Services liberalization and GVC participation: New evidence for heterogeneous effects by income level and provisions*

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February 2019

Abstract

Participation in global value chains (GVCs) is a key element in the industrialization strategies of many developing nations. This paper investigates the role of services liberalization in promoting participation in GVCs. Using the gravity framework, I examine the impact of services trade agreements on gross trade and GVC-trade (backward and forward participation) in goods. I find that services trade agreements promote both, but especially GVC-trade, although the effects are heterogeneous: the impact is bigger for developing nation exporters. Moreover, services agreements that allow the export of services without local presence (non-establishment rights) are particularly important in fostering GVC participation.

Keywords: Services liberalization, Global value chains, Regional trade agreements, Gravity equation, Non-establishment rights
JEL classification: F13, F14, F15, F63

*I thank Richard Baldwin, Julia Cajal Grossi, and Marcelo Olarreaga for their invaluable advice and support. I also thank Celine Carrere, Alen Mulabdic, Davide Rigo, and Agustin Velasquez for their helpful comments and suggestions. I thank seminar and conference participants at the Graduate Institute, Geneva, the 24^{th} IIOA conference, the International Conference on Services, Investment and Global Value Chains at IIFT, India, DEGIT XXII 2017, and ETSG 2017. I am also indebted to the editor, Davin Chor, and two anonymous referees for their insightful comments and suggestions. All remaining errors are my own. This paper is written as part of a project supported by the Swiss National Science Foundation (grant number: 100018_162511). The views expressed in this article are those of the author and do not represent the views of the World Bank.

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1 Introduction

Global value chains (GVCs) have transformed trade and development since the late 1980s by fragmenting the production process across borders (Baldwin, 2013, 2016). Coming under multiple labels such as trade in tasks, international fragmentation, offshoring, and the second unbundling, GVCs have attracted enormous attention from academics and policy makers in the developing and developed world.

However, studies on GVCs and trade have focused mostly on the manufacturing sector, despite the critical role of services. One of the most startling new facts concerning services has emerged from the "value added trade" concept (Johnson and Noguera, 2012; Koopman et al., 2014; Timmer et al., 2014). A joint OECD-WTO project (TiVA) found that services contribute more than 50% of total value added embodied in the exports from the US, UK, France, Germany and Italy. Even for China, traditionally viewed as a goods exporter, about one-third of its value added exports come from the service sector. Despite such dominance of services in many economies in terms of GDP and employment, the role of services in value chains is often underappreciated and poorly understood (Low, 2013).

The importance of services in GVCs, however, goes beyond their significant contribution to value added. It has been argued that a well-functioning services sector facilitates fragmentation, leading to an international reallocation of production stages (Jones and Kierzkowski, 1990; Francois, 1990c; Deardorff, 2001). The recent popularization of the GVC concept has highlighted this connection, with many authors emphasizing how services are the glue that holds supply chains together and ensures that they function in a fluid manner (Low, 2013; Egger et al., 2015; Francois et al., 2015).

Besides the rise of GVCs, another phenomenon — not unrelated — that characterizes trade in the past three decades is the rapid surge of bilateral and plurilateral trade agreements.[1] This proliferation has not only been in terms of quantity but also the quality or "depth". Recent trade agreements often include provisions on services, investment, environmental and labor standards, as well as tariff reductions (Hofmann et al., 2017).[2] These deep agreements are partly motivated by the international expansion of production networks, since harmonization of certain national policies facilitates cross-border business and allows GVCs to work smoothly (Lawrence, 1996). Furthermore, the actors involved in regional trade agreements (RTAs) have become more diverse. In 2010, South-South trade agreements represented two-thirds of all RTAs in force, compared to barely 20 percent three decades

[1] Hereafter, I use the term regional trade agreements (RTA) for all bilateral and plurilateral trade agreements, also referred to as preferential trade agreements (PTA).

[2] Regarding services, half of the 302 RTAs listed in the WTO database as currently in force covers only goods and the other half covers both goods and services.

earlier (WTO, 2011).

Using the variation in the coverage and members of RTAs, I examine the heterogeneous impact of services liberalization on countries' GVC participation. Specifically, I test whether a country pair engages in more GVC-trade when it has freer trade in services via RTAs, using the gravity equation. By focusing on manufacturing GVCs, I seek to identify the role of services trade liberalization beyond boosting trade in services, but as the "enabler" for a broader unbundling of production. The outcome variable, therefore, is GVC-exports (measured by exports in intermediate goods, backward and forward linkages based on international input-output tables) as well as gross exports in manufacturing between country pairs. The variable of interest is a dummy variable for an RTA in services. However, taking into account the asymmetric and non-discriminatory nature of services liberalization, the specification is adjusted to allow for heterogeneous effects by countries' income levels as well as specific provisions. To address the endogenous adoption of RTAs, I include country-pair fixed effects and hence, identify the effect of services trade agreements from country pairs that enter into RTAs during the sample period (Baier and Bergstrand, 2007).

I find that services trade agreements (or substantive provisions on services) increase gross exports and, to a larger extent, GVC-exports in manufacturing from developing (South) to developed countries (North), and between developing countries. The trade-enhancing effect of RTAs that cover services is more than *double* the effect of RTAs that only cover goods for Southern exporters. It is intuitive that services RTAs have an asymmetric effect on Southern and Northern economies, considering that services liberalization essentially brings "good" services into the South, hence reducing the high coordination cost of carrying out supply chain activities in the South. Regarding specific provisions, services agreements that allow the export of services without local presence (i.e. right of non-establishment) significantly increase GVC-exports in manufacturing. This novel finding emphasizes that reducing the fixed costs of building services linkages between production blocs is key to promoting production sharing.

This paper is related to three groups of literature. First, it contributes to the small but growing body of studies on the role of services in GVCs. Early theoretical research by Jones and Kierzkowski (1990) and Deardorff (2001) shows that trade liberalization in services can stimulate fragmentation of production of both goods and services, thus increasing international trade and gains from trade.[3] Empirical research on services and GVCs has been limited, due to the relative scarcity of data on services trade

[3]On more recent theoretical contributions, Nordås (2010) studies the impact of services trade liberalization on industrial structure and shows how countries can strengthen their comparative advantage in manufacturing following trade liberalization in services.

and services liberalization. Some recent attempts include Francois et al. (2015) who examine the value-added linkages between services and goods and stress the importance of services for the total cost structure of traded goods and services. Debaere et al. (2013) show that, for Ireland, greater availability of services increases firms' foreign sourcing of materials relative to sales, and Miroudot and Shepherd (2016) analyze trade in services with new measures of trade costs, distinguishing between services used as inputs and for final consumption. The main message from these studies, emphasizing the importance of services linkages for trade and performance in the goods sector, is in line with the findings of this paper. Nonetheless, the literature has not yet empirically established how preferential services liberalization affects trade flows and GVC participation in manufacturing.

Second, a large strand of literature studies the impact of RTAs on trade flows, but fewer studies focus on services trade agreements. However, as many of the major trade agreements now also cover services, some effort has been made to better understand the implications of trade agreements in services (Francois and Hoekman, 2010). Yet, the effect of having RTAs covering services, or whether they actually are preferential, is debated due to the often non-discriminatory nature of services restrictions (Roy et al., 2007; Miroudot et al., 2010; Miroudot and Shepherd, 2014).[4]

A few recent studies have investigated the effects of services RTAs on trade flows. Egger et al. (2012) analyze the impact of RTAs in goods and services on both types of trade flows for European countries, finding much larger welfare gains from liberalization in goods *and* services than from just one of the two. Dhingra et al. (2018) examine the effects of non-tariff provisions on trade in goods and services, and find that provisions related to services, investment, and competition jointly make up roughly half of the impact of RTAs on exports. Shingal (2016) is one of the first to take into account heterogeneous provisions found in services RTAs, although the analysis only considers the aggregate number of provisions ("depth") and how it affects services trade flows. This paper adds to the literature by exploring the heterogeneous effects of services RTAs depending on countries' income levels and specific provisions included in the services agreement.

Finally, this paper relates to the growing literature on the relationship between goods and services trade.[5] The increasing shift towards services in the manufacturing sector (sometimes called servitization or servicification) has been stressed by many authors.[6] A number of recent studies analyze

[4]Marchetti and Roy (2008) and Miroudot et al. (2010) investigate the commitments made in services RTAs and compare them with countries' multilateral commitments.

[5]A growing literature analyzes trade in services at the firm level (Kelle and Kleinert, 2010; Breinlich and Criscuolo, 2011; Ariu, 2015) and aggregate (Freund and Weinhold, 2002; Kimura and Lee, 2006), but the review here focuses only on those that study the interlinkages with the goods sector.

