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Latin America's faltering manufacturing competitiveness: what role for intermediate services?

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Abstract
Latin America's share in global exports of manufactures stagnated around 5% from 2000 to 2016, which contrasts the performance of developing Asia (which share rose from 23% to 37%). The former region's underperformance is often explained by the overvaluation of its exchange rate during this period due to the growing specialization in natural resources. This paper analyzes another potential explanation of the region's stagnant performance: the insufficient incorporation of domestic and foreign intermediate services as a source of value added. A growing literature shows that a country's manufacturing export performance depends critically on its degree of (business) servicification. We compare Latin America and ASEAN in terms the role of intermediate services in exports of manufactures using international input output tables between 1995 and 2011: domestic services value added intensity of manufacturing exports is higher in Latin America, whereas the imported services value added intensity is higher in ASEAN. Regressions seems to suggest that total domestic services content of manufacturing exports is negatively associated to global exports market shares, whereas total imported services are positively associated. However, some types of domestic business services are positively associated to changes global export market shares, while domestic finance and real estate services may be negatively associated.

1. Introduction

From 1990 to 2016, Latin America's share in global exports of manufactures has stagnated around 5%. The region slightly gained market share in global trade in medium-tech manufactures, but lost in global trade of resource based, low and high tech manufactures. This overall disappointing performance differs strongly from that of developing Asia (ASEAN, China and India), which increased its global exports share from 23% to 37% during the same period. Latin America's overall underperformance in trade in manufactures is often explained by its growing specialization in natural resources, which has been exacerbated by the fast rising demand for these products by China and the rest of Asia since the early 2000s. The region's growing overdependence on these export goods led to a stronger concentration in the terms of goods and export firms. Also, it led to an appreciation of several of its currencies, which in turn dampened the competitiveness of its manufacturing exports.

This paper analyzes another potential explanation of the region's stagnant performance in global manufacturing exports in terms of global market share: the insufficient incorporation of high quality domestic and foreign intermediate services. A growing body of literature has shown the increasing role of services as a source of value added into exports of manufactures. Increasing evidence on developed countries show that the "servicification" is a key condition of successful manufacturing export performance and diversification. Services play a key role in manufacturing dominated global value chains (GVCs), as logistics and information technology facilitate the movement of goods and information between segments, R&D, innovation and other intermediate services improve the productivity of firms, contribute to the diversification, differentiation and value of products, overcome domestic market barriers, and outsource non-core inputs and services. Baldwin *et al*. (2015) and Lodefalk (2017) summarize several studies that confirm this growing services value added share in manufacturing production and exports in the cases of France, Germany, Sweden, the United States and other OECD countries using both international input - output tables (IIOTs), micro firm-level data and case studies. However, few studies have been conducted in this area on Latin America.

This paper uses international IOTs and case studies to explore the question whether the incorporation of more and different services could revitalize Latin America's manufacturing export performance. In particular, we use the 2016 version of OECD's TIVA database includes seven countries from the region Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico and Peru) with data between 1995 and 2011. After looking at broad measures of Latin America's export manufacturing performance, the paper reviews motivations of manufacturing firms to incorporate different types of services within their products, as well as available evidence on the role of services in manufacturing exports. Using OECD's TIVA database, the domestic and imported intermediate services value added contents of exports of manufactures are compared between seven Latin American countries and eight ASEAN countries (Brunei Darussalam, Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam) between 1995 and 2011. In addition to the total contents of services, the paper focuses on business services which are of strategic importance to improve the manufacturing sector's international competitiveness.

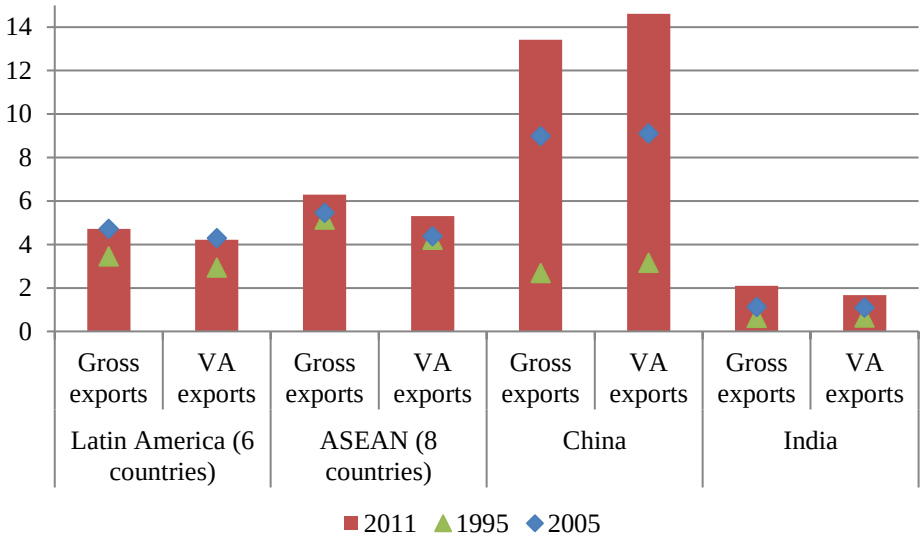
In the final part of the paper, panel regressions are carried out to test whether intermediate services intensities of manufacturing sectors help to explain their export performance in terms of either global export market shares and other trade performance variables such as the degree of product diversification, building on the approaches of Evangelista *et al*. (2015), Francois and Woerz (2007), and Wolfmayr (2008). Possible control variables are unit labor cost, share of each country in global patents per sector, openness of specific intermediate service sectors, and direct exports of these services. A distinction is made between three groups of manufacturing industries: natural resource intensive ones, labor intensive ones and technology intensive ones.

This paper complements the previous ones by making the distinction between domestic and imported intermediate services and the use of a new dataset. Some conclusions and policy recommendations are made at the end on which intermediate services are most strategic for the export performance of manufacturing sectors.

2. Latin America's stagnant manufacturing export performance

A major motivation for this study is the stagnating performance of Latin American manufacturing exporters. This stagnation can be illustrated with two different output measures estimated using the TIVA database (Figure 1). A comparison is made with the performance of ten emerging economies from the Association of Southeast Asian Nations (ASEAN), China and India. A first measure is gross exports, which shows that Latin America's share in global manufacturing exports first increased between 1995 and 2005, but stagnated afterwards. ASEAN's market share increased little until 2005, but rose substantially afterwards. China and India's market shares rose continuously over this period. Alternative and more recent gross export statistics from UN COMTRADE until 2016 confirm the stagnation of Latin America's market share and continuous rise of that of ASEAN, China and India.

Figure 1
Latin America, ASEAN, China and India: Participation in world manufacturing exports, 1995-2011
(Percentage)



Source: Author based on calculations using the OECD-WTO 2016 version of the TiVA database.

A second and more accurate measure of the "true" participation of a country in global exports is its share in global value added exports, which equals gross exports minus imported intermediate inputs. This measure shows slightly lower shares in world manufacturing exports for Latin America, ASEAN and India, which reflects the fact that their manufacturing sectors have a higher imported content of intermediate inputs than the rest of the world. The trends over time are similar.

Latin America's overall underperformance in trade in manufactures is often explained by its growing specialization in natural resources, which has been exacerbated by the fast rising demand for these products by China and the rest of Asia since the early 2000s. The region's growing overdependence on

natural resources led to a stronger concentration of export in the terms of goods and export firms. Also, it contributed to an appreciation of several of its currencies, which in turn increased the international prices of its manufacturing goods and dampened these exports, also referred to as Dutch Disease. This paper explores another potential explanation of the region's stagnant performance in global manufacturing exports in terms of global market share: the insufficient incorporation of domestic and foreign intermediate services.

