	2417.2	8319.2	77.0	77.7
2008	3008.5	9524.8	76.9	76.8
2009	2631.6	7379.6	76.6	75.5
2010	2008.4	7538.8	83.6	82.2

Source: UNComtrade and TSD; own calculations

Table 2: Decile distribution of bilateral goods and services exports for 39 OECD-BRICS countries (avg. 1995-2010)

Deciles (n= 1520)	Goods exports (\$ bn)	GTA	STA	Services exports (\$ bn)	STA	GTA
D1	26.65	0.56	0.47	6.81	0.50	0.62
D2	4.82	0.45	0.34	1.48	0.39	0.49
D3	2.45	0.44	0.33	0.72	0.32	0.41
D4	1.46	0.38	0.31	0.43	0.29	0.37
D5	0.84	0.42	0.23	0.26	0.29	0.45
D6	0.42	0.41	0.30	0.14	0.26	0.41
D7	0.22	0.40	0.26	0.08	0.24	0.34
D8	0.10	0.37	0.24	0.04	0.29	0.41
D9	0.04	0.37	0.31	0.02	0.28	0.37
D10	0.01	0.40	0.29	0.003	0.21	0.32

Source: UNComtrade and TSD; own calculations

Table 3: Results from estimating bilateral goods trade

<b>3HDFE estimation: Dependent variable <math>\ln(\text{TF}_{ij}^G)</math></b>					
	(1)	(2)	(3)	(4)	(5)
GTA	.047*** (.004)	.10*** (.006)	.10*** (.006)	.10*** (.006)	.10*** (.006)
STA		-.08*** (.007)	-.08*** (.007)	-.08*** (.007)	-.08*** (.007)
$\ln(\text{TF}_{ij}^S)$			.018*** (.002)	.018*** (.002)	
STA*GTA				omitted	omitted
N	16850	16850	16850	16850	16850
df_m	4	5	6	6	5
r2	0.9985	0.9985	0.9985	0.9985	0.9985
<b>Fixed effects:</b>					
dyadic	Yes	Yes	Yes	Yes	Yes
importer*time	Yes	Yes	Yes	Yes	Yes
exporter*time	Yes	Yes	Yes	Yes	Yes

**Note:** Levels of significance: \* 5% \*\*1% \*\*\*0.1%; standard errors reported in brackets.

Table 4: Results from estimating bilateral services trade

<b>3HDFE estimation: Dependent variable <math>\ln(\text{TF}_{ij}^S)</math></b>					
	(1)	(2)	(3)	(4)	(5)
STA	.04*** (.009)	.10*** (.013)	.11*** (.013)	.11*** (.013)	.10*** (.013)
GTA		-.09*** (.012)	-.10*** (.012)	-.10*** (.012)	-.09*** (.012)
$\ln(\text{TF}_{ij}^G)$			.07*** (.003)	.07*** (.003)	
STA*GTA				omitted	omitted
N	16850	16850	16850	16850	16850
df_m	4	5	6	6	5
r2	0.992	0.992	0.992	0.992	0.992
<b>Fixed effects:</b>					
dyadic	Yes	Yes	Yes	Yes	Yes
importer*time	Yes	Yes	Yes	Yes	Yes
exporter*time	Yes	Yes	Yes	Yes	Yes

**Note:** Levels of significance: \* 5% \*\*1% \*\*\*0.1%; standard errors reported in brackets.