[6]See, for example, Neely et al. (2011); Lanz and Maurer (2015); Crozet and Milet

the interaction between trade in goods and services. For example, Ariu et al. (2017) examine the interaction of goods and services trade at the firm level, and show how trade liberalization in one sector can promote trade in the other. Ariu et al. (2018) demonstrate that firms can boost manufacturing exports by also providing services, due to demand complementarities between services and goods. Such bundling of trade in goods and services by firms provides another mechanism through which services liberalization can boost manufacturing exports. Other studies have shown that services trade liberalization (or restrictiveness) affects the performance of the manufacturing sector in terms of exports (Hoekman and Shepherd, 2015; Nordås and Rouzet, 2015; van der Marel, 2016; Liu et al., 2018) and productivity (Arnold et al., 2011, 2016; Beverelli et al., 2017). However, most of the empirical studies on the impact of services liberalization on the goods sector use country-level measures of services restrictiveness while this paper links preferential liberalization of services to manufacturing GVCs.

This paper is one of the first attempts to empirically test the impact of services liberalization on manufacturing trade flows in the context of GVCs. It is also one of the few studies to shed light on the effect of services trade agreements on trade flows. The evidence on the heterogeneous effects of services trade agreements, depending on countries' income level as well as specific provisions, is a novel contribution to the literature. My results have policy implications for developing countries pursuing more active participation in GVCs.

The remainder of the paper is organized as follows. Section 2 discusses the role of services in GVCs: how and why services liberalization should affect cross-border production sharing. The empirical specification is described in Section 3, and the data in Section 4. Section 5 presents the results, Section 6 the robustness analysis, and Section 7 concludes.

2 The role of services in GVCs

How does services liberalization affect manufacturing GVC participation? Jones and Kierzkowski (1990) provide a simple theoretical framework where trade liberalization in services could lead to an increased fragmentation of the production process across borders. In their framework, the disparity in productivity and factor prices between countries encourages the use of multiple locations for production of a given product (i.e. GVCs). Fragmentation, therefore, essentially lowers the marginal costs of production while increasing the total fixed costs arising from multiple locations. A key element of this fixed cost is the cost of *services linkages* — for example, transportation, telecommunications, and producer services such as finan-

(2017); Breinlich et al. (2018). Baines et al. (2009) reviews this literature.

cial and business services — which are necessary for coordinating different stages of production.[7] International fragmentation would be the efficient production choice if the additional fixed cost of building services linkages across borders is outweighed by the reduction in marginal costs. For this reason, services trade agreements are expected to increase GVC-trade by reducing the cost of services linkages between production blocs.

2.1 Characteristics of services trade liberalization

Trade liberalization in services has some important differences from trade liberalization in goods: it is fundamentally *asymmetric*, and often tends to be *non-discriminatory*. In a typical trade model, RTAs liberalizing trade in goods are often modeled as a symmetric reduction in trade cost. This makes sense when the liberalization takes the form of reciprocal reduction in tariffs, for example. However, services liberalization is profoundly different due to the special nature of services: its global concentration in the North as well as its non-discriminatory character. What matters is to get good services into a country which, in most cases, developed countries already have. Therefore, we should not expect a preferential liberalization in services trade between a developing and developed country to have a symmetric impact on the two partners: it will enhance the quality of services available in the South while having a small effect on the North.

Furthermore, many of the restrictions in services trade are in fact behind-the-border measures or non-discriminatory in nature. This makes it difficult to analyze the impact of services trade liberalization through RTAs as they often do not provide substantial preferential treatment to partner countries, as is the case for goods. Miroudot and Shepherd (2014) show that the trade cost reduction for country pairs that are part of an RTA is much smaller and diminishing over time for services, while trade costs are significantly lower within RTAs for goods. This means that we cannot expect an unambiguous trade-promoting effect of services trade agreements, but it does not mean that services RTAs do not provide any preferential liberalization. Depending on the specific provisions and commitments included in the services agreement, preferential liberalization of services *can* affect trade flows between partner countries.[8]

[7]Services that facilitate GVCs are not limited to those directly supporting trade (i.e. trade services such as transportation and insurance) but also include various business services. The role of producer services in specialization and the division of labor has also been stressed in Francois (1990a,c) and Egger et al. (2015).

[8]Comparing commitments in services RTAs to multilateral commitments in GATS, Marchetti and Roy (2008) and Miroudot et al. (2010) show that many RTAs in services *do* go beyond GATS and introduce preferential bindings. Furthermore, even if the trade cost reduction due to services RTAs were minimal, we know that trade policy can affect trade flows by creating greater certainty of market access between trading partners

RTAs increasingly include a comprehensive set of disciplines on investment and the temporary movement of business people. For example, RTAs featuring generic investment disciplines often include the right of non-establishment, which means that no local presence is required as a pre-condition to supply services. Moreover, many RTAs explicitly allow the supply of services through the temporary presence of a natural person of one member in the territory of another.

These characteristics of services liberalization necessitate a careful approach in examining the effect of services trade agreements on trade flows. In the next section, I describe how the impact of services RTAs is expected to differ by income levels and specific provisions.

2.2 Heterogeneous effects of services trade agreements

Not all services trade agreements are the same. Specific provisions and commitments made in the services trade agreements determine whether an agreement would effectively reduce the cost of services linkages in GVCs and how preferential the treatment will be. Furthermore, the asymmetric nature of services liberalization suggests that services trade agreements play a stronger role in facilitating GVC participation of developing countries, where services sectors tend to be more restrictive.

With whom you sign the agreement matters

The possibility that production stages can be dispersed geographically increases opportunities for less developed countries to industrialize by liberalizing trade in services and attracting manufacturing activities. This is formalized in the North-South model of global sourcing in Antràs and Helpman (2004) where a northern firm's choice of supplier location is governed by the trade-off between the lower variable costs of southern manufacturing against the lower *fixed organizational costs* in the North.[9] The location of production is determined by the North-South difference in fixed organizational costs and the wage gap. The model predicts that more firms will relocate their manufacturing stages to the South as the South's organizational cost disadvantage becomes smaller.

In light of services, trade liberalization in services that enhances services linkages can decrease the cost of coordinating production stages across bor-

(Handley and Limão, 2015; Pierce and Schott, 2016).

[9]The fixed organizational cost includes joint management costs of final and intermediate goods production such as supervision, quality control, accounting, and marketing. In their model, organizational forms are characterized by ownership structures as well as supplier locations, but I focus here only on the choice of supplier locations. My subsequent interpretation of their model is limited in a way that might speak to the phenomenon of services liberalization.

ders, one of the key elements in the fixed organizational costs. However, as discussed above, services RTAs do not necessarily provide substantial preferential treatment to partner countries symmetrically. A North-South RTA in services is likely to affect the services sector in the South more, by allowing access to high-quality services from the North. Moreover, an agreement is more likely to be cost-reducing if the existing barriers to services flows are high, which is often the case for developing countries. This suggests that services RTAs have differential effects depending on whether they are signed between developed countries, between developing countries, or between a developed and a developing country, where the effect should be asymmetric.

In terms of the global sourcing model, this means that North-South RTAs in services that bring good services to the South would lead to an *asymmetric* reduction in the fixed organizational cost, reducing the fixed organizational cost disadvantage of the South, and result in more offshoring to the South. Therefore, even if the most efficient providers of service were located in the developed world, liberalization of services and a subsequent fragmentation of production could lead to a finer international division of labor that developing countries could actively share (Jones and Kierzkowski, 1990).

Provisions in services trade agreements

Services trade agreements are heterogeneous in their commitments and provisions, and their effect on GVC-exports depends on the specific provisions included. In this paper, I introduce four types of provisions frequently found in services RTAs: most-favored nation (MFN), national treatment (NT), the right of non-establishment, and movement of natural persons.[10] The MFN principle guarantees that the best access conditions conceded to one country are automatically extended to all other participants in the system. MFN clauses in RTAs, however, are more complex and diverse than in multilateral agreements. While the MFN discipline in multilateral agreements ensures non-discrimination between all members of the multilateral trade body, in RTAs, the promise of non-discriminatory treatment is a reciprocal trade preference between RTA partners. However, MFN clauses in services RTAs do not necessarily provide preferential liberalization and the reach of these MFN clauses in RTAs is often limited by specific reservations (Fink and Jansen, 2009). NT forbids discriminatory measures that may modify the conditions of competition to the detriment of foreign

[10]The MFN and NT clauses are core disciplines that are also found in GATT (Articles 1 and II) as well as GATS (Articles II and XVII), while the right of non-establishment and movement of natural persons are specific to services trade agreements. The choice of these provisions is governed by the availability of data.

services or service suppliers, and the scope for preferential treatment of certain foreign providers post-establishment may be limited.