3 Literature review

3.1 Motivations for using services to improve manufacturing export performance

Manufacturing firms increasingly use different types of services at each stage of their value chains. This servicification has different origins (Lodefalk, 2017). First, several "cost" services are important to reduce expenditures, improve production efficiency and increase productivity (Arbache et al., 2016). Examples are transport and logistics, finance, information technology and communication (ICT) services, insurance, management, renting and leasing of machinery, equipment and buildings, and financial and insurance. These services improve the coordination of the production process and save time and materials (Nordas, 2010; USITC, 2013). As many manufacturing firms do not consider these services as part of their core competencies, these are outsourced to specialized providers. The importance of cost services increases with the lengths of supply chains.

Second, services are essential to establish and operate international production networks and global value chains (USITC, 2013). From the 1980s until recently, countries increasingly specialized in different types of manufacturing and business services segments of the value chain.[1] These business-to-business (B2B) and business-to-customer (B2C) services include accounting, customer relations, headquarters functions, IT services and logistics. These trends were facilitated by technological developments in these areas, including containerization and the spread of high-quality ICT infrastructure. These services greatly reduced coordination costs, levels of inventory and delivery times of intermediate and final products.

Third, manufacturers add services to differentiate their goods and make them more attractive to customers in an often highly competitive environment. Firms also combine services with goods to adapt to changes in consumer demand. Using wireless networks and digital technologies, manufacturers build in sensors and microchips in their goods that allow communication with each other (internet of things) to provide additional services and collect information on consumer behavior. Also, services can help to limit the environmental and social impacts of their goods production and consumption through repurchasing and recycling. In short, services help to produce premium product and increase customer loyalty. This category can be referred to as "value" services, and generally require a higher content of human capital and other capabilities. Value services play are more important for sophisticated and differentiated products (Arbache et al., 2016).

Fourth, firms use services to overcome barriers to foreign market entry in the form of exports or foreign direct investment (FDI) and to sustain foreign market sales (Lodefalk, 2017). Through the establishment of affiliates abroad, multinational companies provide different types of services including distribution, maintenance, marketing, matchmaking, monitoring reparation and translation. These establishments and their local workers can help firms to improve their knowledge about local markets and networks.

[1] Lewis and Monarch (2016) conclude that the fragmentation of supply chains has slowed or stalled between 2011 and 2015.

3.2 Research findings on role of services in manufacturing export performance

Miroudot and Cadestin (2017) show multiple stylized facts on the servicification of manufacturing on the basis of the 2015 version of the OECD international input-output table called Trade in Value Added (TiVA). In 2011, the share of services value added in the world gross value of exports was above 30% for all sixteen different manufacturing industries, except for coke and petroleum. Distribution services account for about one third, whereas business services (including telecoms, computer services, R&D and other business services) account for another third. The rest is split between transport, finance and other services. From 1995 to 2011, the domestic services value added share of world gross value of manufacturing exports fell one percentage points, whereas the foreign services value added share slightly increased two percentage points. In many countries, except for China and the United States, manufacturing exports have increased their share of services value-added during this period. These results confirm those of De Backer et al. (2015), who analyzed trends between 1995 and 2009 with the same database.

From the late 2000s, there is also a growing body of meso and firm-level literature on the importance of intermediate services for the export and productivity performance of manufacturing firms. The ESCIP consortium (2014) analyzed the contribution of the domestic and imported services contents of manufacturing in the European Union to another competitiveness variable being labor productivity growth. In the EU, services represented about 25% of total costs in manufacturing in 2011, which is only slightly higher than the level in 1995. The main categories are distribution (12%) and business services (9%). Within business services, the key items are legal and accounting activities, architectural and engineering activities, advertising and market research, other professional and scientific activities, computer programming and scientific research and development. Regression show that only imported business services inputs in manufacturing impact significantly labor productivity in manufacturing for all EU-27 countries. When splitting the sample by country size results are slightly different: in larger economies only domestic backward linkages affect positively labor productivity growth, whereas in smaller nations only foreign backward linkages play a role. Another outcome is that only in medium-high- and high-tech industries there is a positive effect of business services inputs on labor productivity.

On the basis cross-country statistics on production and trade in goods and services for 78 countries for the period 1994 to 2004, Francois and Woerz (2008) find a growing importance of services in production as the level of development increases, as well inverted U-pattern in pattern with respect to density of intermediate linkages. Using panel regressions, they show that an increased import intensity by business services between 1994 and 2004 contributed positively skilled and technology intensive manufacturing exports. Also, they confirm that the protection of intermediate services has a negative impact on export performance of technology intensive industries.

Wolfmayr (2008) looks into the determinants of export market shares of 18 manufacturing industries for 16 OECD countries from 1995 to 2000. She shows that services value added as a share of gross output increased in most countries over this period and reached over 20% in Ireland, Sweden and the UK. The author also shows that manufacturing in these countries purchased most services at home and imported little from abroad. Using regression analysis and controlling for unit labor cost, R&D intensity and patent performance at the industry level, the author shows that total and domestic services value added does not significantly contribute to export market shares, whereas imported services do. Separate regressions for technology-driven industries show that total services inputs and imported services significantly affect market shares, whereas domestic services have no impact. Another set of regressions for the non-technology industries show that total, domestic and imported services do all not affect market shares of these industries. Another set of regressions focus exclusively on links between export market shares and purchases of a subset of services: computer and related activities, research and development and business services. These knowledge intensive business services (KIBS) are more crucial for shaping international

competitiveness. These regressions show that total and imported KIBS significantly affect market shares, but not domestic ones.

Nordas and Kim (2013) show that the production of manufacturing industries in both developed and emerging economies became more services intensive between 1995 and 2005. This rising intensity is mostly linked to the growing importance of imported services, in particular in low-tech sectors where geographical fragmentation is largest requiring transport, logistics and other supply chain management services. Other evidence points to a positive link between business services intensity of production and export prices obtained in high-income markets. These authors also provide econometric evidence on the importance of service performance for manufacturing competitiveness across countries and industries. They show that indicators like telecommunications density, interest spread between banks' deposit and lending rates, transport costs, time for exports and imports, etc. impact significantly manufacturing performance dependent on the income of the country and the technological character of the industry.

Evangelista *et al*. (2015) looked into the role of three types of business services (post and communication, computer services and other business services) to explain changes in export market shares between 2000 and 2007 of five European countries (France, Germany, Italy, Spain and the United Kingdom). They confirm all three types of business services contribute significantly to each country's industrial competitiveness, controlling for unit labor cost and different types of innovation expenditure. Separate regressions for medium high tech sectors and medium low tech sectors show that communication and computer related services affect significantly market shares of both types of sectors, whereas other business services contribute to medium high-tech manufacturing industries only.

