Servicification, Regulation and Economic Performance in GVCs

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Abstract

This paper investigates services regulations impact on the value-added of backward as well as domestic direct and domestic indirect linkages in services, and whether this in turn has any effect in generating higher levels of value-added or in other words, value chain upgrading. This paper contributes to the existing literature in the following ways. First, it not only looks into the extent to which industries source services into their production (i.e. backward linkages), but also how much industries directly or indirectly produce (and sell) services themselves (i.e. domestic forward linkages). Second, we look at sector-specific services regulations in addition to national-wide policy indicators to see whether their "matched" or interacted results has any bearing on global value chains participation. Third, compared to all previous work in services analysing the role of regulations on performance, this paper investigates this question from a global value chains perspective so that value-added is central in our analysis.

The results show that regulatory entry barriers are strongly associated with lower levels of exported services value-added though all types of linkages. However, conduct regulations of services suppliers show in some instances a positive contribution to explaining these services linkages, particularly regarding the domestic indirect forward linkages in services. On the other hand, the results also show that both entry barriers and conduct regulations play a significant inhibiting role for countries to "upgrade" their production processes. The results show that different regulatory measure matter for different types of services linkages and stages of servicification and as such can help improve the economic performance of countries through their servicification process.

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1. Introduction

The role of services in the domestic economy has been increasingly recognized in the international economic literature. The importance of services stems mainly from being a vehicle for increased economic performance through input linkages as part of firms' sourcing strategies. Indeed, many services are used as intermediate inputs and the efficient delivery of services therefore enhances the productive performance of downstream industries using them. Examples include transport services, telecommunications, computer services, and other business services. In a world where production stages are spread across many geographical locations, so-called Global Value Chains (GVCs), the efficient production and supply of services so as to link these cross-border production stages becomes even more key for domestic economic performance.

Yet, compared to goods many services markets are still highly regulated with government interventions with the result that trade costs in services are manifold relative to goods. (Miroudot and Shepherd, 2014). Regulations in services vary from certification requirement for professional services to network regulations in telecommunications, or standard entry barriers in, for instance, the distribution or construction sector. Although some regulations in services are warranted because of their so-called market failures from which services suffer, many of these regulatory measures can spill-over in *de facto* trade barriers which as a consequence create excessive costs for businesses. These increased cost will be felt in the domestic economy in two ways: first, through foreign backward or indirect domestic forward linkages since industries using services are less able to source and generate value from services inputs in the most efficient way (Arnold *et al*, 2015), and second through direct domestic forward linkages as the services sector themselves will face higher costs for their own production and exports (Nordas and Rouzet, 2015).

This paper will therefore take a look these three linkages from a value chain perspective and investigate whether services regulations in services have any effect on the value-added of

backward as well as domestic direct and domestic indirect linkages in services, and whether this in turn has any effect in generating higher levels of value-added or in other words, value chain upgrading. A focus on all three export linkages of services value-added is important as the recent trade literature emphasised the increased employment of services across the entire economy, also known has “servicification”, which has become a wide-spread phenomenon (Kommerskollegium, 2010). Moreover, at the level of the firm, Crozet and Milet (2015) show that manufacturing firms in France increasingly produce and sell services to third parties next to goods. This in turn provides firms with increased performance in terms of profitability, sales and employment. This improved performance should also be reflected when using our performance indicator of generating greater levels of domestic value-added in this paper. In particular, this paper assesses what regulatory policies will help explain this value-added servicification and upgrading within global value chains.

The recent literature that focuses on value chain upgrading has been put forward by Kummritz *et al*. (2015). In particular, this paper focuses on which national-wide policies have an effect on economic upgrading through their interaction with so-called backward and forward linkages in global value chains. This paper follows but adapts their empirical strategy so as to take account of the specific sector-specific services regulations currently existing across countries and then tries to links up these policies with the various services linkages on which industries are so much reliant on to reach economic upgrading. Moreover, although regulations in services as such are of direct importance on the performance and/ or upgrading within value chains, this paper will also look which other national-wide policies can “support” these regulations. In particular, we assess various factors which are known to be important for countries to generate greater services activities and hence will have a further effect on economic performance.

Taken together, this paper contributes to the existing literature in the following ways. First, contrary to previous works on services and their effects of regulation on performance, it will not only look into the extent to which industries source services into their production (i.e. backward linkages), but will also include how much industries directly or indirectly produce (and sell) services themselves (i.e. domestic forward linkages). We investigate this increased servicification of production for the entire economy so that manufacturing as well services sectors are incorporated in our analysis. Second, we look at sector-specific services regulations in addition to national-wide policy indicators to see whether their “matched” or interacted results has any bearing on global value chains participation following Kummritz *et al*. (2015). In this sense our focus takes an intermediary step by linking up the sectoral backward and direct

linkages up with sectoral services policies as done e.g. Barone and Cingano (2011). Third, as explained above, compared to all previous work in services analysing the role of regulations on performance, this paper investigates this question from a global value chains perspective so that value-added is central in our analysis.

