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Abstract
In this paper we provided evidence of the role of business services on manufacturing productivity growth. The results indicate that, first, a higher share of imported business services impacts positively on manufacturing productivity growth. Second, results suggest that the use of foreign business services is lower the higher are services trade restrictions (though results are not robust across various specifications). Together, these results suggest a negative impact of services trade restrictiveness on manufacturing labour productivity growth. The paper is based on a database developed within the project. Note: the interim database is available within the consortium, while the final version will be integrated with the final PRONTO database at end of project.

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Services trade restrictiveness and manufacturing labour productivity growth

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Abstract

In this paper we provided evidence of the role of business services on manufacturing productivity growth. The results indicate that, first, a higher share of imported business services impacts positively on manufacturing productivity growth. Second, results suggest that the use of foreign business services is lower the higher are services trade restrictions (though results are not robust across various specifications). Together, these results suggest a negative impact of services trade restrictiveness on manufacturing labour productivity growth.

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Deliverable 3.2

Analysis and database linking NTMs in services markets to productivity in the EU manufacturing industries

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1 Introduction

Service activities are an important input factor in the production process of manufacturing industries and accounts for a sizeable cost share. The value of gross output produced by an industry consists of inputs of primary factors such as labour and capital services (measured in this context by the respective factor payments to them) and the use of intermediary inputs sourced from other manufacturing industries and services. Given strong inter-country production linkages these intermediate products (both manufactured goods and services) can be sourced from domestic or from foreign sources.

The latter aspect, the use of services in the manufacturing production process - and in particular the business related services and those sourced from abroad – are in the focus of this paper. Services in general play an increasingly important role in the global economy, accounting for more than 70% of GDP in most of the economically advanced countries, and for a significant share of the global trade. Cross-border trade in services constitutes about 20% of the global trade in goods and services, and services' share gets even higher if sales of services through foreign affiliates of multinational companies are added (Francois and Hoekman, 2010).

It is a well-established stylized fact that services sectors are characterized by different productivity levels and growth rates across countries (Maroto and Rubalcaba, 2008; Van Ark, O'Mahony and Timmer, 2008; Inklaar, Timmer, and van Ark, 2008). A natural question arises about the factors, which would explain these differences across countries with similar income levels, and to what extent services policies and regulations affect services performance (Francois and Hoekman, 2010). This paper focuses on a specific aspect of this, the role of regulations in services and its impact on manufacturing productivity.

Given the importance of services for the economy, it is not surprising that regulation in services is pervasive. The restrictions to services supply are driven both by efficiency and equity concerns (Francois and Hoekman, 2010), and can be classified using several dimensions: (i) Affecting establishment (the ability of services suppliers to establish physical outlets in an economy and supply services through those outlets) or ongoing operations (the operations of a services supplier after it has entered the market); (ii) Non-discriminatory (restricting domestic and foreign services suppliers equally) or discriminatory (restricting only foreign services suppliers); and (iii) Affecting prices of services or costs of service providers.

There are several possible channels of impact of services liberalization (which implies reducing non-tariff measures to services trade[1]) on growth in productivity that is concisely summed up in Shepotylo and Vakhitov (2011). Increased specialization of producer services leads to gains from trade in services due to increased variety and expanded market (Markusen, 1989). Higher variety of services generates knowledge, increases its diffusion and exchange (Burgess and Venables, 2004). Also, as was shown by Oulton (2001), outsourcing of services by productive firms in non-stagnant sectors results in more efficient factor allocation that expands output and production. Lower price, better quality, and wider choice of services allow more complex organization of a manufacturing firm through further fragmentation of production activities (Deardoff, 2001).

Even in cases when services regulations are not discriminatory and are designed to meet legitimate economic or social objectives, they may they still impact on trade as regulatory requirements in a given export market are additional to the ones a service provider faces at home and other export markets. Governments in the OECD have been extensively reforming the regulatory environment in the services sectors. However, due to differences in initial conditions and the pace of reform the dispersion of regulatory approaches is still wide across services industry (Nicoletti, 2011).

As services account for high and increasing cost shares for industry and there is an increasing share of traded (business) services in the manufacturing production processes it is not surprising that there is increasing evidence that services liberalization – and in particular those impacting on trade in (business) services - have a positive impact on productivity of downstream manufacturing industries (Hoekman and Mattoo, 2008; Francois and Woerz, 2008; Arnold, Javorcik and Mattoo, 2011).

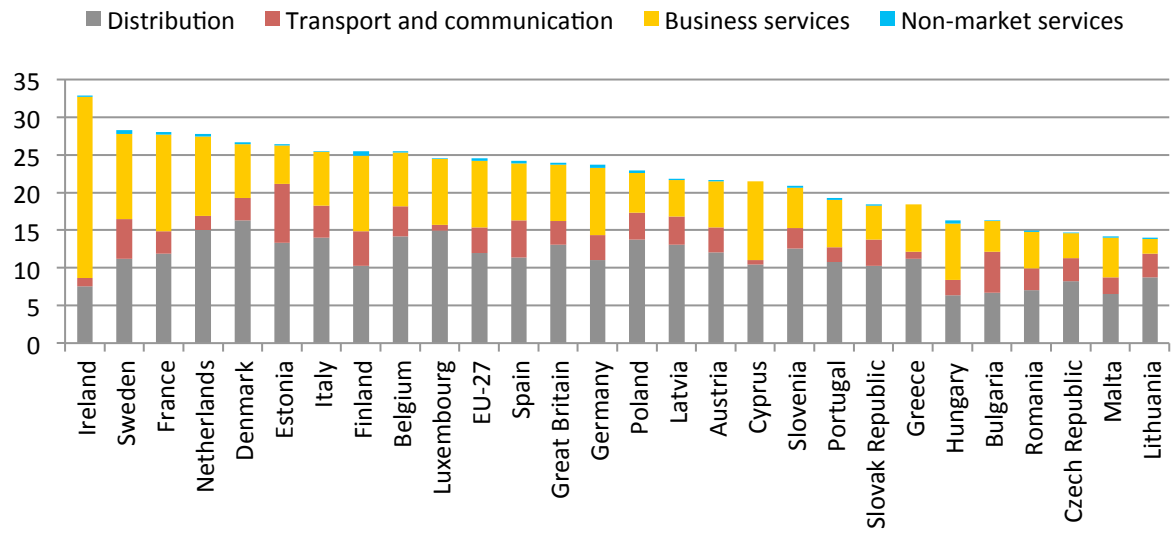
This paper presents some evidence along these lines in various steps. In the next section the importance of services – and business services in particular – for manufacturing production is presented. Section 3 provides various evidence of the positive impact the use of business services have on manufacturing productivity performance in a panel econometric approach. Section 4 discusses the services restrictiveness indicators used and how these are merged to the data on productivity performance. Section 5 uses these data and analyses the impact of services trade restrictiveness on the use of business services. Section 6 concludes.

[1]Non-tariff measures are defined as all non-price and non-quantity restrictions on trade at federal and state level. This includes border measures (customs procedures, etc.) as well as behind-the-border measures flowing from domestic laws, regulations and practices.