4 Stylized facts based on international input-output tables

4.1 Methodology and data sources to calculate services contents of manufacturing exports

The estimations of the services content in manufacturing exports in this paper is based on the OECD TIVA Inter-Country Input-Output (ICIO) tables. Below a summary is given of how different variables are calculated:

i. *Gross output* is the sum of intermediate and final demand for each country *c* and sector *i* in any given year. The combination of sector and country is also referred to as geo-sector.

ii. *Gross exports* are computed adding the exports of intermediate and final goods. This means excluding the *i* x *i* diagonal block matrix from the intermediate demand matrix and a *i* x *f* diagonal block matrix from the final demand matrix. The vector *f* refers to the final demand items: household consumption, non-profit institutions serving households, general government final consumption, gross fixed capital formation, changes in inventories (which are excluded from our calculations to avoid negative values, and direct purchases abroad by residents (exports to non residents).

iii. *Value added* in output is computed as:

$$VA_{ci} = V\ B\ F$$

where V is a *ni* x *ni* diagonalised vector with value added (computed as output minus input) as a share of output, B is the traditional *ni* x *ni* Leontieff inverse $(I\text{-}A)^{-1}$ and F is a *ni* x 1 vector with final demand excluding changes in inventories to avoid that F and value added could be negative. The domestic homologue of this measure is computed in the same way using however B_d which is the *i* x *i* diagonal block matrix extracted from B, including only domestic inter-sectoral relationships.

iv. GDP is computed at the country level by using the value added (computed as output minus input) already provided by the ICIO tables for the intermediate production and taxes and subsidies on final demand, also extracted from ICIO tables. This is a slightly different measure to value added as it does include changes in inventories.

v. Value added exports are computed by:

$$EXGR_{VA_{ci}} = V\ B\ \text{EXGR}$$

where is EXGR a *ni*x1 vector with gross value of export.

vi. Domestic and foreign services value added content in export and domestic and foreign value added content of export is estimated as follows:

$$EXGR_{VA_{ii}} = V\ B\ diag(F_{exp})$$

Diag(F_{exp}) is the *ni* x *ni* diagonalised F_{exp} vector with export satisfying foreign final demand – this is the only difference with the formula used to compute value added in export. This formula above yields a *ni* x *ni* matrix (rather than a *ni* x *1* vector) where each inter-sectoral contribution can be isolated; so, each element tells us how much the geo-sector corresponding to the row contributes, in value added terms, to the export of the geo-sector corresponding to the column – note that the subscript has changed from ci to ii, to indicate that contribution of each geo-sector to every other geo-sector is captured.

From this matrix the domestic diagonal block matrix (the block is as usual a *i* x *i* matrix) is extracted and the foreign off-diagonal block matrix to isolate domestic and foreign value added inter-sectoral contributions, respectively. In order to look exclusively at the service content in manufacturing export only the elements corresponding to services on the rows and manufacturing on the column from both matrices are isolated.

Below is an example on how these variables are computed using a basic example with two sectors (1 and 2) and two countries (a and b). In this case, the domestic value added in export would be:

$$V\ B\ diag(F_{exp}) = \begin{bmatrix} v_1^A & 0 & 0 & 0 \\ 0 & v_2^A & 0 & 0 \\ 0 & 0 & v_1^B & 0 \\ 0 & 0 & 0 & v_2^B \end{bmatrix} \begin{bmatrix} \boldsymbol{b_{11}^{AA}} & \boldsymbol{b_{12}^{AA}} & b_{11}^{AB} & b_{12}^{AB} \\ \boldsymbol{b_{21}^{AA}} & \boldsymbol{b_{22}^{AA}} & b_{21}^{AB} & b_{22}^{AB} \\ b_{11}^{BA} & b_{12}^{BA} & \boldsymbol{b_{11}^{BB}} & \boldsymbol{b_{12}^{BB}} \\ b_{21}^{BA} & B_{22}^{BA} & \boldsymbol{b_{21}^{BB}} & \boldsymbol{b_{22}^{BB}} \end{bmatrix} \begin{bmatrix} {f_{exp}}_1^A & 0 & 0 & 0 \\ 0 & {f_{exp}}_2^A & 0 & 0 \\ 0 & 0 & {f_{exp}}_1^B & 0 \\ 0 & 0 & 0 & {f_{exp}}_2^B \end{bmatrix}$$

Which yields:

$$V\ B\ diag(F_{exp}) = \begin{bmatrix} \boldsymbol{v_1^A b_{11}^{AA} f_{exp_1}^A} & \boldsymbol{v_1^A b_{12}^{AA} f_{exp_1}^A} & v_1^A b_{11}^{AB} f_{exp_1}^A & v_1^A b_{12}^{AB} f_{exp_1}^A \\ \boldsymbol{v_2^A b_{21}^{AA} f_{exp_2}^A} & \boldsymbol{v_2^A b_{22}^{AA} f_{exp_2}^A} & v_2^A b_{21}^{AB} f_{exp_2}^A & v_2^A b_{22}^{AB} f_{exp_2}^A \\ v_1^B b_{11}^{BA} f_{exp_1}^B & v_1^B b_{12}^{BA} f_{exp_1}^B & \boldsymbol{v_1^B b_{11}^{BB} f_{exp_1}^B} & \boldsymbol{v_1^B b_{12}^{BB} f_{exp_1}^B} \\ v_2^B b_{21}^{BA} f_{exp_2}^B & v_2^B b_{22}^{BA} f_{exp_2}^B & \boldsymbol{v_2^B b_{21}^{BB} f_{exp_2}^B} & \boldsymbol{v_2^B b_{22}^{BB} f_{exp_2}^B} \end{bmatrix}$$

In bold the diagonal blocks identifying domestic value added in export for country A and B, the off-diagonal block matrix captures foreign value added in export. This matrix is used to compute various variables:

- Summing the **rows** the value added exported by each geo-sector is obtained either **directly** (i.e. the values lying on the diagonal of the matrix) or **indirectly** through other sectors and other countries' exports. When the diagonal-block matrix are used, the domestic value added exported by each geo-sector is obtained either **directly** or through other sectors within the same home country. These two measures correspond to "Value added in export" and "Domestic value added in export" respectively.
- In contrast, summing the **columns** gives each geo-sector requirements for export, or the content of its export. This includes each geo-sector's own contribution (lying on the diagonal) as well as other sectors' and countries' contributions, lying in the same column but off diagonal. The diagonal block matrix shows the domestic value added content of export. These two measures are called "Value added content of export" and "Domestic value added content of export" respectively.

From the square matrix presented above, the entries corresponding to service rows and manufacturing columns are extracted. Each column indicates how much of the value added of services is embodied (or contained) in the export of each manufacturing geo-sectors.

The Inter-Country Input-Output (ICIO) table used in this study is drawn from the trade in value added (TiVA) database of the Organization of Economic Cooperation and Development (OECD) and World Trade Organization (WTO). This database covers 63 countries and 34 sectors, including 16 in manufacturing and 15 in services. Annual data are available from 1995 to 2011. The TiVA database distinguishes 16 manufacturing industries, which can be divided into three groups following Francois and Woerz (2008): natural resource intensive ones, labor intensive ones and technology intensive ones (see table 1).

Table 1: Manufacturing industries in TIVA and their intensity

ISIC Rev.3	Category	Intensity
15, 16	Food products, beverages and tobacco	Resource
17, 18, 19	Textiles, textile products, leather and footwear	Labor
20	Wood and products of wood and cork	Resource
21,22	Pulp, paper, paper products, printing and publishing	Resource
23	Coke, refined petroleum products and nuclear fuel	Resource
24	Chemicals and chemical products	Technology
25	Rubber and plastics products	Resource
26	Other non-metallic mineral products	Resource
27	Basic metals	Resource
28	Fabricated metal products except machinery and equipment	Resource
29	Machinery and equipment n.e.c	Technology
30, 32, 33	Computer, electronic and optical products	Technology
31	Electrical machinery and apparatus n.e.c	Technology
34	Motor vehicles, trailers and semi-trailers	Technology
35	Other transport equipment	Labor
36,37	Manufacturing n.e.c; recycling	Labor

Source: Authors based on OECD TIVA database and Francois, J. and J. Woerz (2008), "Producer Services, Manufacturing Linkages, and Trade," Journal of Industry, Competition and Trade, 8:3, 199-229.