On the other hand, the non-establishment and movement provisions provide more preferential treatment and can lower the costs of services linkages necessary for coordinating GVCs. The non-establishment provision, for which no GATS equivalent exists, reduces the fixed cost for foreign services provider and is particularly relevant to services that are not naturally bound by proximity requirements. While traditional services often require temporal and spatial proximity between the production and consumption of the service (e.g. haircut), ICT development has allowed many modern services to be traded and consumed at a distance (e.g. e-learning courses, financial products). Therefore, the right of non-establishment is naturally more important for some services sectors (e.g. business and financial services) than others (e.g. construction and transport services).[11]

The ease of temporarily relocating people could be essential when supply chains are internationally dispersed, for instance for a firm deciding to offshore its assembly process only if it can easily send its own engineers or managers when necessary. However, the movement of persons is also often dealt with outside the scope of RTAs, such as in migration policies.

3 Empirical specification

To examine the heterogeneous effect of services trade agreements on gross exports and GVC-exports, I use the gravity equation. The gravity equation is a very strong and robust empirical tool in international trade, widely used and improving over time in terms of econometric techniques to accurately estimate the effects of RTAs on trade flows (Carrère, 2006; Santos Silva and Tenreyro, 2006; Baier and Bergstrand, 2007; Baldwin and Taglioni, 2007; Bergstrand et al., 2013, 2015).[12] The microfoundations of the gravity model also provide theoretical validity to the gravity equation (Eaton and Kortum, 2002; Anderson and van Wincoop, 2003).

To control for observed and unobserved heterogeneity across countries and pairs, and to address endogeneity, I include a rich set of importer-year, exporter-year, and country-pair fixed effects. Endogeneity is always a concern when analyzing the impact of policy on trade flows, because countries

[11]Consider financial services, for example. A financial institution can deliver its services abroad through physical channels such as branches and representative offices, or through remote channels like call centers or the internet. While supplying insurance services is often allowed on a cross-border basis with certain regulations, pure cross-border supply is often prohibited for banking which requires a commercial presence (Marchetti, 2009). Such requirements increase the fixed cost of providing services across borders by necessitating additional capital and liquidity as well as higher regulatory complexity.

[12]See Cipollina and Salvatici (2010) and Head and Mayer (2014) for a survey.

that trade more with each other are more likely to conclude an RTA. Baier and Bergstrand (2007) argue that the most plausible estimates of the average effect of RTAs on bilateral trade flows can be obtained using panel data with country-pair fixed effects. This eliminates an important source of endogeneity that is due to time-invariant unobserved heterogeneity between country pairs, and has been used widely in the literature to address the endogeneous formation of RTAs.[13]

In estimating the gravity equation, I use the Poisson Pseudo Maximum Likelihood (PPML) estimation, as advocated by Santos Silva and Tenreyro (2006), to account for heteroskedasticity in the trade flow data which can lead to inconsistent estimation of log-linearized OLS.[14] A diagnosis of the error term, following Head and Mayer (2014), supports the use of PPML over OLS or Gamma PML.[15]

The baseline estimating equation is given by

$$Y_{ijt} = \exp(\beta_0 + \beta_1 RTA_{ijt} + \beta_2 SERV_{ijt} + \alpha_{ij} + \alpha_{it} + \alpha_{jt}) + \epsilon_{ijt} \quad (1)$$

where Y_{ijt} is gross or GVC-exports in manufacturing from country i to country j in year t. Three alternative measures of GVC-exports (described in detail below) will be used: gross exports in intermediate goods, backward GVC-exports, and forward GVC-exports. α_{ij} captures all time-invariant country pair-specific effects such as distance, cultural and linguistic similarities, and any unobserved bilateral characteristics that may affect the trade flow between the two countries. α_{it} and α_{jt} are country-year fixed effects that capture all exporter and importer characteristics that vary over time such as output, price levels and multilateral resistance. RTA is a dummy variable which takes value one when the country pair has an RTA (FTA or stronger), and $SERV$ is a dummy variable for having a services trade agreement or a substantive services provision.[16]

Note that variable $SERV$ is equivalent to an interaction term with RTA (i.e. $RTA_{ijt} \times SERV_{ijt}$) since there are no observations where a country pair has a services agreement without having an RTA in goods. Hence,

[13]The fixed effects, however, cannot account for country-pair-specific changes over time, other than trade agreements, that may affect trade flows. The concern for potentially remaining endogeneity is addressed in Section 6.

[14]PPML regressions were technically implemented using the STATA command *ppml_panel_sg*, developed by Larch et al. (2017).

[15]Head and Mayer (2014) compare the performance of OLS, PPML, and GPML under different data generating processes and show that PPML performs best when the mean-variance ratio is constant (CVMR). Using Monte Carlo simulations, the authors show that the Manning and Mullahy (2001) test statistic ("MaMu test") can be used to distinguish between log-normal and CVMR. For my sample, the MaMu test delivers 1.64 (significantly less than 2), supporting CVMR error and hence a preference for PPML estimation. The authors also find no evidence of bias due to the incidental parameter problem with PPML using multi-way fixed effects.

[16]See the Section 4 on data for more details.

β_2 captures the extra effect of having a services agreement additional to a goods RTA. Also note that the identification is within country pairs since dyad fixed effects are included. This means that β_2 is identified *not* by comparing GVC-trade of a country pair that always had an RTA in services to another pair that never did, but by comparing GVC-trade of country pairs before and after they enter into an RTA either covering just goods or covering both goods and services.[17]

A caveat for the bilateral framework is that it has some limitations for the current research question. First, GVCs are not bilateral. As the name suggests, GVCs involve a chain or network of countries at the global or regional level, often more than two. Although bilateral measures of GVC-trade are available, these are not ideal for capturing the degree of "global" value chains. Second, estimating the impact of services trade liberalization through a bilateral framework (RTAs) is much less straightforward than for goods liberalization because many of the restrictions in services trade are behind the border or non-discriminatory, as discussed in Section 2.1. The bilateral framework of the gravity equation can identify only the effect of services liberalization that is *preferential*.[18] Despite these limitations, it allows us to capture to the extent possible the impact of services trade liberalization on cross-country trade flows while minimizing concerns for endogeneity often present in country-level indicators of services liberalization.[19] One should however be cautious in interpreting the results of bilateral (or preferential) services liberalization.

Bilateral measures of GVC participation

The outcome variable is a bilateral measure of GVC-trade in manufacturing.[20] I focus on manufacturing GVC-trade to identify the role of

[17]This includes country pairs that first had an RTA in goods and later also in services. See Appendix **??** for a discussion on the variations used.

[18]The potential spillover effects of services RTAs are not captured in my specification. If the benefits of services RTAs are not limited to the signatories and spill over to non-member countries, due to nondiscriminatory provisions, this would be absorbed by the fixed effects. The presence of such positive spillovers suggests that the gravity coefficients are a lower bound of the trade-enhancing effect of services RTAs.

[19]Although the empirical analysis in this paper is limited to the preferential dimension of services liberalization, services restrictions that hinder GVC-trade can be both unilateral and bilateral. Unilateral restrictions include domestic barriers to competition or administrative requirements that make business activity more costly. A country with restrictive logistics or transport services, for instance, will not be attractive for production offshoring from any country. On the other hand, there are also bilateral restrictions. For example, when a firm imports intermediate inputs, it may want to provide its own legal or banking services to the foreign affiliate or supplier. The cost of building such services linkages can vary bilaterally depending on RTAs that grant preferential treatment.

[20]Developing novel indicators of GVC participation is an ongoing process. One of the

services liberalization in the fragmentation of the production process, going beyond facilitating services trade. This also solves potential problems arising from the fact that services trade data in the inter-country I-O tables are often imputed using a gravity model, which can cast doubt on the validity of using the gravity model to analyze the data.

The most basic measure of GVC-trade would be *gross trade in intermediate goods*, as trade within a GVC involves parts and components crossing borders multiple times. More sophisticated indicators of GVC participation can be calculated based on either backward or forward linkages. At the unilateral country level, backward and forward linkages are defined as the foreign value added in domestic exports, and the domestic value added in foreign exports, respectively. GVC indicators based on backward and forward linkages bring out different aspects of GVC participation, depending on the country's specialization. For instance, exports from countries that are specialized in high value-added tasks are better captured by forward linkages, while exports of countries specialized in simpler tasks have stronger backward linkages (Kummritz, 2016).