2 Services input in manufacturing production

This section sheds light on the magnitudes of inputs of (business) services in the manufacturing production process, showing how these vary across countries and how these have changed over time.[2] It needs to be stressed that these direct cost shares, which are considered in this approach, capture bought-in services only. Therefore this does not take in-house provision of services into account. Figure 2.1 provides the magnitudes concerning the importance of services inputs in terms of (direct) cost shares, i.e. service inputs in per cent of gross output, in the manufacturing industry for the EU-27 countries.[3]

Figure 2.1 – Structure of services cost shares in % of gross output, 2011



Source: Stehrer et al. (2015) based on WIOD and wiiw calculations.

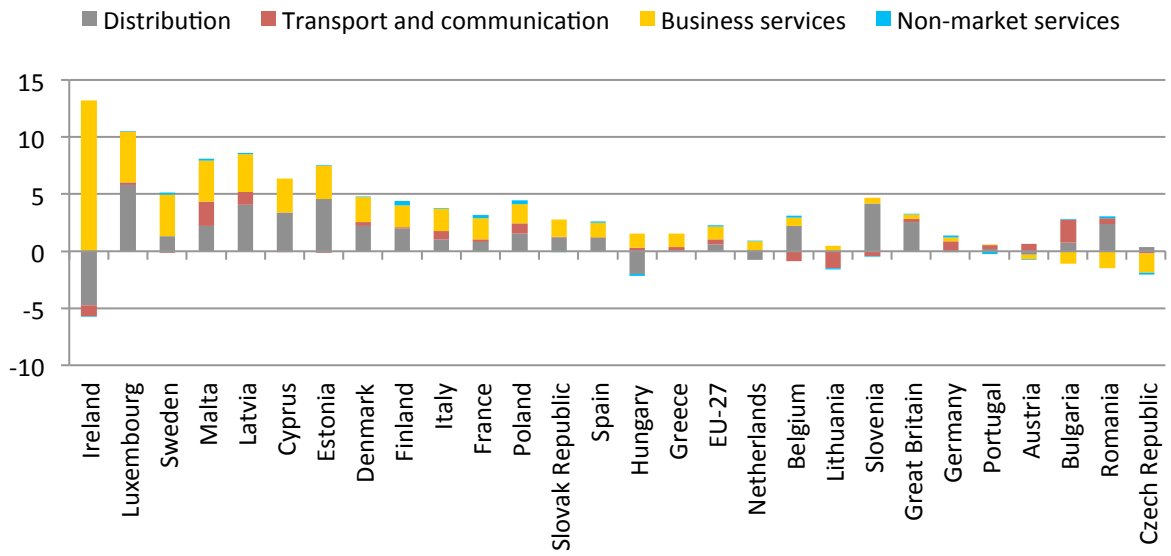
For the EU-27 as a whole this share stood at almost 25% in 2011, marking a slight increase from about 22% in 1995. However, the shares range markedly across countries: from more than 30% in Ireland to less than 15% in the Czech Republic, Malta and Lithuania. Concerning the structure of services inputs, the cost shares of distribution services range from slightly above 6% in Bulgaria, Hungary, and Malta to shares up to 15% or more as e.g. in Denmark (16.3%), Netherlands (15%), Luxembourg (14.9%) to list the countries with the highest shares. Cost shares of transportation and communication services are again more similar across countries, though these are relatively low in Cyprus, Greece and Luxembourg. Importantly, the direct cost shares of business services (including R&D, finance, marketing,

[2] For an extensive description of these linkages see Stehrer et al. (2015).
[3] These data are based on the WIOD release 2013 (www.wiod.org) which does not include Croatia.

consulting, etc.) are much more diverse across countries. These range from 24% in Ireland, 12.9% in France, about 10% in Cyprus, Finland, Netherlands and Sweden to about 4-5% in the other countries. Shares are particularly low in Lithuania with only 2%.

Generally, these shares have increased over time, particularly so with respect to business related services and - in some countries - for transport and communication services as highlighted in Figure 2.2. The cost share of services in manufacturing increased by about 2.5 percentage points between 1995 and 2011 for the EU-27 as a whole However, these changes ranged from about 10 percentage points (as in Ireland and Luxembourg) to even small decreases as observed for the Czech Republic. In most cases the increases in business related services accounted most for the overall change.

Figure 2.2 – Percentage point changes in services cost shares in manufacturing, 1995-2011



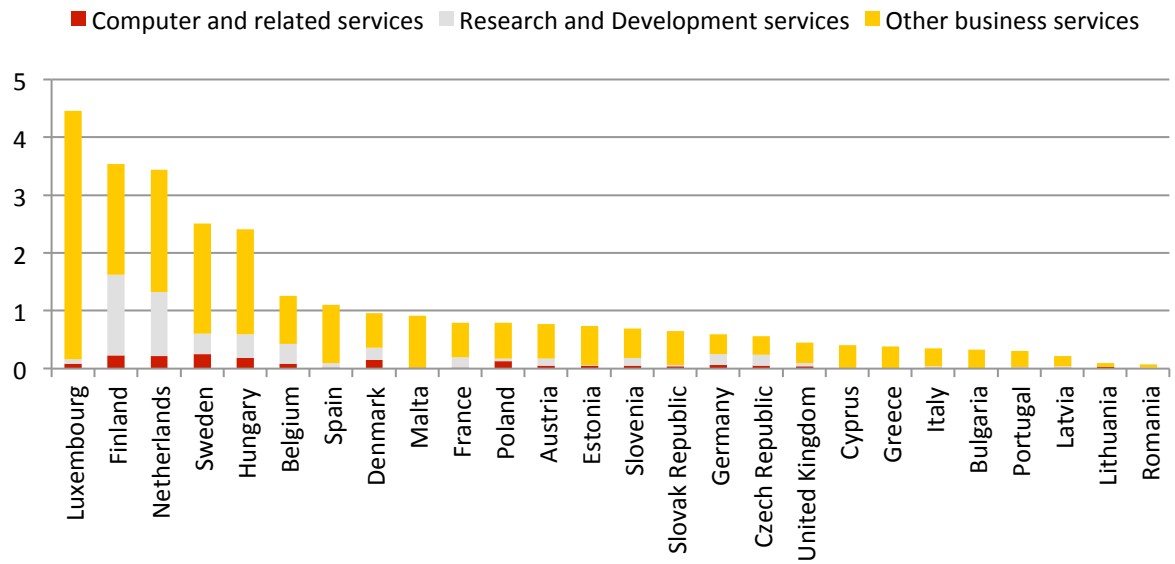
Note: Countries are ranked according to increase in business services (in percentage points).
Source: Stehrer et al. (2015) based on WIOD and wiiw calculations.