The TIVA sector classification distinguishes 15 services sectors (Table 2). In this paper, these sectors are split into four groups. First, distribution services contain three industries that are crucial for the sale and movement of goods from the manufacturer to the consumer. Second, financial services, insurance and real estate are important for payments, loans, insurance and non-residential investments. Third, business services include three industries that are more crucial for international competitiveness as confirmed by prior studies: Renting of machinery and equipment, Computer and related activities; and Research and development and Other Business Activities (Arbache et al., 2016; Evangelista et al., 2015; Wolfmayr, 2008).

Table 2: Service industries in TIVA and groupings

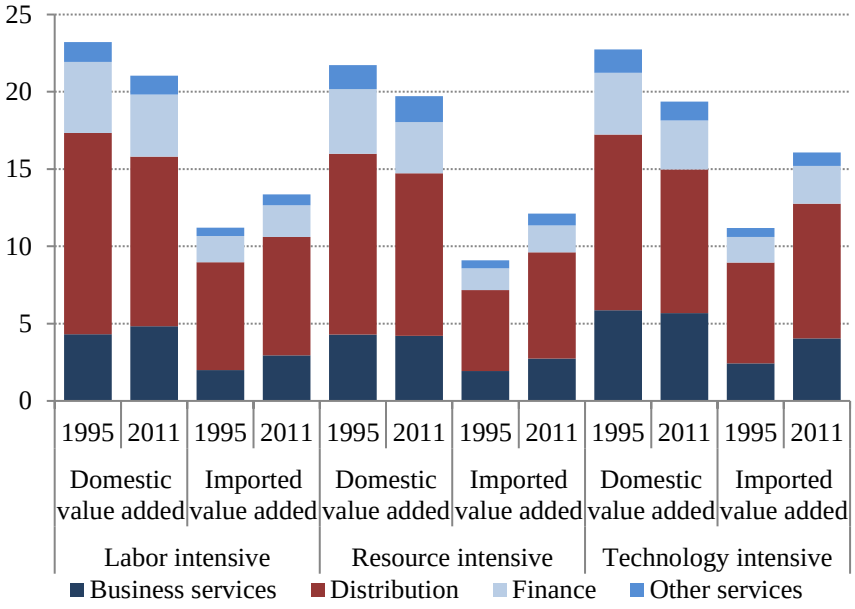
ISIC rev3	Name	Category
50, 51, 52	Wholesale and retail trade; repairs	Distribution
60, 61, 62, 63	Transport and storage	Distribution
64	Post and telecommunications	Distribution
65, 66, 67	Finance and insurance	Finance
70	Real estate activities	Finance
71	Renting of machinery and equipment	Business services
72	Computer and related activities	Business services
73, 74	Research and development, Other Business Activities	Business services
55	Hotels and restaurants	Other
75	Public admin. and defense; compulsory social security	Other
80	Education	Other
85	Health and social work	Other
90, 91, 92, 93	Other community, social and personal services	Other
95	Private households with employed persons	Other

Source: Author based on OECD TIVA database and Wolfmayr, Y. (2008), Producer Services and Competitiveness of Manufacturing Exports, FIW Research Report, N° 009, WIFO, Vienna.

4.3 Servicification of manufacturing exports

A first set of results shows trends at the global level between 1995 and 2011. During this period the total domestic services value added share of global manufacturing exports fell, whereas the total foreign (imported) value added share increased for all three types of manufacturing industries: labor intensive, resource intensive and technology intensive (Figure 2). In 2011, the domestic value added intensity is highest in the labor intensive industries, while the imported intensity is highest in technology intensive industries. Both types of industries are highly competitive and geographically fragmented industries, in which both domestic and imported outsourced services are essential to differentiate products and coordinate different actors in the value chain. The lower domestic services content in technology intensive industries does not necessarily mean they use less domestic services. This is because services may be produced within the firm (such as R&D services), which are not accounted for in the input-output statistics. In particular imported intermediate business services increased their share from 1995 to 2011 across all three types of industries, even though the absolute share of domestic ones are higher than the import shares across the board. Business services include renting of machinery and equipment, computer and related services and R&D and other business services. These are considered most crucial for international competitiveness of manufacturing products.

Figure 2
World: Value added content of services in manufacturing exports, 1995 and 2011
(*Percentage*)



Source: Author based on calculations using the OECD-WTO TIVA database.

Previous findings are confirmed at the level of individual manufacturing industries (see Figure 3). The highest domestic services content is in Pulp and paper, together with Food and beverages in 2011. The lowest domestic share is in Petroleum and fuels. The domestic services value added share in manufacturing exports between 1995 and 2011 fell in all but two industries. The largest percentage points drop was in Computer, electronic and optical products. The highest imported services content is in Computer, electronic and optical products, together with Electrical machinery and apparatus and Motor vehicles, trailers and semi-trailers industries in 2011. The share of imported services value added share in manufacturing exports between 1995 and 2011 increased in all industries, and most in terms of percentage points in Computer, electronic and optical products and least in Textiles and clothing.

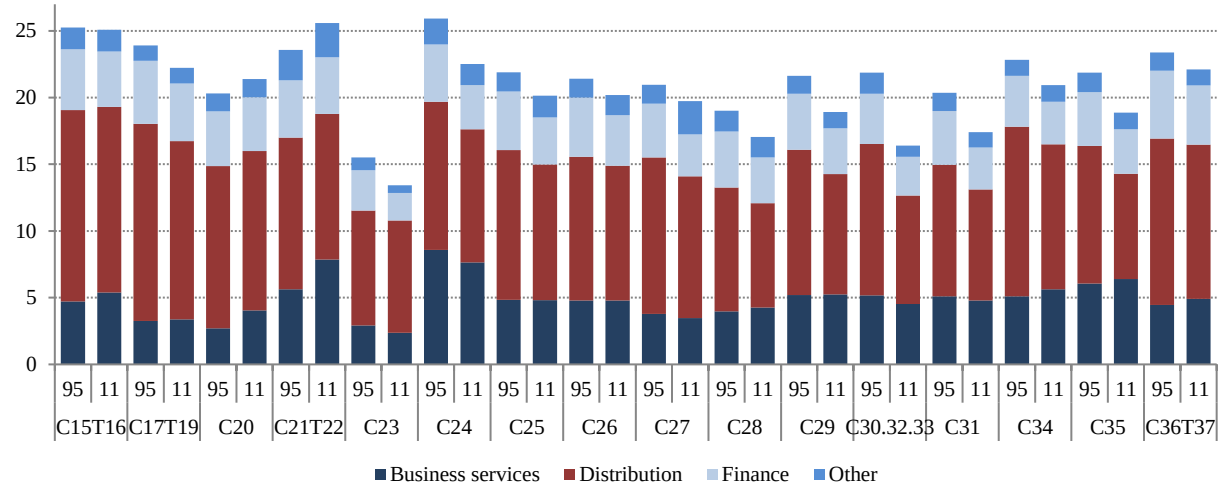
When focusing on business services value added incorporated in manufacturing exports only, the results change as the domestic content increased over time in 11 out of 16 industries. Moreover, the imported contents increased in all industries. The highest domestic content of business services in 2011 was in Pulp and paper and Other transport equipment, while the highest imported content of business services was in Chemicals and chemical products and Motor vehicles. The lowest domestic and imported content of this category was in Petroleum and fuels.