To build bilateral measures of backward and forward linkages, I use the decomposition method developed in Wang et al. (2013). This decomposition splits gross bilateral exports into 16 components, broadly into domestic value added absorbed abroad (DVA), domestic value added returning home (RDV), foreign value added (FVA), and pure double counting terms (PDC) at the sector level.[21] This accounting framework allows me to construct the following bilateral measures of GVC participation. First, the bilateral *backward* linkage indicator between countries i and j for industry k is defined as the sum of value added from all industries of all foreign countries in the exports of country i's industry k to country j.[22] Second, the bilateral *for-*

earliest attempts to measure international fragmentation was the foreign content of domestic production by Feenstra and Hanson (1996), using information from input-output (I-O) tables. Hummels et al. (2001) further narrowed the Vertical Specialization (VS) measure to capture the import content of exports. Recent efforts to build international I-O matrices have led to more advanced measures such as the VAX ratio, the share of value-added to gross exports, as an inverse measure of GVC (Johnson and Noguera, 2012). Koopman et al. (2014) summarize the relationship among these different measures by deriving a comprehensive decomposition of gross exports, and Wang et al. (2013) extend the decomposition to a bilateral and sector level. See Amador and Cabral (2016) and Johnson (2017) for a review of different GVC measures.

[21]Some recent studies propose alternative methods of decomposition (Borin and Mancini, 2017; Miroudot and Ye, 2017). However, the literature has not yet reached a consensus on the best methodology to decompose bilateral exports at the sectoral level. The decomposition by Wang et al. (2013), based on Koopman et al. (2014), has been widely used in the literature, so I use GVC indicators based on this methodology in combination with gross total and intermediate exports as dependent variables.

[22]Industry k in this paper is the aggregate manufacturing sector for reasons discussed above. However, note that the foreign value-added can come from any sector as long as the exporting sector (from country i to j) is in manufacturing.

ward linkage indicator is the sum of value added from country i's industry k in country j's exports to all foreign countries in all industries. This measure includes back-and-forth trade, that is the value added from country i's export to country j in industry k that comes back to country i.[23] To clarify what these bilateral indicators capture, consider for example a GVC of car speakers as in Figure **??**. Say a Japanese car manufacturer offshores the production of speakers for a new car model. South Korea exports the speaker drivers such as tweeters and woofers to Thailand, which manufactures a frame around them. This is, then, shipped to a Chinese plant for final assembly before being exported to Japan and put into a new car.

In this example, Thailand and China are engaged in GVC-trade that also involves South Korea (backward) and Japan (forward). The bilateral backward and forward measures for Thailand (T) and China (C) would be:

- $Backward_{TC}$: Korean value-added in Thailand's exports to China (i.e. Korean value-added embodied in the tweeters and woofers)
- $Forward_{TC}$: Thai value added in Chinese exports to Japan (i.e. Thai value added embodied in the frames)

The backward-GVC measure for Thailand and China captures the foreign value added in Thailand's exports to China, while the forward measure captures the Thai value added exports to China that are re-exported. Both measures are elements of gross exports from Thailand to China but capture different aspects of GVC participation.[24]

Heterogeneous effects of services agreements

As described in Section 2, the asymmetric and often non-discriminatory nature of services liberalization suggests that the effects of services trade agreements are likely heterogeneous. To allow for such heterogeneity, I include interactions variables with the SERV variable: first with a vector of income pair dummies ($\mathbf{income}_{ij}$) and then with provision dummies (MFN, NT, $NonEst$, $Move$).

$$\begin{aligned} Y_{ijt} = \exp\big[&\beta_0 + \beta_1 RTA_{ijt} + \beta_2(SERV_{ijt} \times \mathbf{income}_{ij}) + \alpha_{ij} \\ &+ \alpha_{it} + \alpha_{jt}\big] + \epsilon_{ijt} \end{aligned} \tag{2}$$

[23]The decomposition was technically implemented using the R package *decompr* which automates the calculation of GVC indicators (Quast and Kummritz, 2015).

[24]Note that the notion of "forward" and "backward" is relative for these bilateral indicators. The forward measure captures what is a forward participation from Thailand's point of view but a backward participation from China's point of view. Also, the value of Korean woofers exported to Thailand is captured by the forward-GVC measure between South Korea and Thailand ($Forward_{KT}$) as well as the backward GVC measure for Thailand and China ($Backward_{TC}$).

The income pair vector $\mathbf{income}_{ij}$ includes four mutually exclusive binary variables: NN, SS, NS, and SN. SS is a dummy variable equal to one if the exporter and importer are both developing countries (South-South), NS equals one if the exporter is high-income and the importer is a developing country (North-South), and so on.[25] In Section 6, the RTA variable is also interacted with $\mathbf{income}_{ij}$ to ensure that the differential effect of services agreements is not driven by that of RTAs.

Similarly for provisions, I estimate

$$\begin{aligned} Y_{ijt} = \exp\big[&\beta_0 + \beta_1 RTA_{ijt} + \beta_2 SERV_{ijt} + \beta_3(SERV_{ijt} \times MFN_{ijt}) \\ &+ \beta_4(SERV_{ijt} \times NT_{ijt}) + \beta_5(SERV_{ijt} \times NonEst_{ijt}) \\ &+ \beta_6(SERV_{ijt} \times Move_{ijt}) + \alpha_{ij} + \alpha_{it} + \alpha_{jt}\big] + \epsilon_{ijt} \end{aligned} \tag{3}$$

where MFN equals one if the services agreement between the country pair (ij) at time (t) includes a MFN provision. Likewise, NT, $NonEst$, and $Move$ are dummy variables for having a provision on national treatment, non-establishment rights, and movement of natural persons.

4 Data

The bilateral indicators of GVC participation are calculated from the OECD Inter-Country Input-Output tables (ICIO, 2016 edition). These ICIO data, constructed from harmonized national input-output tables and bilateral trade coefficients from official sources, allows one to decompose gross trade, using the method developed in Wang et al. (2013) with a large coverage — 63 countries, 34 industries, and 17 years.[26] I exclude countries that do not have a manufacturing export base (i.e. less than 20 percent of total exports in manufacturing) since I am interested in manufacturing GVCs.[27] Also, I

[25]Income groups are defined according to the World Bank's classification. North includes countries that were classified as high-income, and South includes those classified as low- and middle-income in 1995 (beginning of sample period). See Appendix **??** for the classification of countries. An alternative classification is used for sensitivity analysis.

[26]As the underlying ICIO tables for the WTO-OECD TiVA indicators, the wide coverage of developing and developed countries in the OECD ICIO database makes it most suitable for analyzing heterogeneous effects of services RTAs by income level. Alternative data sources include the World Input-Output Database (WIOD) which provides more detailed sectoral data but is limited mostly to advanced economies, and EORA Multi-Region Input-Output (MRIO) database which has a higher country coverage but relies heavily on approximation for missing national I-O tables. OECD ICIO makes some adjustments for analytical purposes and symmetry, but the imputation of missing trade flows is largely a concern for services trade flows for which statistics are generally not available at the bilateral-sectoral level. For details on the construction method, see https://www.oecd.org/sti/ind/49894138.pdf.)

[27]These are Brunei Darussalam, Cyprus, Hong Kong SAR, Luxembourg, and Saudi Arabia. See Appendix **??** for the full list of countries.

use 3-year intervals to allow for adjustment to trade policy changes, as recommended in the literature (Yotov et al., 2016).[28] The resulting dataset is a panel of 58 countries and 6 years (1995, 1998, 2001, 2004, 2007, 2011).[29]

For data on trade agreements, I use the Economic Integration Agreement (EIA) database by Baier and Bergstrand (2007) and the Design of Trade Agreements (DESTA) database by Dür et al. (2014). The EIA database is used to construct a dummy variable for the existence of an RTA, taking value one if a country pair has an FTA or stronger, as often used in the literature.[30]

The variables on services agreements are constructed from DESTA.[31] The dataset measures the depth of each agreement as an additive index that combines seven key provisions. I use the binary variable (SERV) that indicates whether the trade agreement includes a substantive provision on services, and the detailed data on different types of provisions found in services trade agreements to examine the heterogeneous effect of services RTAs by contents.[32] In particular, the database codes whether the services agreement contains an MFN clause, national treatment clause, the right of non-establishment, and movement of natural persons, and so on (see Appendix **??** for more details).

Using these data sources, I construct the main variables. The summary statistics over time are provided in Table **??**, and across income groups in Table **??**. Table **??** shows that the average rate of GVC participation has been steadily increasing since 1995. At the same time, regional trade agreements in goods and services saw a rapid increase. In 2011, 44 percent of the country pairs in the dataset have an RTA covering goods, and 38 percent have an RTA for services as well. The provisions data show that a smaller share of services agreements includes an MFN clause, while provisions on

[28]Trefler (2004) and Cheng and Wall (2005) criticize trade estimations with data pooled over consecutive years, as adjustments take longer than a single year's time. Olivero and Yotov (2012) show that estimates using 3-year or 5-year intervals are very similar. My baseline estimates use 3-year intervals, but are robust to using annual or 5-year-interval observations (results available upon request).