Part of the (business) services used in manufacturing industries as intermediate inputs are imported from other countries. This becomes more and more important when taking account of the increasing specialisation across Europe, the effects of the Single Market and more recently the EU services directive. The bulk of imported services for most countries are in business services.[4] It needs to be emphasised, that for the distinction between domestic and imported intermediaries (and therefore also for business services) it is the location of

[4] Imports of transport and communication services in manufacturing play a relatively important role in e.g. Sweden, Belgium, Austria and Denmark with a cost share of about 1 per cent. Distribution services show cost shares of less than 1 per cent in general.

production which matters, but not the ownership of the providing firms, in line with national accounting principles. Furthermore, it should be stressed that these figures only include Mode 1 and Mode 2 services trade.[5] Figure 2.3 presents the shares of imported business services used in manufacturing in per cent of gross output for individual Member States.[6]

Figure 2.3 – Cost shares of imported business services used in manufacturing in % of gross output, 2011



Note: These figures do not include financial intermediation services.
Source: Stehrer et al. (2015) based on WIOD and wiiw calculations.

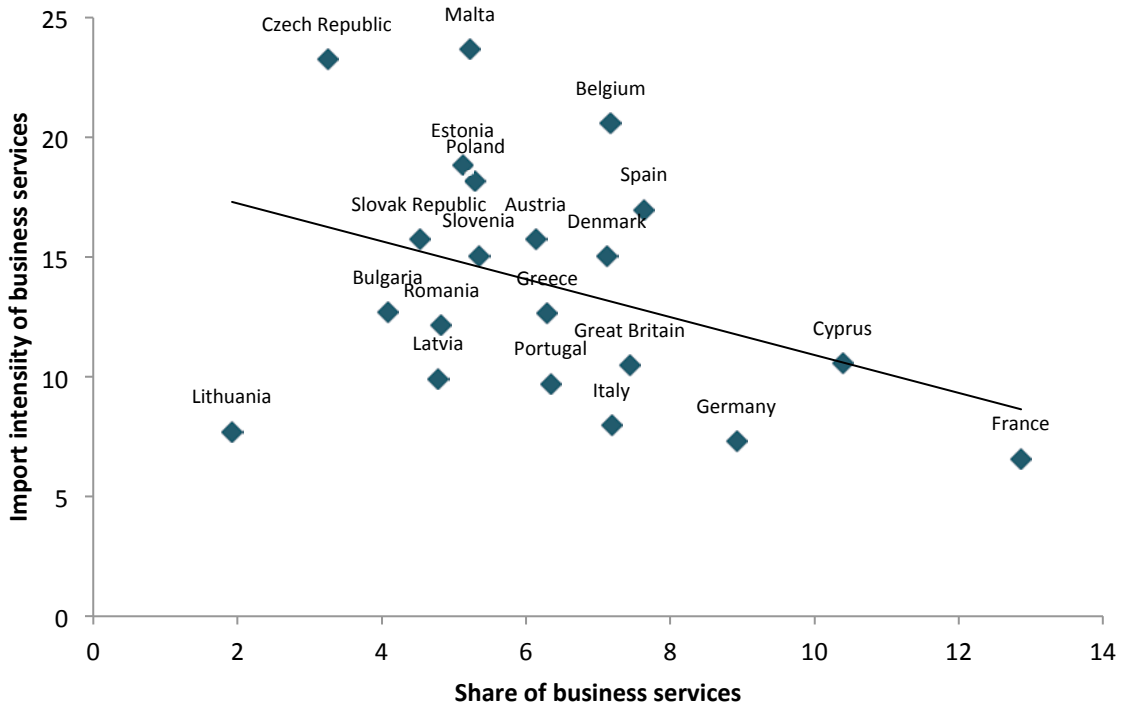
For individual Member States, the shares of imported services in per cent of gross output range from more than 5% in Luxembourg to about 1-2% or less in a number of countries. In fact, in seventeen countries these shares are below 2% in 2011. This group comprises both large countries such as Germany, Italy, Great Britain or France but also most of the Eastern European countries. Larger shares are observed for the Netherlands, Finland, Sweden and Hungary with about 3%. In most countries these shares have been increasing over time.

[5] These two modes characterise services supply where the supplier is not present within the territory of the member: Mode 1 (cross-border services supply) are defined as delivery of a service from the territory of one country into the territory of other country, whereas Mode 2 (consumption abroad) comprises consumption abroad (supply of a service in a country to the service consumer of any other country). Mode 3 (commercial presence) and 4 (presence of a natural person) are services deliveries where the supplier is present in the territory of the partner.

[6] Comparing the EU-27 (extra-EU imports) with the US and Japan reveals that for these large countries the imported services account for a very small share only, usually less than 1%. These are slightly higher for the EU-27 as some European economies (e.g. Switzerland, Norway) are included in the rest-of-world category. This is also the reason why shares for individual EU Member States are generally larger when including intra-EU imports.

In combination with the findings concerning the overall use of (business) services as presented in Figure 2.1, there is a wide range of import intensities defined as the share of imported business services in per cent of total business services used in manufacturing. These import intensities range from more than 50% in Ireland and Luxembourg to less than 10% in France, Germany, Italy and others. Particularly high import intensities are observed in smaller countries and the New Member States for which therefore imports of business services play an important role in the manufacturing process when compared to larger countries as indicated in Figure 2.4.

Figure 2.4 – Import intensity of business services used in manufacturing



Source: Stehrer, et al. (2015).

Summarizing, services input in manufacturing industries account for about 25% of total costs in 2011 for the EU-27, a share which increased only slightly since 1995. Differentiating by services categories shows that distribution (12% on average) and business services (9% on average) are the most important services inputs on average. Over time, the shares of business services are the most dynamic component over time in the majority of countries. The cost

share of imported services in manufacturing gross output is at about 1% for most countries; only a few countries show significantly larger shares. These patterns are dominated by imports of businesses services which account for about 50% of services imports. Most of the smaller countries tend to have lower shares of business services in manufacturing output together with relatively larger imports resulting in a larger 'import intensity'. The most important items imported for use in manufacturing are scientific research and development, legal and accounting activities followed by advertising and market research according to NACE/CPA Rev. 2 classification with a wide heterogeneity across countries.

These results therefore indicate a rising importance of services sourced from outside a firm for the manufacturing production process which however ranges widely across countries due to differences in market structure and firm organisations. It further points towards the importance of a well-functioning of the Single Market for business related services which is particularly important for smaller countries and the New Member States which rely relatively more on imported services given the specialisation tendencies across Europe.

3 Business services linkages and manufacturing productivity

3.1 Motivation

As argued in the previous section the manufacturing is strongly intertwined with the services industries and business services in particular. Hence, given strong inter-sectoral linkages and interrelationships, changes or improvements in the service sector should important effects on the productivity, efficiency, innovativeness or competitiveness of the manufacturing sector. Against this backdrop, the analysis sheds light on the role manufacturing-services interactions play for performance improvements observable in the manufacturing sector. In particular, it looks at labour productivity growth to capture performance improvements in the manufacturing sector. In doing so, the analysis focuses on business services[7] linkages that are considered more relevant and important sources of productivity spillovers for the manufacturing sector than other types of services. Additionally, the analysis also accounts for different geographic sourcing strategies and their likely effects on performance changes in the manufacturing sector and accordingly differentiates between (i) *domestic* business service linkages, that is business services that are sourced domestically and (ii) *foreign* business service linkages, that is business services that are sourced from abroad.

[7] Business services comprise Financial intermediation services (NACE Rev. 1 70) and Renting of M&Eq and Other Business Activities (NACE Rev. 1 71t74).