Figure 3

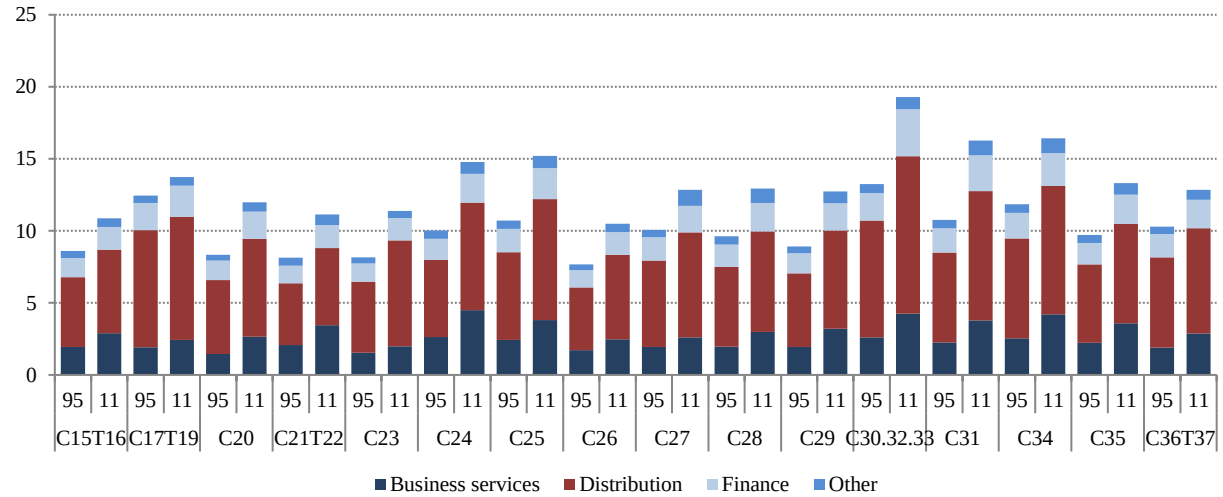
World: Value added content of services in manufacturing exports by industry, 1995 and 2011

(*Percentage*)

A. Domestic services value added



B. Imported services value added



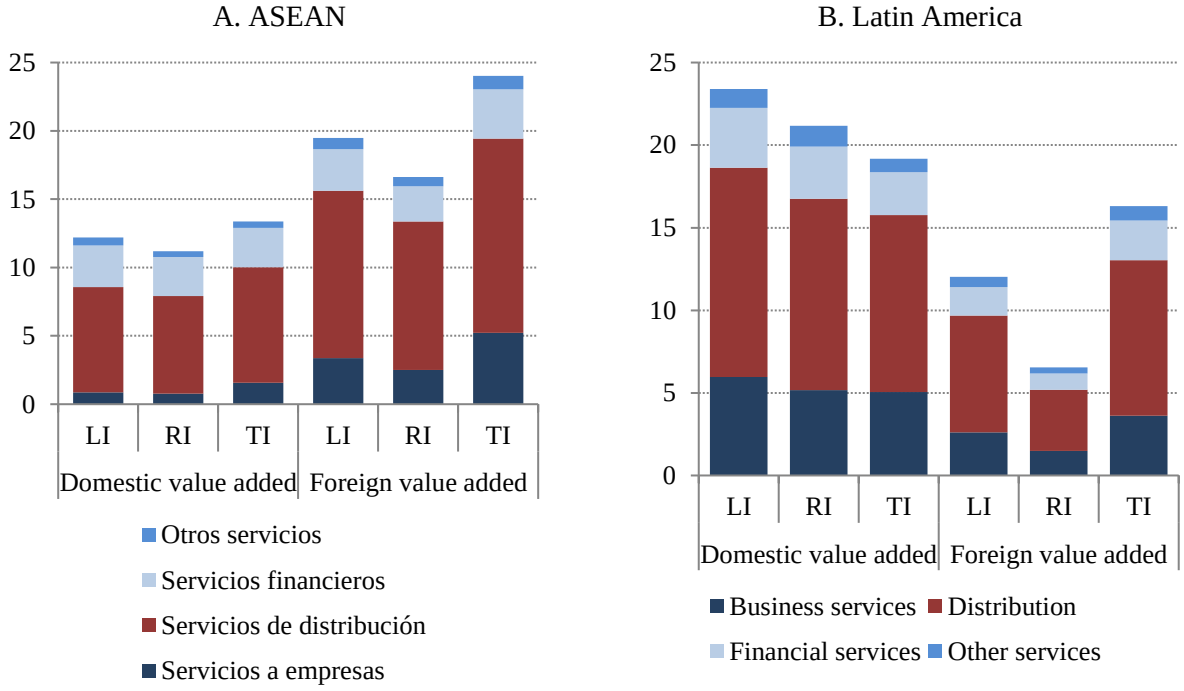
Notes: 15, 16 = Food products, beverages and tobacco; 17, 18, 19 = Textiles, textile products, leather and footwear; 20 = Wood and products of wood and cork; 21,22 = Pulp, paper, paper products, printing and publishing; 23 = Coke, refined petroleum products and nuclear fuel; 24 = Chemicals and chemical products; 25 = Rubber and plastics products; 26 = Other non-metallic mineral products; 27 = Basic metals; 28 = Fabricated metal products except machinery and equipment; 29 = Machinery and equipment n.e.c; 30, 32, 33 = Computer, electronic and optical products; 31 = Electrical machinery and apparatus n.e.c; 34 = Motor vehicles, trailers and semi-trailers; 35 = Other transport equipment; and 36,37 =Manufacturing n.e.c; recycling.

Source: Authors based on calculations using the December 2016 release of the OECD TiVA database.

The ASEAN and Latin America differ in several respects with regard to the services content of manufacturing exports (Figure 4). In Latin America, the domestic services value added intensity of manufacturing exports is higher than in ASEAN for all three types of industries. In contrast, in ASEAN the imported services value added intensity of manufacturing exports is higher than in Latin America for all three types of industries. Multiple possible explanations can explain these results, which require further investigation. First, as ASEAN countries are more integrated in regional production networks and value

chains, they import relatively more business services. The causality could also run the other way, as these countries may first have imported proportionally more business services, which helped it in turn to insert better into international production networks. Second, Latin America may have a more developed domestic services sector than ASEAN and therefore can more easily subcontract business services at home instead of importing these from abroad. Third, there may be a composition effect: Latin America may export proportionally more manufacturing goods which are more intensive in domestic business services compared to ASEAN. In similar vein, ASEAN may export relatively more manufactures that are intensive in imported business services.

Figure 4
ASEAN and Latin America: Services value added shares in manufacturing exports, 2011
(*Percentage*)

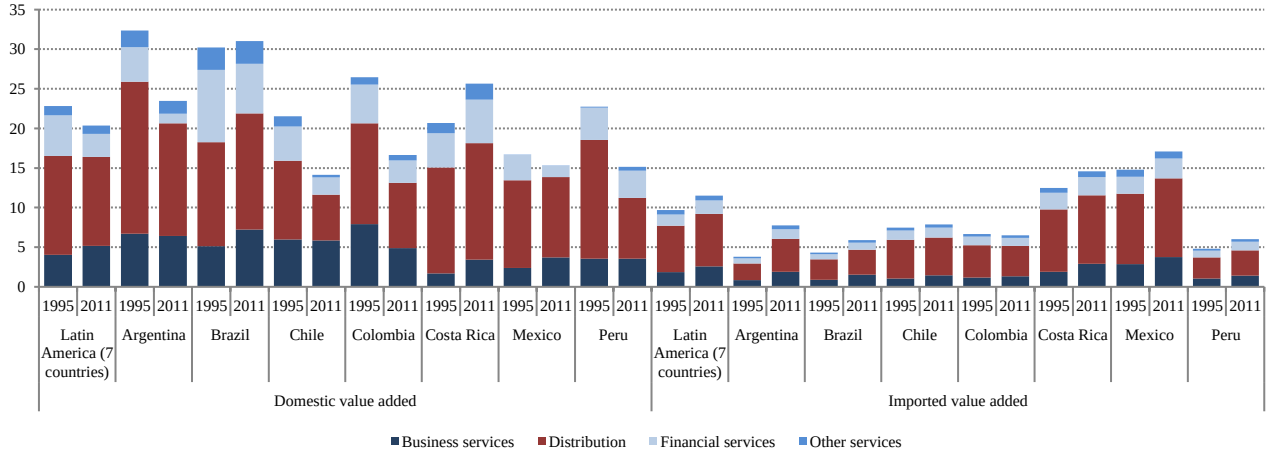


Notes: LI are labor intensive industries, RI are resource intensive industries and TI are technology intensive industries.
Source: Author based on calculations using the OECD-WTO TIVA database.