[29]The baseline regressions include year 2011 instead of 2010 for two reasons: (i) In 2010, many countries' trade flows were still heavily affected by the global financial crisis, and (ii) by using 2011 instead of 2010, the number of services agreements included in the sample increases significantly.

[30]EIA database codes the trade agreements as following: (1) non-reciprocal preferential trade arrangements, (2) preferential trade arrangements, (3) free trade areas, (4) customs union, (5) common market, and (6) economic union.

[31]Building on the list held by the World Trade Organization (WTO) and World Trade Institute (WTI), DESTA combines agreements from a large number of other sources such as web pages of foreign ministries or governmental institutions.

[32]The World Bank's Content of Deep Trade Agreements database (Hofmann et al., 2017) also codes RTAs that include specific provisions (including services). However, DESTA's information on the detailed provisions included in the services agreement makes it more suitable for the analysis in this paper.

NT, non-establishment, and movement of persons are more common.[33]

The comparison between different income pairs also shows interesting trends. The share of intermediate goods in total manufacturing exports is highest between developed countries. For the backward and forward GVC-measures, developing countries tend to have higher backward linkages in their exports to developed and developing countries, while forward linkages show the opposite trend. This is intuitive since higher income countries tend to export high value-added inputs to each other (as part of the production process of sophisticated goods), or to developing countries for assembly. On the other hand, developing countries have a high share of foreign-value added in their exports since their participation in GVCs is often characterized by lower value-added activities such as assembly. In terms of trade agreements, high-income country pairs are most likely to have an RTA and a large share of them include a services agreement. A smaller share of developing country pairs has RTAs, and having an RTA for services is even less likely.

5 Results

Section 2 highlighted the need to go beyond average effects in studying services trade agreements: due to the often asymmetric and non-discriminatory nature of services liberalization, services RTAs do not necessarily provide substantial preferential treatment to partner countries. Indeed, the results shown in Table **??** find no significant effect, on average, of having a services agreement on trade flows, except for backward GVC-exports at the 10% level.

The lack of the effect of services trade agreements may seem discouraging, but is in fact not surprising for the reasons described above. This does not mean that bilateral or regional agreements in services trade do not matter. Despite the lack of average effect, services agreements affect trade flows and GVC participation of country pairs in a heterogeneous manner depending on the countries' income level or the specific provisions included in the services trade agreement.

Heterogeneous effects of services RTAs by income group

The discussion in Section 2 conjectures an asymmetric impact of services trade liberalization for developed and developing economies. Consistent with the intuition, the empirical results in Table **??** show that the

[33]The provisions are not mutually exclusive and different combinations of these provisions are included in services trade agreements. See Table **??** for the pattern of complementarity between provisions.

effect of services agreements are heterogeneous across income groups, with a significantly positive impact on exports and especially GVC-exports for developing countries. Compared to country pairs that have an RTA only covering goods, services agreements increase GVC-exports from developing to developed countries (SN) as well as between developing countries (SS). In contrast, services agreements generally do not increase GVC-exports from developed countries to their developed counterparts (NN) nor to developing countries (NS).

The effects of services trade agreements are asymmetric: a services agreement between a developing (South) and developed country (North) increases exports from South to North, but not the other way around. Furthermore, the increase is proportionally larger for GVC-exports than for gross exports, consistently across different measures of GVC-exports.

The average effect of signing an RTA in goods is a 9.6 percent increase in gross bilateral exports in manufacturing.[34] When a North-South country pair further enters into a services agreement, this increases gross exports from South to North by an additional 27.7 percent, making the total effect of their RTA (in goods and services) a 37.3 percent increase in gross exports.[35] For intermediate goods, the effect of goods RTAs is smaller but the additional effect of services agreements is larger at 29 percent, suggesting that services liberalization is more important for GVC-trade than the more traditional final-goods trade. The stronger positive impact of services agreements on GVC-exports is found consistently with backward and forward indicators as well. Services RTAs additionally increase backward GVC-exports by 29.8 percent, and forward GVC-exports by 37.6 percent, which are 2 and 10 percentage points larger, respectively, than the effect on gross exports.

The positive impact of services liberalization on GVC-trade between the South and North is consistent with the theoretical predictions. The higher forward GVC measure captures the increased value added in South's exports to the North that will be re-exported to the rest of the world. This can be explained by firms in the North offshoring parts of their production to the South. As discussed in Section 2, less costly service links between the South and North makes it more economically reasonable for Northern

[34]The coefficients (β) in the PPML regressions are interpreted as $(e^{\beta}-1)\times 100$ percent change in trade flows. Therefore, the effect of RTAs in goods is $(e^{\beta_{RTA}}-1)\times 100$ percent increase in exports, while the effect of RTAs covering both goods and services is $(e^{\beta_{RTA}+\beta_{SERV}}-1)\times 100$. The difference between the two is the additional effect of the services agreement.

[35]The magnitudes of the effects are comparable to those found in the literature. Most similarly, Dhingra et al. (2018) find that RTAs with provisions on services, investment and competition increase gross exports in goods by 30% (on average), of which roughly a third is due to these provisions. Mattoo et al. (2017) find that RTAs with the highest "depth" (number of provisions) increase trade by 44%.

firms to locate production activities in the South. The increase in backward GVC-exports implies an increase in foreign value added in the exports from South to North. If the input provided by South is not the first stage of production, i.e. if the South imports intermediate inputs from other countries to produce its own intermediate exports to the North, this increase is natural. More exports of a composite intermediate good from the South would imply an increase in both domestic and foreign value added in the export. Furthermore, better services linkages could allow the South to export more downstream or complex inputs that require higher values of imported intermediate inputs.[36]

Another interesting finding is that services trade agreements have a positive and significant effect on gross and GVC-exports *between* developing countries.[37] Since trade barriers tend to be highest between developing countries, the flow of services is often highly restrictive, and an RTA that liberalizes services trade could substantially increase GVC trade between the two countries. Having a trade agreement in services increases South-South total gross exports by an additional 17.1 percent, export in intermediate goods by 17.1 percent, backward GVC-exports by 23.8 percent, and forward GVC-exports by a smaller 12.3 percent. One could imagine situations that would lead to an increase in backward GVC-exports without an equivalent increase in forward exports. For example, say that the last two stages of a production process are assembly and packaging. A manufacturing product could be assembled in Vietnam, then shipped to China for final packaging before being sold as a final good around the world. If more complex and valuable products require better service links between production stages, a services agreement between Vietnam and China (ASEAN-China) could encourage firms to assemble and package more valuable or sophisticated goods in these two countries. So instead of assembling 100 units of fans, after the ASEAN-China agreement, Vietnam assembles 100 units of air purifiers and exports to China for packaging. This would lead to an increase of foreign value added in Vietnamese exports to China, without necessarily increasing the domestic value added.[38]

Services trade agreements do not seem to increase GVC- nor gross-exports from developed economies either to other developed countries nor to developing countries. The lack of North-North effect could be because developed countries already have relatively low levels of services restrictions

[36]Note that the intermediate inputs that the South imports to produce intermediate exports to the North can be in any sector (including agriculture and services) as long as the input the South exports to the North is a manufacturing product.

[37]The coefficients on SERV*SS and SERV*SN in Table **??** are not statistically different for gross exports, intermediate exports, and backward GVC-exports (columns 1-3), while they are different (at 5% level) for forward GVC-exports (column 4).

[38]This is assuming that the value of assembly is the same for fans and air purifiers, while the value of intermediate inputs that Vietnam imports is higher for air purifiers.

and the flow of services is not costly regardless of the services RTAs. Note that the main effect of services RTAs is not estimated in Table **??** because the income pair dummies fully span the complete set of observations.

To ensure that the income-varying effects of services agreements are not driven by the varying effects of RTAs in general, a robustness check is performed in Section 6, allowing the effect of RTAs to vary by income levels.

Heterogeneous effects of services RTAs by specific provisions

What types of provisions in services trade agreements are important for facilitating GVC participation? The question boils down to what type of service linkages are needed to maintain internationally dispersed production blocs. As discussed in Section 2, one of the key factors that enabled the rise in GVCs is the capacity to coordinate different stages of production across borders. ICT has reduced the cost of coordination and communication along GVCs but there are still costs, depending on how restrictive the services sector is. Considering that the gravity equation can only identify the effects of preferential services liberalization, the MFN clause in services RTAs which does not grant preferential treatment to the partner country is not expected to affect a country pair's engagement in GVC-trade. The same holds for the NT provision, which is also often a multilateral commitment rather than preferential.[39] The provisions on non-establishment and movement of natural persons, on the other hand, have a more preferential flavor, and are intuitively important for bilateral GVC-trade.