3.2 Data and methodology

The analysis[8] draws on the World Input-Output Database (WIOD)[9], which covers the time horizon from 1995 to 2011 (see Dietzenbacher et al., 2013; Timmer et al., 2015). However, to avoid any crisis-related distortions, the empirical analysis is restricted to the period between 1995 and 2007 only. Methodologically, a growth equation approach was taken to capture long-term trends. In this equation, apart from the variables capturing domestic and foreign linkages of manufacturing and business services, other control variables (initial productivity gap, shares of high and low skilled labour, FDI and R&D intensity) have been taken into account. To account for prevailing cross-country and cross-industry differences and the different business service linkage effects that may arise as a result, a number of different groupings are analysed.

The first grouping is based on *EU-membership status* and differentiates between the group of EU-15 member countries on the one hand and the group of New Member States (EU-12) on the other to highlight that EU members joined the EU in different years and underwent fundamentally different economic and political processes in the course of the last two to three decades. Particularly, in the period under consideration, the group of EU-12 underwent strong growth and convergence processes and initiated key financial market and trade liberalisation policies and, as a result, became strongly integrated into the EU and global markets.

The second grouping is based on *country-size* and differentiates between the groups of the 5 largest EU-economies on the one hand (comprising France, Germany, Italy, Spain and the UK) and the remaining 22 medium and small EU-economies on the other. Throughout the period under consideration, the five largest EU-economies together accounted for about 70 per cent of total EU-27 GDP. Given the size of their internal markets size-related differences in business service linkages are evident and performance differences can be expected, particularly as a result of the particular domestic and foreign sourcing patterns observable in large economies.

Finally, the third grouping accounts for the cross-industry heterogeneity in the sample and differentiates by *technology-intensity of industries*. In particular, in accordance with the R&D intensity based OECD technology intensity definition[10], it differentiates between *medium-*

[8] This section presents results based on Stehrer et al. (2015).
[9] WIOD was complemented by other data sources like: OECD ANBERD, ISIC Rev. 3, OECD IDI, ISIC Rev. 3 or the wiiw FDI Database to account for the roles R&D expenditures or inward FDI stocks play for productivity improvements in the manufacturing sector.
[10] The OECD classification had to be adapted to the slightly more aggregated industry classification in the WIOD.

high and high-technology industries (MHT) comprising Chemicals (ISIC 24), Machinery and equipment (ISIC 29), Electrical machinery (ISIC 30t33), Motor vehicles (ISIC 34t35), *medium-low-technology industries (MLT)* comprising Coke and refined petroleum products (ISIC 23), Rubber and plastic (ISIC 25), Non-metallic mineral product (ISIC 26) and Basic and fabricated metal products (ISIC 27t28) and *low-technology industries (LT)* comprising Food, beverages and tobacco (ISIC 15t16), Textiles and wearing apparel (ISIC 17t18), Leather and leather products (ISIC 19), Wood and wood products (ISIC 20), Paper, paper products, printing and publishing (ISIC 21t22) and Manufacturing nec. and recycling (ISIC 36t37).

3.3 Impact of business services linkages on manufacturing performance

The results of this exercise are reported in Table 3.1. In general, the analysis finds evidence of important productivity-enhancing backward linkage effects in manufacturing, these effects however differ by particular grouping or sourcing strategy. In particular, results by ***EU-membership status*** point to the presence of non-negligible business service linkage effects: particularly, for the EU as a whole, strong business service linkages are associated with significantly higher labour productivity growth in manufacturing. However, these backward linkage effects strongly depend on the particular sourcing strategy and are only significant in the case of strong *foreign* business service linkages. This finding also holds both for the EU-15 and the EU-12.

Differentiated by the ***size of economies*** results again consistently point to the presence of non-negligible business service linkage effects which, however, depend on the country-sample analysed and the sourcing strategy considered. In particular, for the group of the five largest EU economies, strong *domestic* business service linkages are associated with significant labour productivity improvements in manufacturing. With respect to foreign business service linkages results suggest a positive though insignificant relationship. However, for the group of remaining small and medium-sized EU economies, the opposite holds: strong *foreign* business service linkages are associated with labour productivity improvements in manufacturing. This result is in line with findings that smaller countries tend to have larger share of imported business services which renders – direct and indirectly sourced – foreign services inputs an important factor for manufacturing performance.

Finally, results by ***technology-intensity of industries*** highlight that strong business service linkages only matter for the group of medium and high-technology industries (MHT). More

specifically, strong *foreign* business service linkages are associated with significant increases in labour productivity growth in medium and high-technology industries only while no significant backward linkage effects emerge for either medium-low technology (MLT) or low technology industries (LT).

Furthermore, the analysis also shed light on the role of other factors for productivity growth in manufacturing and found consistent evidence of productivity convergence which, however, tends to be stronger in more technology-intensive industries. Additionally, higher R&D intensities are associated with significantly higher labour productivity growth in manufacturing which, however, holds for the group of small and medium-sized EU economies only or the group of medium to high-technology industries. As concerns the human capital endowment indicators, larger shares of low-skilled labour are associated with significantly lower labour productivity growth. This effect is more consistent among the group of small and medium-sized EU economies however and particularly holds for medium and high as well as low technology industries. On the contrary, there is no evidence that a higher inward FDI intensity is associated with higher labour productivity growth, irrespective of country sample considered.[11]

Summarizing, the results presented point towards an important positive impact of foreign soured business services on manufacturing productivity growth which is particularly the case for smaller countries, the EU-12 Member States and the medium-high tech industries.

[11] This finding is particularly surprising for the group of NMS which experienced strong inward FDI flows and a rapid accumulation of inward FDI stocks after the fall of the iron curtain. However, there are a number of reasons for the absence of any positive effect in the group of NMS countries: firstly, the strongest push in inward FDI accumulation took place in the initial transition phase of the 1990s, a period not properly covered by the analysis due to low data quality and limited availability in either OECD IDI or wiiw FDI databases. Secondly, firm-level analyses (e.g. Evenett and Voicu, 2001) find support of 'cherry picking', i.e. foreign firms are found to invest in domestic firms which are more productive ex ante so that hardly any productivity effects materialise as a result of the investment. And even if productivity improvements occur at the micro-level, aggregation tends to blur effects.