A comparison of seven Latin American countries included in the TIVA database shows that Brazil and Costa Rica are the countries with the highest domestic services content of manufacturing exports. Both countries have the highest share of distribution services of all seven, while Brazil also has the highest share of the other three types of services (Figure 5). Arbache (2014) argues that this high domestic services content in Brazil contributes little to the international competitiveness of the manufacturing sector, as it mostly reflects the high prices of key services such as finance, logistics and telecom. In turn, these high prices result from low productivity, little competition and reduced investment levels. In the case of Chile, a potential explanation may be the concentration of Chilean manufacturing in food products, which are highly business services intensive. Brazil and Costa Rica are the only countries in the region where the domestic services contents increased between 1995 and 2011. In the other five countries, this content fell up to 9 percentage points. This results in part from the increasing export specialization in natural resource based manufactures, which are least intensive in services.

Mexico is the first country and Costa Rica the second in terms of the foreign services value added contents of exports in 2011. This may result from the fact that the manufacturing sectors in these two economies are the most integrated in global and regional production networks with a concentration in both labor and technology intensive products, which are highly intensive in the use of services. Both countries have the highest share of both services aimed to reducing costs and adding value to manufacturing exports.

Figure 5
Selected Latin American countries: Services value added in manufacturing exports, 1995 and 2011
(*Percentage*)



Source: Author based on calculations using the December 2016 release of the OECD TiVA database.

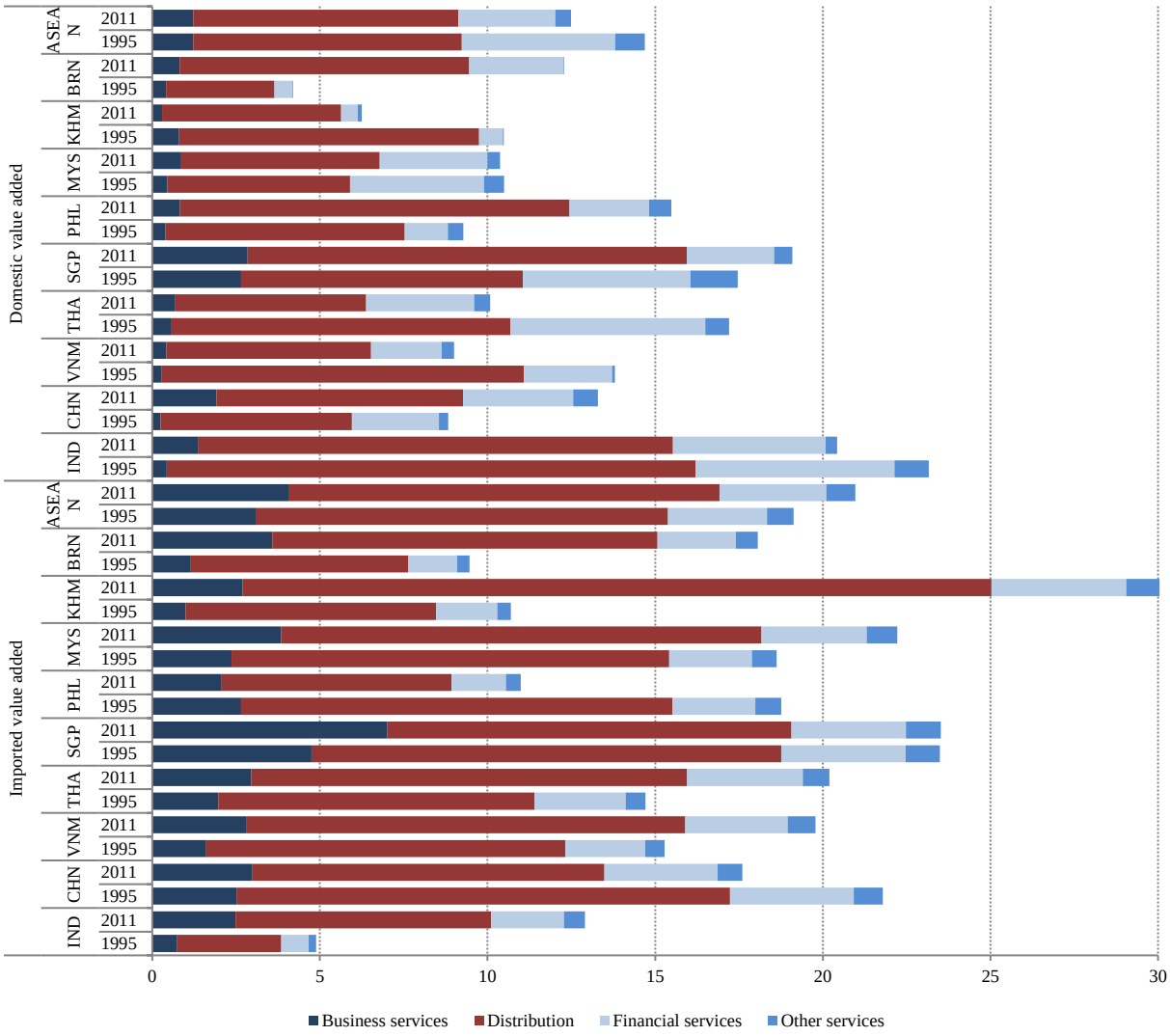
ASEAN countries, China and India also show interesting differences. India and Singapore are the countries with the highest domestic services value added contents (almost 20%) of manufacturing exports in 2011. While two thirds of this content is concentrated in distribution services, the business services content of these two countries is also the highest within this region (Figure 6). This result reflects the fact that both countries probably have the most developed domestic business services sector within the Asian sample. The business services content increased in the value of manufacturing exports in all countries between 1995 and 2011, except Brunei, as a result of the increasing depth of regional value chains which require proportionally more of these services. Financial services and real estate also are important services, in particular in India, Thailand and Malaysia.

The imported services content is higher than the domestic one in 2011 in all countries, except for India and the Philippines. This content is higher in particular in Cambodia (21 percentage points), Malaysia (9 points), Vietnam and Thailand (8 points). In these countries, the imported service content is especially high in distribution services, which may be explained by the underdeveloped nature of these services in the domestic market.

Figure 6

ASEAN, China and India: Services value added share of manufacturing exports, 1995 and 2011

(*Percentage*)



Notes: the country codes are BRN = Brunei, KHM = Cambodia, MYS = Malaysia, PHL = Philippines, SGP = Singapore, THA = Thailand, VNM = Vietnam, CHN = China and IND = India.
Source: Author based on calculations using the TiVA database.

5 Regressions

Different types of domestic and imported services have different effects on manufacturing competitiveness

The previous section showed the heterogeneity both across industries and countries in terms of the intensity of manufacturing exports in different types of both domestic and imported services inputs. According to the reviewed theoretical and empirical studies, two types of services can be distinguished: "cost services" and "value services" (Arbache, 2016). "Cost services" improve production efficiency, increase productivity, smoothen international production networks and minimize costs associated to exports. These are in particular distribution services (Wholesale and retail trade; Transport and storage, and Post and telecommunications) and financial services (Finance and insurance, and Real estate

activities). Manufacturing firms certainly need to contract a certain amount of these intermediate services to achieve the above objectives. However, if these services are too expensive they may hinder export competitiveness instead of supporting it. Therefore their expected effect on global export market shares may be either positive or negative. "Value services" refer in particular to business services used to differentiate goods and add characteristics that support their competitiveness. These are in particular Renting of machinery and equipment, Computer and related activities, and Research and development and Other Business Activities. As these activities add value to the product, their effect on global export competitiveness is expected to be positive.