Table **??** shows the estimation results with interaction terms between the services agreement dummy ($SERV$) and provision dummies (MFN, NT, $NonEst$, and $Move$). As expected, MFN and NT clauses in services RTAs do not have a significant impact on a country pair's trade flows. However, services RTAs that grant the right of non-establishment significantly increase both gross- and GVC-exports. Exports increase by an additional 1.6 percent when a country pair has an RTA that allows services exports without local establishment, compared to when it only has an RTA covering goods. The positive impact of services RTAs with non-establishment rights is particularly large for backward GVC-exports at 11.5 percent.[40] The ef-

[39]Even if these provisions do increase trade with all countries, this effect will be absorbed by the country-year fixed effects.

[40]The magnitude of effects may seem small but note that these are marginal effects of services RTAs that include *only* non-establishment provisions (and *not* provisions on MFN, NT, or movement). In reality, services RTAs often include more than just one of these provisions (correlations in Table **??**). Simply computing the marginal effects of services RTAs with non-establishment rights (regardless of other provisions) gives larger estimated effects: 10.0, 10.3, 11.5, and 10.1 percent increase in gross, intermediate, backward, and forward GVC-exports, respectively, compared to having RTAs only covering goods. These magnitudes are obtained by calculating $(e^{\beta_{total}} - e^{\beta_{RTA}}) \times 100$

fect of services agreements without a non-establishment clause is absent. Provisions on the movement of natural persons do not show significant effects on GVC-exports (with the exception of forward GVC-exports) but one could speculate that this issue is often dealt with outside the scope of RTAs, such as separate visa arrangements or migration policies.

The intuition for why the non-establishment clause should matter for GVC-trade is straightforward. The requirement of local presence is one of the large fixed costs of building the services links needed for multiple production blocs. The relaxation of proximity requirements, thus, could result in a reallocation of production activities by facilitating trade in producer services (Francois, 1990b). Moreover, sectors that are particularly affected by this provision are those without an inherent requirement of proximity in the provision of the services, such as business and financial services, which arguably are particularly important in the context of offshoring.

6 Robustness

The rich set of fixed effects included in the econometric analysis alleviates concerns for endogeneity, specifically by controlling for country pair-specific propensity to engage in trade and GVC activities (Baier and Bergstrand, 2007). However, the concern for endogeneity remains if there are other time-varying changes in bilateral trade costs (omitted variables) or if country pairs change their propensity to engage in trade and production sharing over time, causing them to liberalize services trade (reverse causality). In addition, the first set of findings on the heterogeneous effects of services agreements by income level may be biased if RTAs in goods also have similar effects on GVC-exports of developing countries. A set of robustness checks is preformed to address these concerns.

First, I include additional pair-specific and time-varying variables that proxy for the bilateral propensity to engage in GVC-trade. Specifically, I add indicator variables for a country pair being part of a Common Market (CM) or having a Bilateral Investment Treaty (BIT). Controlling for CMs ensures that the estimated effects of services trade agreements are not driven by a few exceptionally deep economic integration agreements, such as the European Common Market.[41] Other than trade agreements, BITs are another important means for countries to promote GVC activities by facilitating investment, and can proxy for the bilateral propensity to en-

from the coefficients in Table B.1 of the Online Appendix, where β_{total} is the sum of coefficients on RTA, SERV, and SERV*NonEst.

[41]Common Markets are coded in Baier and Bergstrand (2007). In my sample, it essentially captures the European common market (EU and EFTA countries). Results are robust to including controls specific to the EU, customs unions, or economic unions (available upon request).

gage in GVC-trade.[42] As shown in Table **??** and **??**, the main findings are robust to the inclusion of these additional control variables, strengthening confidence in the causal relationship between services liberalization and increased GVC-exports in goods.

Second, I include interaction terms between distance and year dummies which would capture the changing effects of distance over time, as in Bergstrand et al. (2015).[43] If distance is an important element in bilateral trade costs that evolves over time, this would control for changes in bilateral trade costs, other than trade agreements, that could affect trade flows. The findings are robust to this specification (Tables B.2 and B.3 in the Online Appendix).

Third, I further exploit the timing of the services agreements to isolate the effect of these agreements more convincingly. One aspect of the timing of services agreements is that they always enter into force either together with or after RTAs in goods, and not before. This may raise doubts that the services agreement variable is capturing an "aging effect" of RTAs in goods. If the trade-promoting effect of RTAs tends to grow over time, this could bias the effect of services agreements upwards. To address this concern, I include interaction terms between RTA and age or year dummies to control for the different age and waves of RTAs (Tables B.4-B.7 in the Online Appendix).

Fourth, as briefly discussed in Section 5, a potential source of bias for the heterogeneous effects of services RTAs by income level is that RTAs in general may have differential effects depending on countries' income levels. If other provisions in RTAs have similar income-dependent effects, the interaction terms ($SERV \times$ **income**) may be capturing this instead. To address this concern, I allow the effects of RTAs to vary by income level as well. Table **??** confirms that the heterogeneous effects are specific to services agreements rather than RTAs in general.

Finally, the literature has claimed strict exogeneity of RTA variables by showing that future levels of RTAs do not have a significant effect on concurrent trade flows (Baier and Bergstrand, 2007; Yotov et al., 2016). The empirical setup in this paper that simultaneously estimates the effects of RTA and SERV, using variation within country pairs, poses some challenges in exploring the dynamics of these agreements.[44] Therefore, in Table **??**, I include lead variables to the specification in Table **??**, using annual data which provides more granularity to the timing of the agreements. The

[42]The importance of investment treaties for trade and GVCs, or the trade-services-investment nexus, is stressed in Baldwin (2013) and Egger and Wamser (2013).

[43]It is not possible to include the full set of controls suggested by Bergstrand et al. (2015) because there is no clear equivalent of intra-national trade flows for GVC-exports.

[44]As *SERV* shifts to one together with or a few years after *RTA* (with an average of 4.5 years lagged entry for those with sequential entry), the anticipated (lead) effect of *SERV* and the (contemporaneous or lagged) effect of *RTA* is difficult to disentangle.

results show no significant increases in trade occurring before the RTAs in goods and services enter into force, strengthening the case for exogeneity. Furthermore, the interaction effects between SERV and developing-country exporter continues to be notably more robust than those with RTAs across different indicators of GVC-exports.

Additional robustness checks were performed using annual data and 5-year intervals, using a different classification for North and South, and including the full sample of countries available in the OECD ICIO database, all of which do not alter the main findings.[45] The consistency of the main results throughout alternative specifications and different measures of GVC-exports adds credibility to the mechanisms described in Section 2.

7 Conclusion

The link between excellent services and the functioning of GVCs has long been emphasized both by economists and policy makers. This paper is one of the first attempts to empirically assess the importance of this link, in particular, the connection between services trade agreements and GVC participation in manufacturing. Using inter-country input-output tables and detailed data on services trade agreements, I show that having a services agreement is associated with higher gross exports and GVC-exports between developing countries, and from developing to developed countries. The effect is proportionally larger for GVC-trade, suggesting a larger importance of services linkages for fragmented production processes. The finding that services trade agreements asymmetrically benefit developing countries has important policy implications: when the production of goods involves intermediate inputs crossing borders multiple times, lowering tariffs and liberalizing trade in intermediate goods are not the only options available for developing countries to take part in GVCs. Liberalizing trade in services can provide new pathways for developing countries to utilize their comparative advantage in labor-intensive stages by joining GVCs, even when they lack comparative advantage in the integrated process.

The paper's findings also highlight the importance of non-establishment rights for services liberalization in the GVC context. I find that allowing cross-border supply of services without local presence significantly increases countries' participation in manufacturing GVCs. This novel finding warrants further investigation since it is likely to gain relevance as advanced communication technology enables more services to be supplied and consumed from a distance.

[45]The alternative North-South definition classifies "advanced economies", as defined by the International Monetary Fund, as North (see Table B.8 in the Online Appendix). Other results are available upon request.

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Table 1: Summary statistics (mean) over time

	1995	1998	2001	2004	2007	2011
Intermediate goods	0.533	0.532	0.548	0.560	0.566	0.568
Backward-GVC	0.215	0.225	0.239	0.247	0.258	0.253
Forward-GVC	0.136	0.146	0.155	0.159	0.160	0.165
RTA	0.188	0.235	0.297	0.381	0.412	0.439
SERV	0.131	0.159	0.202	0.305	0.360	0.384
— MFN	0.006	0.016	0.051	0.081	0.093	0.110
— NT	0.122	0.140	0.150	0.236	0.300	0.324
— NonEst	0.103	0.121	0.164	0.266	0.309	0.329
— Move	0.128	0.153	0.174	0.263	0.314	0.338

The three GVC-variables are expressed as shares of total gross bilateral trade in manufacturing. *RTA*, *SERV*, *MFN*, *NT*, *NonEst*, and *Move* are dummy variables, and therefore the mean shows the share of country pairs that have the respective agreement or provision. Means for each variable are statistically different between 1995, 2004 and 2011 at the one percent level.