Table 3.1 – Selected results of business service linkages and manufacturing performance

Dependent variable: Labour productivity growth rates (VA-based)

	Membership status			Country size		Technology intensity		
	EU-27	EU-15	EU-12	Large	Small	Medium-high	Medium-low	Low tech
Initial VA-based LP	-0.038***	-0.014*	-0.048***	-0.028***	-0.038***	-0.049***	-0.048***	-0.020*
	(-7.84)	(-1.88)	(-4.91)	(-3.23)	(-6.42)	(-6.57)	(-4.76)	(-1.92)
Business service linkages: domestic	-0.017	0.007	0.279	0.240***	-0.211	0.144	-0.280	0.028
	(-0.21)	(0.10)	(0.87)	(2.93)	(-1.14)	(1.58)	(-1.23)	(0.22)
Business service linkages: foreign	0.274**	0.281***	0.517**	0.452	0.264**	0.396***	-0.115	0.086
	(2.60)	(2.87)	(2.13)	(1.28)	(2.11)	(4.05)	(-0.32)	(0.51)
Share high-skilled labour	0.042	-0.079	0.214	0.026	0.032	-0.047	0.057	0.099
	(0.85)	(-1.34)	(1.59)	(0.38)	(0.45)	(-0.83)	(0.44)	(1.31)
Share low-skilled labour	-0.045**	-0.059**	-0.254***	-0.038	-0.035	-0.058***	-0.014	-0.062**
	(-2.27)	(-2.48)	(-2.74)	(-1.10)	(-1.32)	(-2.77)	(-0.27)	(-2.31)
Inward FDI intensity	0.010	-0.008	-0.011	0.066	0.010	0.019	0.010	-0.009
	(0.54)	(-0.47)	(-0.20)	(1.02)	(0.48)	(1.19)	(0.22)	(-0.17)
R&D intensity	0.592***	0.385**	2.066***	0.219	0.739***	0.327*	2.046	-0.237
	(3.17)	(2.38)	(3.04)	(0.95)	(2.94)	(1.93)	(1.59)	(-0.10)
Constant	0.156***	0.092**	0.150***	0.064	0.171***	0.191***	0.237***	0.096***
	(8.36)	(2.54)	(2.80)	(1.28)	(6.88)	(9.04)	(4.30)	(3.36)
No of observations	189	106	83	44	145	76	59	54
Adjusted R^2	0.371	0.201	0.431	0.582	0.281	0.579	0.375	0.226

Note: t-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Source: Stehrer et al. (2015).

4 Data on services trade restrictions

The next step is to analyse whether services trade restrictions impact on manufacturing productivity growth. For this data on restrictions in services trade need to be collected. Recently, there have been increasingly more attempts to quantify non-tariff measures (NTMs) in services trade, which, however, have not provided consistent estimates yet. The methodologies of estimating barriers to trade and investment in services, which have been used in literature, can be divided into two broad categories: direct and indirect methodology. In the direct methodology information on applied policies is collected and converted into coverage / frequency indicators. Available policy indices affecting services trade are primarily a result of the ongoing work of the OECD and World Bank. Major drawback of this methodology is that an assumption is made that a country conforms to the sample average responsiveness of performance to policy settings, while in reality there can be country-specific factors that are likely to play an important role (Dee, 2005). Also, these measures are difficult to use when estimating impact of non-discriminatory, yet heterogeneous regulations of services markets.

Indirect methodology determines a benchmark price for a service and attributes part or all of a price above the benchmark price to the effect of restrictions using gravity-type models. While applying this methodology it is necessary to distinguish between other factors which can move prices above the benchmark, such as market size, market structure etc. Major impediment or using this methodology are severe data limitations which have not been resolved yet, so we cannot find any comprehensive set of estimates suitable for our analysis.

In this paper we are interested in using available direct measures of NTMs: STRI (services trade restrictions index) compiled by the OECD, STRI complied by the World Bank, and also FDI restrictiveness index (FDI RI) estimated by the OECD (this indicator could be seen as proxy for NTMs in case of mode 3 trade[12]); see Box 1 for details.

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[12] In contrast to manufacturing, services are characterized by intangibility and non-storability that greatly affect their tradability. Services also often require differentiation and joint production, with customers having to participate in the production process.
In order to capture these aspects, the WTO defines trade to span four modes of supply:

- Mode 1 – Cross-border: services supplied from the territory of one country into the territory of another.
- Mode 2 – Consumption abroad: services supplied in the territory of a nation to the consumers of another.
- Mode 3 – Commercial presence: services supplied through any type of business or professional establishment of one country in the territory of another (i.e., FDI).
- Mode 4 – Presence of natural persons: services supplied by nationals of a country in the territory of another.

All the indices take values from 0 to 100, 100 indicating the highest NTMs (market completely closed to foreign service providers), and 0 means a fully liberalized sector (we recalibrated OECD indices which initially had values in the range 0 to 1 to make them on the same scale as the WB STRI).

The indices cover different time periods: WB STRI was estimated for 2007/2008, OECD STRI – for 2014 and 2015, and OECD FDI RI – for 1997, 2003, 2006, 2010-2014. We take averages for the OECD indices. As the methodology of the OECD FDI restrictiveness index estimation was changed in 2006, we take an average of the index for the total sample, as well as for 2006-2014 for robustness check.

Box 1 – Sources of data for services trade restrictions

The **World Bank STRI** database focuses on policies and regulations that discriminate against foreign services or foreign service providers, as well as certain key aspects of the overall regulatory environment that have a significant impact on trade in services. It was constructed using publically available information for the OECD countries, and administering a questionnaire for non-OECD countries. Then policy information was subjected to review by government officials, which lead to confirmation and/or update of the date for most of the OECD countries and a number of developing countries. Within each services sector, the database covers most relevant modes of supplying the respective service (see Bochert, Gootiiz, and Mattoo, 2012).

The **OECD STRI** database contains indices that are a measure of MFN restrictions and does not take into account any specific concessions. It was assembled by analysing laws and regulations in 34 OECD countries and Brazil, China, India, Indonesia, Russia, and South Africa. The policy measures are grouped under the same five policy areas in all sectors, and are turned into an index using a scoring and weighing technique that is based on a number of studies and expert meetings (see Geloso Grosso, 2015).

The **OECD FDI restrictiveness** index retains its focus on four measures: equity restrictions, screening and approval requirements, restrictions on foreign key personnel, and other operational restrictions (such as limits on purchase of land or on repatriation of profits and capital). For the OECD countries the source of information to be scored under the FDI index is the list of countries' reservations under the OECD Code of Liberalisation of Capital Movement and their lists of exceptions and of other measures reported for transparency under the National treatment instrument. For the 12 non-member countries, additional sources of information have been used to identify restrictions on activities of non-residents (including official national publications, information gathered for the OECD Investment Policy Reviews, etc) (see Kalinova, Palerm, and Thomsen, 2010).

Tables A1-A3 in the Appendix show the correspondence between the sector breakdowns in the NTM indicators database and the BOP and NACE classifications. In terms of the geographic breakdown, the WB STRI has the broadest coverage of 102 countries. OECD STRI covers only

41 country, while for OECD FDI RI the geographic coverage varies from 44 countries in 1997 to 59 countries in 2014.

Other variables for the model come from the WIOD dataset (see Timmer et al. (2015) for the description). As mentioned above, the data we use are for the period of 1995-2009 and cover 40 countries (country coverage broadly corresponds to the one in OECD STRI dataset).

5 Services trade restrictions and manufacturing productivity

To assess the impact of services trade restrictions on manufacturing productivity we proceed in two steps: First, in line with the panel results above we re-estimate these equations in a cross-section regression. The reason for this is that the data on services trade restrictiveness are only available for one year or so which therefore warrants cross-section estimations. Second, we analyse whether the services trade restrictiveness impacts on the use of (foreign) business services in manufacturing.