The rest of this chapter is organized as follows. The next section describes some of the pattern visible across countries, and in particular developing countries, regarding the services dimension of production across various industries (i.e. so-called servicification) over time to uncover any trends. The third section will uncover some of the associated factors in explaining this increase servicification linkages across countries. The fourth section provides the empirical analysis to see how these services linkages are important for domestic economic performance (or value chain upgrading) and investigates which type of regulatory policies form an inhibiting factor in this regard. Finally, Section 5 concludes.

2. Current Patterns in Services Value-added

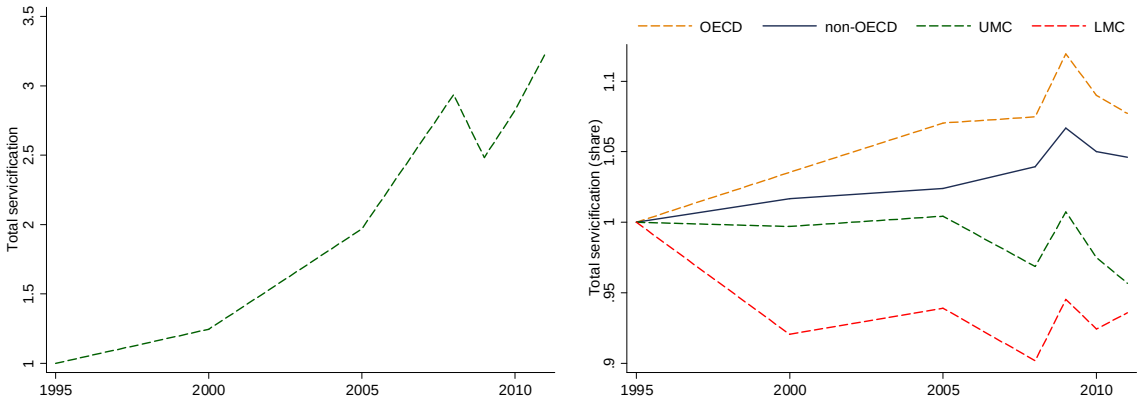
In recent decades, technology changes have transformed trade patterns which are increasingly organized around GVCs. The emergence of GVCs has put forward the role of services which includes a wide variety of activities such as design, production, marketing, distribution and customer support. These services are a crucial factor in the fragmentation of production which in turn has been facilitated by new information and communications technologies (ICT). These new patterns of trade are characterized by an increased amount of "customized" intermediates next to the "generic" or final products and commodities. Many of these intermediate inputs are actually services as shown by Miroudot *et al*. (2009).[1] As such, services have a dual role, namely one as an enhancer of value-added in GVCs for industries much dependent on services so as to create value; as well as one as a creator of value-added since services become more and more tradable themselves. Sequentially, industries which are dependent on services as a value-added enhancer can either source their value-added from abroad (backward) or domestically (indirect forward).

Figure 1 sums up all these three linkages (i.e. backward foreign, domestic indirect forward and domestic direct forward) and shows in the left-hand panel that the overall growth in these services linkages have been growing steadily over time, except for a decrease in 2008. When

[1] More than half of world-manufactured imports are intermediate goods whereas more than 70 percent of world imported services are intermediate services (Miroudot *et al,* 2009).

splitting up into various income groups of OECD, non-OECD, Upper Middle-income group of countries (UMC) and Lower Middle-income of countries (LMC), growth has been most pronounced in the latter two income groups (see Appendix Figure A.1), which in itself is unsurprising since their services activities starts growing from a lower base and has over the years resulted in a relatively higher growth rate. The right-hand panel of Figure 1 therefore shows total services linkages of each income group as a share of the overall exported value-added. From this figure it becomes clear that richer countries have seen a higher growth rate in the share of total services value-added linkages over time. On the other hand, however, this growth of the share of services linkages has been decreasing for the less developed country groups. In particular, upper middle income countries and lower middle income countries have seen lower levels of servicification over time, although for the latter group this has been increasing in recent years.[2]

Figure 1: Growth of Total servicification linkages for World and various income groups (1995-2011)