Table 2: Summary statistics (mean) across income groups

	South-South	North-North	North-South	South-North
Intermediate goods	0.538	0.585	0.544	0.551
Backward-GVC	0.252	0.223	0.231	0.244
Forward-GVC	0.140	0.175	0.153	0.157
RTA	0.223	0.485	0.333	0.333
SERV	0.143	0.439	0.263	0.263
— MFN	0.042	0.059	0.071	0.071
— NT	0.116	0.386	0.210	0.210
— NonEst	0.118	0.404	0.209	0.209
— Move	0.119	0.408	0.233	0.233

The three GVC-variables are expressed as shares of total gross bilateral trade in manufacturing. *RTA*, *SERV*, *MFN*, *NT*, *NonEst*, and *Move* are dummy variables, and therefore the mean shows the share of country pairs that have the respective agreement or provision. 1056, 600, 825, 825 are the number of directional country pairs that are included in South-South, North-North, North-South, and South-North, respectively. Values are averaged across sample years. Means across corridors are statistically different at the one percent level. This is the case for all variables with the exception of: exports in intermediate goods between South-South and North-South, forward-GVC exports between North-South and South-North, and MFN clause between North-North and South-North.

Table 3: Services trade agreements and trade flows (average effect)

	(1)	(2)	(3)	(4)
		GVC-exports		
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA	0.0973***	0.0836**	0.0982***	0.0803**
	(0.0308)	(0.0336)	(0.0344)	(0.0388)
SERV	0.0378	0.0414	0.0579*	0.0386
	(0.0337)	(0.0357)	(0.0350)	(0.0406)
Obs.	19836	19836	19836	19836

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Heterogeneous impact of services agreements by income group

	(1)	(2)	(3)	(4)
		GVC-exports		
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA	0.0920***	0.0779**	0.0797**	0.0883**
	(0.0316)	(0.0352)	(0.0352)	(0.0409)
SERV*NN	-0.0576	-0.0781	-0.0664	-0.0289
	(0.0625)	(0.0722)	(0.0785)	(0.0867)
SERV*SS	0.145***	0.147**	0.199***	0.107*
	(0.0535)	(0.0583)	(0.0595)	(0.0569)
SERV*NS	-0.101*	-0.0847	-0.0973	-0.124**
	(0.0534)	(0.0585)	(0.0597)	(0.0628)
SERV*SN	0.225***	0.238***	0.243***	0.296***
	(0.0557)	(0.0619)	(0.0576)	(0.0761)
Obs.	19836	19836	19836	19836

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Heterogeneous impact of services agreements by provisions

	(1)	(2)	(3)	(4)
			GVC-exports	
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA	0.0741**	0.0607*	0.0975***	0.0362
	(0.0317)	(0.0346)	(0.0362)	(0.0365)
SERV	-0.114	-0.129	-0.0309	-0.267***
	(0.105)	(0.105)	(0.117)	(0.0980)
SERV*MFN	-0.115*	-0.0995	-0.179**	0.0296
	(0.0602)	(0.0688)	(0.0765)	(0.0688)
SERV*NT	0.0810	0.0653	0.0507	0.0222
	(0.0617)	(0.0669)	(0.0605)	(0.0876)
SERV*NonEst	0.129**	0.137***	0.130**	0.128**
	(0.0509)	(0.0531)	(0.0585)	(0.0567)
SERV*Move	0.0610	0.0734	0.0257	0.210*
	(0.107)	(0.107)	(0.115)	(0.112)
Obs.	19836	19836	19836	19836

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML. *MFN*=1 if the services agreement contains an MFN clause. *NT*=1 if the services agreement contains a national treatment clause. *NonEst=1* if the services agreement explicitly grants the right of non-establishment (i.e. if it allows the provision of services without local presence). *Move*=1 if the services agreement allows the movement of natural persons in the provision of services. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 6: Heterogeneous impact of services agreements by income group (Controlling for Common Market and BITs)

	(1)	(2)	(3)	(4)
			GVC-exports	
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA	0.0821**	0.0683*	0.0746**	0.0748*
	(0.0319)	(0.0353)	(0.0348)	(0.0407)
SERV*NN	-0.0547	-0.0743	-0.0680	-0.0231
	(0.0625)	(0.0724)	(0.0786)	(0.0865)
SERV*SS	0.161***	0.161***	0.216***	0.125**
	(0.0538)	(0.0586)	(0.0593)	(0.0573)
SERV*NS	-0.0935*	-0.0771	-0.0931	-0.113*
	(0.0533)	(0.0584)	(0.0595)	(0.0631)
SERV*SN	0.232***	0.245***	0.246***	0.307***
	(0.0559)	(0.0620)	(0.0573)	(0.0763)
CM	0.131***	0.120**	0.144***	0.120**
	(0.0485)	(0.0502)	(0.0550)	(0.0581)
BIT	0.0895**	0.104**	0.0346	0.127***
	(0.0382)	(0.0429)	(0.0284)	(0.0436)
Obs.	19836	19836	19836	19836

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML. CM=1 if the country pair is part of a common market (EU). BIT=1 if the country pair has a Bilateral Investment Treaty in force. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Heterogeneous impact of services agreements by provisions (Controlling for Common Market and BITs)

	(1)	(2)	(3)	(4)
		GVC-exports		
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA	0.0665**	0.0519	0.0981***	0.0227
	(0.0321)	(0.0350)	(0.0362)	(0.0364)
SERV	-0.102	-0.123	-0.0103	-0.262**
	(0.107)	(0.108)	(0.117)	(0.102)
SERV*MFN	-0.113*	-0.0991	-0.176**	0.0319
	(0.0607)	(0.0692)	(0.0770)	(0.0685)
SERV*NT	0.0802	0.0655	0.0472	0.0238
	(0.0627)	(0.0677)	(0.0621)	(0.0871)
SERV*NonEst	0.121**	0.138**	0.111*	0.131**
	(0.0551)	(0.0578)	(0.0599)	(0.0623)
SERV*Move	0.0602	0.0733	0.0223	0.211*
	(0.107)	(0.108)	(0.115)	(0.111)
CM	0.0421	0.0201	0.0547	0.0189
	(0.0542)	(0.0559)	(0.0584)	(0.0630)
BIT	0.0927**	0.108**	0.0386	0.134***
	(0.0385)	(0.0431)	(0.0289)	(0.0437)
Obs.	19836	19836	19836	19836

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML. *MFN*=1 if the services agreement contains an MFN clause. *NT*=1 if the services agreement contains a national treatment clause. *NonEst=1* if the services agreement explicitly grants the right of non-establishment (i.e. if it allows the provision of services without local presence). *Move*=1 if the services agreement allows the movement of natural persons in the provision of services. *CM*=1 if the country pair is part of a common market (EU). *BIT*=1 if the country pair has a Bilateral Investment Treaty in force. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 8: Heterogeneous impact of services and goods agreements by income group

	(1)	(2)	(3)	(4)
		GVC-exports		
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA*NN	0.139	0.108	0.0401	0.177
	(0.0986)	(0.114)	(0.126)	(0.119)
RTA*SS	0.125**	0.107*	0.131**	0.0731
	(0.0535)	(0.0610)	(0.0601)	(0.0654)
RTA*NS	0.0173	0.0287	0.0186	0.0197
	(0.0615)	(0.0624)	(0.0634)	(0.0643)
RTA*SN	0.0848	0.0631	0.115	0.134*
	(0.0656)	(0.0682)	(0.0738)	(0.0781)
SERV*NN	-0.0803	-0.0929	-0.0464	-0.0712
	(0.0594)	(0.0676)	(0.0577)	(0.0935)
SERV*SS	0.124**	0.128**	0.167***	0.115**
	(0.0556)	(0.0595)	(0.0586)	(0.0564)
SERV*NS	-0.0362	-0.0418	-0.0482	-0.0638
	(0.0647)	(0.0662)	(0.0636)	(0.0693)
SERV*SN	0.233***	0.251***	0.213***	0.259***
	(0.0667)	(0.0691)	(0.0730)	(0.0771)
Obs.	19836	19836	19836	19836

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Heterogeneous impact of services and goods agreements by income group with lead variables