5.1 Use of business services and manufacturing productivity growth

Thus, we take averages over time and therefore regress average productivity growth on the indicator for business services linkages, the initial gap and a measure for human capital (share of high and low-skilled workers). Results are presented in Table 5.1. Again we find a strong catching-up process in all sub-samples considered. Further, the shares of high and low-skilled labour show the expected signs, however these are insignificant in most cases for the high-skilled workers whereas significant for the low skilled workers. This indicates that labour productivity is higher in countries and industries with a lower share of low-skilled workers. The fact that the share of high-skilled workers is not significant is explained that both high and medium skilled workers (including technicians) are important for manufacturing productivity.

More importantly, the results for the variables capturing business services linkages are consistent with those found above: Whereas the share of domestic linkages is not significant, the share of foreign linkages is positively significant in most cases. These effects are particularly strong for the smaller EU Member States and the EU-12 as well as for medium-tech industries. This latter result is not fully in line with the panel specification where significant effects have been found for the medium-high tech industries whereas the results for the two other industry groups have not been significant. This might point towards a longer-term effect of access to foreign business services on manufacturing productivity growth.

Table 5.1 – Manufacturing productivity growth and share of business services

Dependent variable: Labour productivity growth rates (VA-based)

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium-low tech	Medium-high and high tech
Initial VA-based LP	-0.0305***	-0.0386***	-0.0403***	-0.0492**	-0.0293***	-0.0301***	-0.0314***	-0.0333***
	(0.00381)	(0.00659)	(0.00764)	(0.0190)	(0.00424)	(0.00456)	(0.00878)	(0.00612)
Business service linkages: domestic	-0.0181	-0.103**	0.121	-0.120	-0.00306	0.0326	-0.0683	-0.0362
	(0.0481)	(0.0492)	(0.0931)	(0.0725)	(0.0571)	(0.0577)	(0.120)	(0.0725)
Business service linkages: foreign	0.295***	0.244***	0.529***	0.572	0.293***	0.228***	0.546***	0.194*
	(0.0649)	(0.0608)	(0.139)	(0.380)	(0.0711)	(0.0692)	(0.178)	(0.105)
Share high-skilled labour	-0.00328	-0.0289	-0.107	0.523***	-0.0252	0.0312	0.0384	-0.0544
	(0.0382)	(0.0403)	(0.0867)	(0.0983)	(0.0440)	(0.0423)	(0.102)	(0.0607)
Share low-skilled labour	-0.0380***	-0.0505***	-0.0470***	0.210***	-0.0400***	-0.0437***	-0.00394	-0.0579***
	(0.0109)	(0.0163)	(0.0168)	(0.0510)	(0.0116)	(0.0116)	(0.0301)	(0.0163)
Constant	0.128***	0.235***	0.119***	-0.00750	0.137***	0.116***	0.0984**	0.178***
	(0.0152)	(0.0331)	(0.0305)	(0.0800)	(0.0187)	(0.0150)	(0.0396)	(0.0199)
Number of observations	361	207	154	56	305	155	102	104
R-squared	0.273	0.340	0.375	0.672	0.250	0.364	0.185	0.410

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations.

Table 5.2 – Manufacturing productivity growth and intensity of business services imports

Dependent variable: Labour productivity growth rates (VA-based)

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
Initial VA-based LP	-0.0335***	-0.0361***	-0.0458***	-0.0387**	-0.0326***	-0.0304***	-0.0379***	-0.0326***
	(0.00353)	(0.00658)	(0.00686)	(0.0169)	(0.00386)	(0.00497)	(0.00732)	(0.00617)
Business service linkages: domestic	-0.0316	-0.0568	-0.0972	-0.0458	-0.0353	0.0735	-0.172	-0.0164
	(0.0546)	(0.0665)	(0.104)	(0.106)	(0.0627)	(0.0748)	(0.134)	(0.0849)
Import intensity	0.0736***	0.0807***	0.0316	0.0775	0.0738***	0.0780***	0.0909*	0.0483
	(0.0218)	(0.0234)	(0.0449)	(0.0771)	(0.0240)	(0.0297)	(0.0542)	(0.0333)
Share high-skilled labour	0.0135	-0.0330	-0.0543	0.497***	-0.00299	0.0305	0.0208	-0.0511
	(0.0345)	(0.0408)	(0.0777)	(0.0987)	(0.0394)	(0.0434)	(0.0805)	(0.0616)
Share low-skilled labour	-0.0401***	-0.0487***	-0.0580***	0.190***	-0.0423***	-0.0429***	-0.0243	-0.0578***
	(0.00970)	(0.0166)	(0.0147)	(0.0514)	(0.0101)	(0.0119)	(0.0241)	(0.0164)
Constant	0.137***	0.201***	0.175***	-0.0429	0.137***	0.105***	0.162***	0.171***
	(0.0149)	(0.0341)	(0.0298)	(0.0812)	(0.0166)	(0.0167)	(0.0325)	(0.0208)
Number of observations	358	206	152	56	302	154	100	104
R-squared	0.350	0.339	0.403	0.661	0.346	0.347	0.344	0.402

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations.

In a second specification instead of the share of foreign business services the intensity of foreign business services in overall use of business services is used. This captures a size effect as we have seen above that some countries use generally less business services and therefore would have a lower share of imported business services. However, results as reported in Table 5.2 are consistent with those in Table 5.1.

5.2 Impact of STRIs on use of foreign services

The results above suggest that a higher share of foreign business services impacts positively on manufacturing productivity growth. The second step is therefore to analyse whether more trade restrictiveness impacts negatively on the use of foreign business services. Again we employ a cross section estimation:

$$\mathrm{shFORBS_{ic}} = \beta_0 + \beta_1 \mathrm{LP_{ic}} + \beta_3 \mathrm{HS_{ic}} + \beta_4 \mathrm{LS_{ic}} + \beta_2 \mathrm{STR_{ic}} + \upsilon_i + \varepsilon_{ic}$$

Thus, the share of foreign business in total costs in industry i and country c depends on the level of labour productivity (in log terms), the shares of high and low-skilled labour and the restrictiveness indicator as explained above. For the latter we used the sum of the indicators over source countries.[13] The results are shown in Tables 5.3 to 5.5 for the three STRI indicators (OECD STRI, OECD FDI, WB STRI) separately. Further, the results are reported for the share of foreign business services as well as for the import intensity, respectively.

The results in Table 5.3 (using the OECD STRI) indicate that more restrictiveness lead to a lower share of imported business services, particularly when considering the import intensity measure. Interestingly, these effects tend to be stronger for the EU-15 economies. Further, the impact is particularly strong for the medium-high and high-tech industries.

Using the OECD FDI index (see Table 5.4) one however finds a significantly negative impact only for the EU-15 whereas for the EU-12 the sign turns into positive.[14] Further, there are no significant effects when splitting the sample by industry. These results are more or less confirmed when taking the WB STRI index as a measure of restrictiveness.

[13] Similar results are obtained when taking means. Other specifications need to be tested further.

[14] This is to be investigated further.