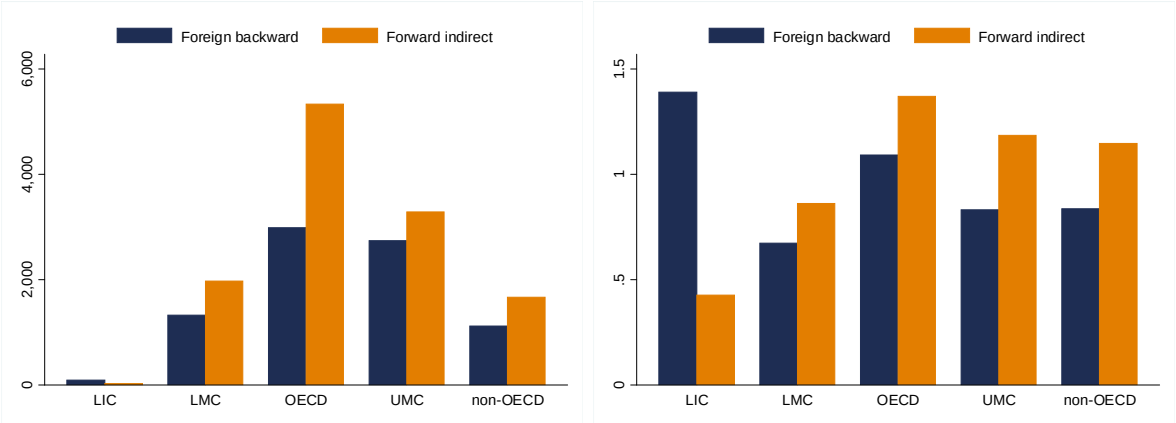
Source: OECD and author's calculations

Figure 2 breaks down the indirect linkages into foreign backward and forward indirect services linkages for the various income groups. Although both linkages are important drivers for the

[2] Note that the group of Low Income Countries (LIC) has been omitted as this paper uses the OECD's TiVA data to compute services linkages in which only Cambodia is taken up as part of this income group. However, Cambodia shows steady increase of services linkages over time outperforming both OECD and non-OECD countries.

entire servicification of economies in each income group, some differences remain. In all income groups apart from the lower income countries (which is only comprised of Cambodia) forward linkages are more important although they play as expected a greater role in sheer value (left-hand panel) in richer countries. Yet, upper middle income countries are nonetheless also much dependent on domestic indirect services linkages as shown by the yellow bars in Figure 2, which is also confirmed when putting the linkages as a share of total exported value-added (right-hand panel). Together these two panels show that the indirect services linkages correlate with income patterns: upper-middle income countries are less-dependent on both linkages compared to OECD countries, but in turn show higher linkages compared to the lower middle income group of countries.

Figure 2: Backward foreign and domestic forward indirect services linkages by income group (2011)



Source: OECD and author's calculations

However, multiple factors may explain the servicification level of countries besides their level of income. The recent trade in services literature has found several additional factors that influence services production and exports, and which in turn should have an influence on the extent to which economies are employing services throughout their supply chains. Most important driver of these servicification linkages are naturally regulations related to the production and/ or foreign supply of services. Services regulations come in many ways and differ from goods in the sense that they are often implemented "behind-the-border" rather than at the border such as entry barriers. Example of behind-the-border measures are operational restrictions in Professional services, or anti-competitive market structures in the Telecom services market. Recent initiatives

over the years trying to quantify these regulatory restrictions have shown that a wide variety exists between countries in terms of levels of services regulations.

Yet, other factors matter too, such as internet connectivity (Freund and Weinhold, 2002), high-skilled labour supply (Amin and Mattoo, 2008) or domestic (regulatory) institutions (Beverelli *et al*., 2015; van der Marel (2016). Empirical studies have furthermore shown the importance of services in GVCs. For instance, Golub *et al*. (2007) have put forward evidence that successful exporters of manufactures, notably in East Asia, actually have favorable services links and which can have very significant effects. Furthermore, services in GVCs are also closely linked with Foreign Direct Investment (FDI) of which more than 60 percent of this FDI around the world is comprised of services (UNCTAD, 2013). The next section will therefore take all these factors into account when assessing which of these factors can explain the increased services linkages across countries and how these linkages can greater overall value-added, i.e. how in turn these factors contribute to economic performance through services linkages.

3. Empirical Set-up of Servicification and Upgrading through Services

In order to assess the role of services linkages in the economy, our empirical exercise makes use of a two-step procedure. First, we first investigate whether services linkages are associated by a variety of regulatory policies in services next to a set of other controls as outlined above that may influence the increased value-added of services passing through the entire economy. Second, we also examine the role this servicification process has on economic upgrading or generating higher domestic value-added in global value chains. As such, linkages in services are first explained by a set of factors which according to the trade literature are known to have an influence, but are later used as a determinant to measure domestic performance in value chains.