	(1)	(2)	(3)	(4)
		GVC-exports		
	Gross exports (total)	Intermediate goods	Backward (sourcing)	Forward (selling)
RTA*NN	0.0283	-0.0343	-0.000525	0.0459
	(0.0892)	(0.111)	(0.105)	(0.143)
RTA*SS	0.0981**	0.0918	0.102**	0.0778
	(0.0461)	(0.0577)	(0.0448)	(0.0613)
RTA*NS	0.00431	0.0242	0.0468	-0.00619
	(0.0501)	(0.0550)	(0.0554)	(0.0514)
RTA*SN	0.102**	0.0774	0.0899	0.0930
	(0.0472)	(0.0518)	(0.0582)	(0.0583)
SERV*NN	-0.0135	0.0242	-0.0235	0.0756
	(0.0583)	(0.0775)	(0.0528)	(0.115)
SERV*SS	0.104***	0.0866**	0.147***	0.0923**
	(0.0347)	(0.0349)	(0.0429)	(0.0374)
SERV*NS	-0.209***	-0.204***	-0.259***	-0.118**
	(0.0557)	(0.0584)	(0.0532)	(0.0598)
SERV*SN	0.269***	0.271***	0.253***	0.284***
	(0.0558)	(0.0581)	(0.0596)	(0.0668)
RTA_{t+1}*NN	0.0721	0.120	-0.00671	0.149
	(0.0733)	(0.0893)	(0.0756)	(0.114)
RTA_{t+1}*SS	0.0706	0.0577	0.0477	0.0461
	(0.0509)	(0.0561)	(0.0625)	(0.0572)
RTA_{t+1}*NS	0.0781*	0.0761	0.0678	0.0606
	(0.0467)	(0.0470)	(0.0555)	(0.0492)
RTA_{t+1}*SN	0.0303	0.0242	0.0688	0.0773
	(0.0555)	(0.0535)	(0.0577)	(0.0635)
$SERV_{t+1}$*NN	-0.0538	-0.115**	-0.0176	-0.151*
	(0.0391)	(0.0539)	(0.0328)	(0.0773)
$SERV_{t+1}$*SS	0.00585	0.0192	0.00886	0.00612
	(0.0446)	(0.0478)	(0.0493)	(0.0443)
$SERV_{t+1}$*NS	0.0679	0.0549	0.0615	0.0184
	(0.0478)	(0.0461)	(0.0551)	(0.0418)
$SERV_{t+1}$*SN	-0.0554	-0.0313	-0.0494	-0.0179
	(0.0586)	(0.0591)	(0.0571)	(0.0678)
N	52896	52896	52896	52896

Standard errors clustered by country pairs in parentheses. All specifications include exporter-year, importer-year, and country pair fixed effects, and are estimated using PPML on annual data between 1995-2011. RTA_{t+1}=1 if RTA=1 in t+1. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A Appendix

A.1 Sample coverage

High-income countries ("North")	Low- and middle-income countries ("South")
Australia	Argentina
Austria	Brazil
Belgium	Bulgaria
Brunei Darussalam	Cambodia
Canada	Chile
Cyprus	China
Denmark	Colombia
Finland	Costa Rica
France	Croatia
Germany	Czech Republic
Hong Kong SAR, China	Estonia
Iceland	Greece
Ireland	Hungary
Israel	India
Italy	Indonesia
Japan	Latvia
Korea, Rep. of	Lithuania
Luxembourg	Malaysia
Netherlands	Malta
New Zealand	Mexico
Norway	Morocco
Portugal	Peru
Singapore	Philippines
Spain	Poland
Sweden	Romania
Switzerland	Russian Federtion
Taiwan, China	*Saudi Arabia*
United Kingdom	Slovak Republic
United States	Slovenia
	South Africa
	Thailand
	Tunisia
	Turkey
	Vietnam

Countries in italics are excluded from the baseline regressions.
Income groups follow the World Bank's income classification in 1995.

A.2 Variation in RTAs for goods and services

The identification of the effect of RTAs in goods and services relies on country pairs that enter into RTAs during the sample period (1995-2011). Table A.1 shows the RTA status of the country pairs included in the baseline analysis (58 countries and 3306 directional pairs).[1] Of the 3306 country pairs, 1856 pairs never had an RTA in goods or services, 428 always had an RTA in goods and services, and 14 pairs always had an RTA in goods but never in services between 1995-2011. Due to the country-pair fixed effects, these country pairs that have no time-variation in the RTA nor SERV variables are not used in the identification.

Table A.1: RTA status in goods and services

		SERV			Total
		Never	Always	Change	
RTA	Never	1856	0	0	1856
	Always	14	428	172	614
	Change	166	0	670	836
Total		2036	428	842	3306

The variation needed for the identification is provided by (i) 166 pairs that entered into an RTA in goods (but never in services), (ii) 172 pairs that always had an RTA in goods but entered into an RTA in services, and (iii) 670 pairs that entered into an RTA in goods and services. Of the 670 pairs that entered into RTAs in goods and services between 1995-2011, 414 of them entered into an RTA in goods and services simultaneously, and 256 of them in different years.[2] The sequential entry into force for goods and services could be due to either (i) a country pair signing an RTA that has a different date of entry into force for goods and services, or (ii) a country pair first entering into an RTA that only covers goods and later on becoming part of another RTA (potentially with different members involved) that also covers services.[3] Table A.2 shows the number of country pairs that have variation in the RTA dummies by income group.[4]

[1] Although RTAs are non-directional, I count the number of directional pairs here because the econometric analysis uses directional pairs. For the number of non-directional country pairs, one simply needs to divide by 2.

[2] The average lag in years between the entry into force of the goods and services agreement is 4.47 and the median is 5 for these 256 country pairs.

[3] An example of the first case would be the ASEAN-China trade agreement which entered into force in 2005 for goods and in 2007 for services. An example of the latter case would be New Zealand and Thailand. They first signed a bilateral trade agreement for goods (entry into force: 2005), and then became part of the ASEAN-Australia-New Zealand agreement covering also services (2010). I implicitly assume that RTAs with sequential entry into force for goods and services are not different from those with

Table A.2: Variation by income groups

	South-South	North-North	North-South	South-North	Total
Change in RTA only	78	8	40	40	166
Change in SERV only	16	58	49	49	172
Change in both	284 (134)	26 (26)	180 (127)	180 (127)	670 (414)
Total	378	92	269	269	1008

This tables shows the number of directional country pairs that have time-variation in their RTA status. Numbers in parentheses are the country pairs for which the change in RTA and SERV occurred simultaneously.

A.3 DESTA services provisions coding

The dummy variables on services agreements and provisions are from **?**.The questions they used to code the data are as follows.

[servicechap] for SERV

Does this agreement include substantive provisions stipulating the liberalization of trade in services?

0 no mention of services trade liberalization
1 services trade liberalization mentioned as general objective
2 substantive provisions liberalizing trade in services

DESTA codes 1 if the aim of liberalizing services is mentioned in the agreement's preamble. Also 1 are agreements with a services chapter or article that does not contain any substantive liberalization measures.

$SERV$ equals one if DESTA codes serviceschap=2, zero otherwise.

[servicesmfn] for *MFN*

Does the service chapter contain an MFN clause?

0 no service chapter
0 no MFN clause included in the service chapter
1 MFN clause included in the service chapter

[servicesnationaltreat] for *NT*

Does the service chapter contain a national treatment clause?

0 no service chapter

simultaneous entry into force. See **?** for a discussion on this.

[4]South-South country pairs entering into services agreements include EU-RTAs with non-EU South countries: for example, Lithuania and Slovakia which had a goods agreement (Lithuania-Slovakia bilateral agreement) since 1997, and then services since the EU expansion in 2004. It also includes other country pairs with South-South agreements such as Argentina-Brazil, with MERCOSUR entering into force in 1991 for goods and 2005 for services, or Vietnam-Cambodia, with Cambodia joining ASEAN (goods) in 2000, which later expands to cover services in 2007.

0 no national treatment clause included in the service chapter

1 national treatment clause included in the service chapter that is limited in scope to specific sectors

2 national treatment clause included in the service chapter

Variable NT equals one if servicesnationaltreat ≥ 1, zero otherwise.

[**sernonestablishment**] **for *NonEst***

Does the service chapter grant the right of non-establishment (that is, does it allow the provision of services without local presence)?

0 no service chapter

0 the right of non-establishment is not explicitly allowed (it may be either omitted or explicitly excluded)

1 the right of non-establishment is explicitly granted

[**sermovement**] **for *Move*** Does the service chapter allow the movement of natural persons in the provision of services?

0 no service chapter

0 movement of natural persons is not explicitly allowed (it may be either omitted or explicitly excluded)

1 movement of natural persons in the provision of services is explicitly allowed

A.4 Correlation among provisions

Table A.3: Correlation among provisions

	MFN	NT	NonEst	Move
MFN	1			
NT	-0.4015	1		
NonEst	0.0608	-0.0210	1	
Move	-0.6195	0.6698	-0.0732	1

Correlations are conditional on the country pair-year having a services agreement.