Table 5.3a – OECD STRI index

Dependent variable: Foreign share of business services

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
log Labour productivity	0.0120***	0.0101**	0.0156***	0.0357***	0.0123***	0.0184***	0.00611	0.0357***
	(0.00293)	(0.00449)	(0.00502)	(0.00744)	(0.00314)	(0.00603)	(0.00372)	(0.00754)
Share high-skilled labour	0.0649*	0.0822	-0.0556	-0.445	0.114***	0.0854	-0.0539	0.0758
	(0.0331)	(0.0530)	(0.0540)	(0.332)	(0.0379)	(0.0530)	(0.0615)	(0.0568)
Share low-skilled labour	-0.00847	-0.00388	-0.0250	-0.110	-0.00576	0.00718	-0.0288	-0.0159
	(0.00994)	(0.0210)	(0.0154)	(0.0654)	(0.0107)	(0.0153)	(0.0189)	(0.0166)
OECD STRI index	-0.00692	-0.0393**	-0.0109**	-0.109	-0.00597	-0.00251	-0.00892	-0.0254***
	(0.00422)	(0.0190)	(0.00523)	(0.113)	(0.00457)	(0.00656)	(0.00779)	(0.00790)
Constant	-0.00991	0.0388	0.00610	0.118	0.0344**	-0.0428**	0.0954***	-0.0765***
	(0.0125)	(0.0364)	(0.0258)	(0.221)	(0.0167)	(0.0192)	(0.0213)	(0.0241)
Observations	362	208	154	56	306	155	103	104
R-squared	0.256	0.203	0.452	0.854	0.272	0.154	0.419	0.307

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations.

Table 5.3b – OECD STRI index

Dependent variable: Import intensity of business services

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
log Labour productivity	0.0357***	0.0325**	0.0445***	0.151**	0.0449***	0.0354**	0.0334**	0.110***
	(0.00754)	(0.0144)	(0.0167)	(0.0559)	(0.00964)	(0.0169)	(0.0128)	(0.0283)
Share high-skilled labour	0.0758	0.338**	-0.238	-4.632*	0.434***	0.282*	0.0827	0.201
	(0.0568)	(0.170)	(0.171)	(2.494)	(0.114)	(0.148)	(0.205)	(0.213)
Share low-skilled labour	-0.0159	0.00703	-0.112**	-0.896*	-0.0174	0.0125	-0.0527	-0.0740
	(0.0166)	(0.0677)	(0.0488)	(0.492)	(0.0320)	(0.0427)	(0.0628)	(0.0623)
OECD STRI index	-0.0254***	-0.145**	-0.0535***	-1.476*	-0.0309**	-0.00882	-0.0483*	-0.0912***
	(0.00790)	(0.0610)	(0.0165)	(0.850)	(0.0138)	(0.0183)	(0.0265)	(0.0297)
Constant	-0.0765***	0.461***	0.0854	2.499	0.251***	-0.0346	0.0803	-0.154*
	(0.0241)	(0.134)	(0.0675)	(1.657)	(0.0529)	(0.0537)	(0.0652)	(0.0905)
Observations	104	207	152	56	303	154	101	104
R-squared	0.307	0.374	0.508	0.754	0.425	0.107	0.598	0.223

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations.

Table 5.4a – OECD FDI index

Dependent variable: Foreign share of business services

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
log Labour productivity	0.0106***	0.0103**	0.0160***	0.0327***	0.0111***	0.0193***	0.00496	0.0249***
	(0.00287)	(0.00448)	(0.00496)	(0.00688)	(0.00309)	(0.00596)	(0.00368)	(0.00726)
Share high-skilled labour	0.0658**	-0.0214	-0.0399	-0.189	0.113***	0.0797	-0.0546	0.0936
	(0.0333)	(0.0738)	(0.0505)	(0.124)	(0.0380)	(0.0533)	(0.0618)	(0.0597)
Share low-skilled labour	-0.00350	-0.0627*	0.00389	-0.0747	-7.60e-05	0.00515	-0.0189	-0.00214
	(0.00984)	(0.0321)	(0.0107)	(0.0509)	(0.0105)	(0.0151)	(0.0187)	(0.0171)
OECD FDI index	-0.00106	-0.0420**	0.0295***	-0.0290	0.00231	-0.0118	0.00799	-0.0109
	(0.00842)	(0.0191)	(0.0109)	(0.0553)	(0.00899)	(0.0131)	(0.0157)	(0.0154)
Constant	-0.0150	0.0450	-0.0258	-0.0579	0.0309*	-0.0415**	0.0835***	-0.0698***
	(0.0125)	(0.0372)	(0.0233)	(0.0715)	(0.0168)	(0.0191)	(0.0213)	(0.0252)
Observations	362	208	154	56	306	155	103	104
R-squared	0.250	0.205	0.463	0.852	0.268	0.157	0.413	0.237

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.4b – OECD FDI index

Dependent variable: Import intensity of business services

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
log Labour productivity	0.0249***	0.0331**	0.0460***	0.112**	0.0380***	0.0343**	0.0282**	0.0688**
	(0.00726)	(0.0144)	(0.0164)	(0.0528)	(0.00953)	(0.0167)	(0.0128)	(0.0272)
Share high-skilled labour	0.0936	-0.0274	-0.172	0.330	0.429***	0.280*	0.0704	0.273
	(0.0597)	(0.237)	(0.159)	(0.953)	(0.115)	(0.150)	(0.208)	(0.224)
Share low-skilled labour	-0.00214	-0.203*	0.0255	0.171	0.0132	0.0151	-0.00791	-0.0200
	(0.0171)	(0.103)	(0.0340)	(0.391)	(0.0316)	(0.0422)	(0.0630)	(0.0643)
OECD FDI index	-0.0109	-0.150**	0.138***	0.321	0.0168	-0.0124	0.0229	-0.0240
	(0.0154)	(0.0619)	(0.0344)	(0.425)	(0.0275)	(0.0376)	(0.0535)	(0.0579)
Constant	-0.0698***	0.477***	-0.0620	-0.732	0.230***	-0.0366	0.0184	-0.130
	(0.0252)	(0.137)	(0.0584)	(0.550)	(0.0535)	(0.0534)	(0.0655)	(0.0944)
Observations	104	207	152	56	303	154	101	104
R-squared	0.237	0.375	0.526	0.739	0.416	0.106	0.585	0.148

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations.