Another differentiation among the intermediate services is their origin: domestic or imported. In particular within the context of emerging countries, it is likely that imported services are of superior quality that those subcontracted domestically. In other words, the effects of domestic versus imported cost services may be different. This is what can be tested using regression analysis.

The model

Several regressions have been performed to test whether and how different domestic and foreign cost and value services contribute to manufacturing export performance. The latter is measured by the change in the share of a country's manufacturing sector in world exports of that same industry.[2] Following a literature review, several standard control variables were included (Basarac Sertić et al. 2015; Nordas and Kim, 2013; and Evangelista et al., 2015) (see Table 7). The contribution of multiple intermediate domestic and imported cost and value services to the competitiveness of manufacturing sectors is empirically tested as follows:

$$\Delta Q_{ijt} = \beta_0 + \beta_1 Q_{ijt-1} + \beta_2 ULC_{ijt-1} + \beta_3 PMR_{ijt-1} + \beta_4 Cost_{ijt-1} + \beta_5 Manuf_{ijt-1} + \beta_6 REER_{jt-1} + \beta_7 FDI_{jt-1} + \beta_8 DomS_{ijt-1} + \beta_9 ImS_{ijt-1} + \varepsilon_{ijt} \quad (1)$$

Where ΔQ_{ijt} is the change in global export market share of sector *i* in country *j* at year t, *ULC* is the unit labor costs, *PMR* is product market regulation, *Cost* is the cost to export, *Manuf* is the size of the manufacturing sector, *REER* is the real effective exchange rate, *FDI* is foreign direct investment, *DomS* is the domestic intensity of different types of (cost and value) services, and *ImS* is the imported intensity of different types of (cost and value) services.[3]

The control variables are measured as follows (see also Table 3):

- Unit labor cost (*ULC*) is measured by the ratio of *i*) labor cost as measured by wages and salaries (in USD) divided by number of employees, and *ii*) labor productivity as calculated by the division of value added and the number of employees;
- Product market regulation (*PMR*) is measured for 36 OECD countries and 11 non-OECD countries for the years 1998, 2003, 2008 and 2013 in three broad areas: state control, barriers to entrepreneurship and barriers to trade and investment;
- Cost to exports (*Cost*) refers to the cost of shipping a container abroad as estimated by World Bank's Doing business data from 2004 onwards;

[2] A more detailed bilateral gravity trade model would have been more precise. However, data quality of bilateral incorporated intermediate services was too poor, especially for emerging economies, to estimate such a model.

[3] Another variable that affects the contribution of indirect services to manufacturing performance is the restrictiveness of service trade. However, data on this type of restrictiveness is available for one year only and could therefore not be included in the regressions.

- Real effective exchange rate (*REER*) is measured for 61 economies by the Bank of International Settlement (BIS). Nominal EERs are estimated as geometric weighted averages of bilateral exchange rates. The trade weights are based on manufacturing exports. In turn, Real EERs are the same weighted averages of bilateral exchange rates but are in turn adjusted by relative consumer prices. The following formula is used with l = 1, 2 … N being the trading partners of country i:

$$REER_j = \sum_{l=1}^{N} \text{Trade weights}_j \text{ x Real exchange rate}_{jl} \quad (2)$$

Table 3
Control variables, sources, period and expected signs for econometric regressions

Variables	Source	Period	Expected sign
Unit labor cost	UNIDO Industrial Statistics Database	1995 to 2010	-
Product market regulation	OECD Product Market Regulation Database	1998 to 2013	-
Real effective exchange rate	Bank of International Settlement Statistics	1995 to 2011	-
Cost to export	World Bank Doing Business	2004 to 2011	-
Size of manufacturing sector	OECD Trade in Value Added (TIVA) database	1995 to 2011	+
Foreign direct investment	UNCTAD Interactive database	1995 to 2011	+

Source: Authors on the basis of literature review and the data websites: UNIDO data on wages, value added and employment to calculate unit labor cost: www.unido.org/resources/statistics/statistical-databases.html; OECD data on Product Market Regulation: http://www.oecd.org/eco/growth/indicatorsofproductmarketregulationhomepage.htm; World Bank data on cost to export: www.doingbusiness.org; BIS Real effective exchange rates: www.bis.org/statistics/eer.htm; and UNCTAD Foreign direct investment: http://unctadstat.unctad.org/EN/.

The following variables are of specific interest for the effect of intermediate services on competitiveness. These

- Total domestic service value added contents as % gross exports;
- Specific domestic cost and value services value added contents as % gross exports;
- Total foreign service value added contents as % gross exports;
- Specific domestic cost and value services value added contents as % gross exports

The model was estimated using generalized methods of moments (GMM) with one time lag of the outcome variable. The GMM has several advantages. The GMM can be used when the distribution of the data may not be known. GMM does not require distributional assumptions for the variable of interest. A dynamic GMM estimation also circumvents the bias associated including a lagged dependent variable as a regressor (uncorrelated to error or fixed effects) and allows to calculate consistent and efficient estimates. The GMM estimation also allows dealing with omitted variable bias and simultaneity bias. Additionally, the panel data provides a richer set of information to exploit the relationship between the dependent and independent variables, reduces collinearity among the explanatory variables, increases the degrees of freedom, and gives more variability and efficiency.

The model was estimated for 61 countries and 16 manufacturing industries for the years 1995, 2000, 2005, 2008, 2009 and 2011. The countries include high-income ones and emerging economies, mainly from Asia and Latin America. All variables are normalized, so the coefficients can be interpreted as elasticities. The

model was first tested including only control variables (Table 4). A model is estimated using a two-step GMM approach. Sargan/Hansen tests are applied for overidentifying restrictions for all specifications, as well as the Arellano Bond test for first and second order correlation. Moreover, a number of covariates are endogenized (PMR, cost to exports, REER and manufacturing size). In addition, a fixed-effects model is tested for each specification to test the robustness of results.

The results suggest that changes in the global export market share of sector *i* in country *j* at year *t* are positively associated to last year's export market share. Product market regulation has an expected negative and significant sign only when regressed with the other control variables. The unit labour costs, defined as wages per employee over labour productivity, are found to be positively correlated to countries' export market share. This surprising result may be arising from the fact that that higher cost may be associated with higher quality products and market shares. Another possible explanation is that a lack of data on wages and labour productivity may distort this result. Cost to exports emerges as a highly significant (and negative) covariate of the global export market share. This result coincides with the literature, suggesting that increasing costs are detrimental for service-exporting countries.

The stock of FDI-to-GDP, a proxy measure of the presence of foreign technology within a country, suggests that FDI is surprisingly negatively linked to higher export shares. A high FDI intensity may reflect the fact that countries with a high intensity already have high global manufacturing export market shares, making it difficult to further increase these shares. Ideally a more disaggregated measure of FDI intensity, at the manufacturing level, could give more robust results. The Real Effective Exchange Rate (REER) is negatively related to the global export market share for countries in the sample as expected. Exchange rate fluctuations and the exchange rate misalignment are considered to have a significant effect on economic growth and export performance (Rodrik, 2008). Countries with undervalued exchange rates grow faster, as a result of production shifts towards tradables, which tend to have higher productivity growth rates. Results suggest that an appreciation of the REER (increase) could negatively impact on the global export market share. Finally, the manufacturing size is included to control for the size effect on global export market shares, but turns out not be significant.