Table 5.5a – WB STRI index

Dependent variable: Foreign share of business services

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
log Labour productivity	0.0112***	0.00718*	0.0183***	0.0326***	0.0110***	0.0192***	0.00474	0.0278***
	(0.00284)	(0.00426)	(0.00479)	(0.00694)	(0.00306)	(0.00571)	(0.00369)	(0.00707)
Share high-skilled labour	0.0706**	0.0912*	0.0600	-0.130***	0.111***	0.0945*	-0.0627	0.105*
	(0.0334)	(0.0496)	(0.0503)	(0.0460)	(0.0380)	(0.0526)	(0.0623)	(0.0581)
Share low-skilled labour	0.00128	0.00298	-0.00575	-0.0523**	-0.00290	0.0180	-0.0271	0.0144
	(0.0101)	(0.0198)	(0.0101)	(0.0238)	(0.0107)	(0.0153)	(0.0191)	(0.0176)
WB STRI index	-0.00437	-0.0332***	0.0199***	0.000615	0.00222	-0.00873	0.00538	-0.0124*
	(0.00354)	(0.00607)	(0.00450)	(0.00312)	(0.00428)	(0.00536)	(0.00673)	(0.00634)
Constant	-0.0151	0.0321	-0.0443**	-0.0916***	0.0314*	-0.0441**	0.0866***	-0.0802***
	(0.0121)	(0.0244)	(0.0179)	(0.0296)	(0.0166)	(0.0187)	(0.0201)	(0.0253)
Observations	362	208	154	56	306	155	103	104
R-squared	0.253	0.296	0.506	0.851	0.268	0.168	0.415	0.262

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.5b – WB STRI index

Dependent variable: Import intensity of business services

	EU-27	EU-15	EU-12	EU Large	EU Small	Low tech	Medium tech	Medium-high and high tech
log Labour productivity	0.0278***	0.0200	0.0584***	0.118**	0.0382***	0.0374**	0.0294**	0.0773***
	(0.00707)	(0.0129)	(0.0156)	(0.0528)	(0.00944)	(0.0160)	(0.0128)	(0.0267)
Share high-skilled labour	0.105*	0.365**	0.258*	-0.279	0.420***	0.311**	0.0851	0.300
	(0.0581)	(0.151)	(0.155)	(0.350)	(0.115)	(0.147)	(0.211)	(0.220)
Share low-skilled labour	0.0144	0.0357	-0.0143	-0.0354	-0.00109	0.0471	-0.00430	0.0226
	(0.0176)	(0.0602)	(0.0316)	(0.181)	(0.0325)	(0.0427)	(0.0649)	(0.0665)
WB STRI index	-0.0124*	-0.139***	0.0824***	-0.0251	0.00934	-0.0275*	-0.0110	-0.0329
	(0.00634)	(0.0184)	(0.0139)	(0.0238)	(0.0130)	(0.0149)	(0.0233)	(0.0240)
Constant	-0.0802***	0.499***	-0.127**	-0.375	0.234***	-0.0390	0.0318	-0.158
	(0.0253)	(0.0949)	(0.0570)	(0.225)	(0.0529)	(0.0522)	(0.0602)	(0.0957)
Observations	104	207	152	56	303	154	101	104
R-squared	0.262	0.504	0.580	0.742	0.416	0.126	0.585	0.163

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: Author's calculations.

For the further variables one finds the expected effects: a higher labour productivity is positively correlated with a higher share of foreign business services which is also significant in most specifications. The shares of high and low-skilled have the expected signs when entering significantly.

Summarising, the results suggest that higher restrictiveness impacts negatively on the use of foreign business services, though results are not that robust across specifications and indicators used.

6 Conclusions

In this paper we provided some evidence of the role of business services on manufacturing productivity growth. In a nutshell, the results indicate that a higher share of imported business services impacts positively on manufacturing productivity growth. This is found both in a panel-specification as well as in a cross-section set-up. In a second step we then analysed whether more restrictions in services trade (measured by various indicators) impact on the use of foreign business services. Results weakly suggest that the use of foreign business impact is lower the higher are services trade restrictions (though results are not robust across various specifications). The results also suggest that the use of foreign business services is also positively correlated with higher productivity and a higher share of high-skilled workers in manufacturing. Together these results suggest a negative impact of services trade restrictiveness on manufacturing labour productivity growth.

Above findings have important policy implications for fostering productivity growth in manufacturing in the long run. In particular, given the presence of non-negligible productivity-enhancing backward business-service linkage effects, policy-makers should seek to facilitate and encourage the development and strengthening of business-service linkages between manufacturing and business services industries and cross-border access. Hence, the reduction or dismantling of still existing hampering barriers should be one major policy objective. In this context, however, explicit account needs to be taken of prevailing sourcing patterns – i.e. domestic versus foreign - and the benefits that manifest as a result which puts foreign business services linkages high on the political agenda of small and medium-sized economies or of economies seeking to strengthen the productivity-growth potential of medium and high-technology industries.

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Appendix

Table A1. Correspondence between WB STRI, BOP, and NACE

WB_code	WB_label	BOP_code	BOP_label	NACE_code	NACE_label
1010	Banking	260	Financial services	J	Financial intermadiation
1020	Insurance	253	Insurance services		
2000	Telecommunications	245	Communication services	64	Post and telecommunication
3000	Retail	271	Other trade related services	52	Retail trade services, except for motor vehicles; Repair of household goods
4020	Air Passenger International	210	Air transport	62	Air transport
4060	Maritime Shipping International	206	Sea transport	61	Water transport
4070	Maritime Auxiliary Services				
4080	Road Freight Domestic	223	Road transport	60	Inland transport
4090	Rail Freight Domestic	219	Rail transport		
5000	Professional	268	Other business services	71t74	Renting of M&Eq and Other business activities

Source: Author's assessment.

Table A2. Correspondence between OECD STRI, BOP, and NACE

WB_code	WB_label	BOP_code	BOP_label	NACE_code	NACE_label
TC	Telecom	247	Communication services	64	Post and telecommunication
CR	Courier	246	Postal and courier services		
CO	Construction	249	Construction services	F	Construction
ASBRD	Broadcasting	288	Audiovisual and related services	-	-
ASMOT	Motion pictures				
ASSOU	Sound recording				
CS	Computer	262	Computer and information services	-	-
FSBNK	Commercial banking	260	Financial services	J	Financial intermediation
FSINS	Insurance	253	Insurance services		
PSACC	Accounting	276	Accounting, auditing, bookkeeping, and tax consulting services	711t74	Renting of M&Eq and Other business activities
PSARC	Architecture	280	Architectural, engineering, and other technical services		
PSENG	Engineering				
PSLEG	Legal	275	Legal services		
TRAIR	Air transport	210	Air transport	62	Air transport
TRMAR	Maritime transport	206	Sea transport	61	Water transport
TRRAI	Rail freight transport	219	Road transport	60	Inland transport
TRROF	Road freight transport	223	Rail transport		
LSCAR	Logistics cargo-handling	232	Other supporting and auxilliary transport services	63	Other supporting and auxilliary transport activities
LSSTG	Logistics storage and warehouse				
LSFGT	Logistics freight forwarding				
LSCUS	Logistics customs brokerage				

Source: Author's assessment.

Table A3. Correspondence between OECD FDI RI, BOP, and NACE

FDI_code	FDI_label	BOP_code	BOP_label	NACE_code	NACE_label
17	Construction	249	Construction services	F	Construction
20	Wholesale	271	Other trade related services	51	Wholesale trade and commission trade services, except of mototr vehicles
21	Retail			52	Retail trade services, except for motor vehicles; Repair of household goods
23	Surface	219 223	Rail transport Road transport	60	Inland transport
24	Maritime	206	Sea transport	61	Water transport
25	Air	210	Air transport	62	Air transport
26	Hotels & restaurants	236	Travel	H	Hotel and restaurants
28	Radio & TV broadcasting	288	Audiovisual and related services	-	-
30	Communications	245	Communications services	64	Post and telecommunicatios
34	Banking	260	Financial services	J	Financial intermediation
35	Insurance	253	Insurance services		
37	Business services	268	Other business services	71t74	Other business activities

Source: Author's assessment.