Table 4
Control variables to explain changes in global manufacturing export market shares, 1995 to 2011

		Global market share change (ΔQijt)					
Previous period market share	Qijt-1	0.118***	0.119***	0.111***	0.118***	0.112***	0.105***
		(0.0175)	(0.0186)	(0.0156)	(0.0186)	(0.0186)	(0.0187)
Product market regulation	PMR		-0.0730		-0.0977	-0.0873	-0.130**
			(0.0634)		(0.0636)	(0.0633)	(0.00630)
Cost to export	Cost				-0.422***	-0.421***	-0.308***
					(0.102)	(0.101)	(0.115)
Unit labor cost	ULC			0.0432*		0.0571*	0.0806***
				(0.0255)		(0.0310)	(0.0309)
FDI stock as share of GDP	FDI						-0.0984**
							(0.0429)
Real effective exchange rate	REER						-0.413***
							(0.0750)
Manufacturing size	Manuf						-0.000163
							(0.0342)
Constant		0.0411***	0.00571***	0.0352***	0.0623***	0.0607***	0.118***
		(0.0162)	(0.0228)	(0.0127)	(0.0228)	(0.0227)	(0.0237)
Observations		2,352	2,064	3,040	2,064	2,064	2,016
Number of geosectors		640	560	816	560	560	560

Notes: Standard errors in parentheses. *** p<0.01, **p<0.05, and *p<0.1
Source: Authors on the basis of econometric regressions.

Table 5 presents results when including in the model's two main variables of interest, namely the domestic and foreign value added of total and business services in the export performance measure (global export market share): renting machinery and equipment, research and development and computing and related activities. The model includes all control variables considered in the baseline regressions. These results suggest that total domestic services content is negatively associated with global exports market shares and total imported services positively. However, when the focus is exclusively on business services the results change: the domestic value added of renting machinery and equipment and research and development are positively associated to a higher global export market share for the average country. In contrast, the effect of imported (foreign) business services in the equation seems less clear: imported renting and machinery services have a positive effect on the export performance measure, while imported computed and related services have a significant (and negative) effect. As a robustness check, regressions were performed with the differentiated global export market shares and differentiated explanatory variables. Results go in line with those from level-variables.

Table 5

Additional variables explaining changes in global manufacturing export market shares, 1995 to 2011

	Global market share change (ΔQ_{ijt})	Global market share change (ΔQ_{ijt})
Previous period market share	0.0982***	0.115***
	(0.0186)	(0.0196)
Total domestic services contents	-0.355**	
	(0.162)	
Total imported services contents	0.600***	
	(0.192)	
Domestic contents of renting of machinery and equipment		0.488***
		(0.121)
Domestic contents of computing and related activities		-0.0901
		(0.154)
Domestic contents of R&D and other business services		0.613***
		(0.242)
Imported contents of renting of machinery and equipment		0.152***
		(0.0776)
Imported contents of computing and related activities		-1.020
		(0.290)
Imported contents of R&D and other business services		0.0550
		(0.268)
Constant	0.214***	0.0934***
	(0.0359)	(0.0334)
Observations	2,016	2,016
Number of geosectors	560	560

Notes: Standard errors in parentheses. *** p<0.01, **p<0.05, and *p<0.1.
Source: Authors on the basis of econometric regressions.

To further explain the result of a negative contribution of the total domestic contents of manufacturing exports to changes in global export market shares, on the one hand, and a positive contribution of some individual types of domestic business services, on the other, separate regressions are performed using the control variables and specific types of domestic services (see Table 6).

Table 6
Additional variables explaining changes in global manufacturing export market shares, 1995 to 2011

	Global market share change (ΔQijt)											
Hotels & restaurants	-0.137*											
	(0.0746)											
Transport & storage		0.0664										
		(0.0801)										
Post & telecom			0.0808									
			(0.0867)									
Finance				-0.292***								
				(0.0593)								
Real estate					-0.228***							
					(0.0672)							
Renting machinery-eq						0.410***						
						(0.0742)						
Computer-related ac							0.0852					
							(0.0878)					
R&D -other business								0.298***				
								(0.0958)				
Government									-0.875			
									(0.0660)			
Education										0.400***		
										(0.0954)		
Health & social work											-0.26***	
											(0.0498)	
Other services												0.0437
												(0.0846)
Constant	0.142***	0.101***	0.100***	0.174***	0.161***	0.0428***	0.0946***	0.0536*	0.134***	0.0421	0.164***	0.108***
	(0.0270)	(0.0308)	(0.0297)	(0.0258)	(0.0266)	(0.0269)	(0.0328)	(0.0310)	(0.0268)	(0.0297)	(0.0249)	(0.0313)
Observations	2,016	2,016	2,016	2,016	2,016	2,016	2,016	2,016	2,016	2,016	2,016	2,016
Number of geosectors	560	560	560	560	560	560	560	560	560	560	560	560

Notes: Standard errors in parentheses. *** p<0.01, **p<0.05, and *p<0.1.
Source: Authors on the basis of econometric regressions.

These regressions illustrate that while some services (renting of machinery and equipment, R&D and business services, education) contribute positively, other services (hotels and restaurants, finance, real estate and health and social work) seem negatively associated with changes in global market shares. In sum, individual services seem to have different impacts on global market shares.

Whereas changes in the global export market shares have already been used in the literature as a measure of export performance, other export performance measures are also explored to capture the role of domestic and foreign services in exports. One of the alternative indicators is the EXPY indicator, which uses the methodology by Hausman et al. (2007) to estimate the level of technological sophistication embodied in a country's export portfolio. Regressions with the same control variables and service-related variables suggest that the effects are not as clear as when considering global export market shares.

7 Conclusions

This paper focuses on indirectly traded services through their incorporation in manufacturing exports. It shows that the Latin America does not underperform in terms of the incorporation of intermediate services in their exports of manufacturing goods, when compared to developing countries and regions in Asia. This finding seems to reject a common thought that the region's stagnant export performance in goods trade over the past fifteen years could be due to the insufficient incorporation of intermediate services in exports. Comparing Latin America with ASEAN, it turns out that the domestic services value added intensity of manufacturing exports is higher in the former, whereas the imported services value added intensity is higher in the latter. This could be due to the fact that ASEAN countries are more integrated in global value chains, which are more intensive in imported services. Another possible explanation is different trade specializations: ASEAN countries export relatively more labor-intensive and technology-intensive manufactures that are more services intensive, compared to Latin America which is more specialized in natural resource-intensive industries.

Regressions seems to suggest that total domestic services content of manufacturing exports are negatively associated to global exports market shares, whereas total imported services are positively associated. However, some types of domestic business services are positively associated to changes global export market shares, while domestic finance and real estate services may be negatively associated.

These results can be further developed to the extent more data become available, which cover more countries and recent years. An on-going ECLAC project is building an almost full regional input-output table for recent years. Better data could help with econometrics to better understand differences between Latin American and Asian countries in terms of the intensity of different types of domestic and imported intermediate services. Factors that need to be studied more are types of specialization in natural resource, labor or technology intensive industries, forward and backward participation in global value chains, product and service markets restrictions, domestic presence of foreign firms in service sectors, and participation in free trade agreements. This work also opens up avenues for future research on the impact of different domestic and imported service intensities on manufacturing export performance. This requires linking these service intensities to performance measures of domestic service sectors. Moreover, this work could be extended to primary goods producing sectors. Finally, other definitions of export performance can be tested, as well as the differential contributions of different types of services.

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