3.1 Servicification Linkages in Global Value Chains

In order to define servicification or all services linkages present in an economy, we compute services linkages from three different perspectives, namely foreign backward, domestic indirect forward as well as domestic direct forward. The first type of linkages summarizes all value-added in services stemming from abroad and which are used and hence exported by all downstream or using sectors (both goods and services) of a country. The domestic indirect forward linkages in services represent the value-added which is domestically produced and hence used

downstream by domestic industries of a country by again both goods industries as well as other services sectors. Finally, the domestic direct forward linkages in services stand for the value-added which is directly exported within each services sector itself. Note that these simple measures are hence summarized over all using industries and sector for each services sector so that:

$$Servicification_{ist} = \{VA\_Sbf_{ist}; VA\_Sfi_{ist}; VA\_Sfd_{ist}\} = \sum_j VA_{ijst} \quad (1)$$

In equation (1) it becomes clear that we take into account all three types of linkages, i.e. backward foreign (*VA_Sbf*), forward indirect (*VA_Sfd*) and forward direct (*VA_Sfd*) for each country *i* for each services sector *s*¸ summed over using sector *j* when looking at the indirect linkages. For the forward direct linkages this latter sector *j* is the industry itself (i.e. *ss*). We furthermore define the total amount of services value-added linkages as the sum of all three linkages and is denoted by *VA_Stt* in the regressions as we also seek to explore what factor determines all linkages together in an economy.

3.2 Baseline Regressions

Our baseline regressions to measure servicification of value added is simply to regress all four services linkages of value-added (including the one summing up total value-added linkages) on our regulatory variables so that:

$$Servicification_{ist} = \Phi + \theta REG_{ist} + \theta X_{it} + \delta_i + \lambda_s + \varsigma_t + \varepsilon_{ist} \quad (2)$$

where, again, servicification stands for one of the three types of services value-added linkages as explained above, and where the vector *REG* contains the various regulatory measures on which services value-added are regressed. Equation (2) also holds a control term, *X*, which covers all other country-wide determinants that may influence servicification of an economy over time as discussed in Section 2. It is not only regulatory policy that have an impact on the employment of services in a country. For instance, many services are ICT-intense or can be

produced and delivered over the internet. The internet may therefore form an additional determinant for industries to employ more services in their production. Other control factors include high-skilled labour, regulatory quality of governments, R&D expenditure as well as GDP per capita (PPP). All these factors are thought to influence services trade (see Sáez *et al*. 2014) and hence potentially also the value-added exports of services, i.e. services linkages. We also include upstreamness to see whether a country's position in the supply chain has any bearing on the value-added linkages in services.

The value-added data to compute each linkage are taken from the OECD's Trade in Value-added (TiVA) database. The regulatory variables also come from the OECD and stand for the sector-specific regulatory barriers in services or the so-called Non-Manufacturing Regulations (NMR) as part of the Product Market Database (PMR). Although the barriers taken up in this database cover a wider range of regulatory barriers and not only trade barriers in services, there are two advantages of using this database as opposed to the OECD's or World Bank's Services Trade Restrictiveness Index (STRI). First, it's not only trade that we are measuring in our linkages, but also production as we also include domestic indirect forward linkages. Second, from a practical perspective the PMR structure are provided in time-series which provides us liberalizing trends over time as opposed to cross-country difference only. We also use a second set of regulatory measures that vary over time which is country-sector specific, namely the Foreign Direct Investment (FD) restrictiveness indicators from the OECD. Assessing the effect of these measures is important as many foreign service suppliers enter the domestic market through a foreign affiliate which under the WTO auspices is covered by regulatory barriers related to Mode 3.

The country-wide variables are sourced from various databases such as the World Development Indicators (WDI), Barro and Lee (2012) and the World Bank's Governance Indicators. Upstreamness is calculated using the OECD's ICIO input-output tables. In the appendix Table A1 to A.3 shows further details for each additional variable used in our regression analysis.

3.3 Results

The results of our regressions are presented in Tables 1 through 4. Table 1 and 2 report the set of regulatory barriers using the PMR structure. These services regulations are set-out in the PMR database into various categories distinguishing between pure entry barriers and other regulatory measures that target the operations of a firm after it has entered the domestic market,

i.e. what we call conduct regulations. Entry barriers are straightforward and include for instance licence certificates or entry permits in order to start providing a service and enter a foreign market. Conduct regulations cover all sort of other regulations that happen “behind-the-border” and impact the operations of the firm which are domestic as well as foreign such as vertical integration allowance in network services, price controls in the Retail sector or regulations on the form of business in Professional services. Table A.1 in the appendix provides an overview which specific regulatory measure is included under entry and conduct regulations.

In Table 1 the total services value-added summing up all three linkages are used as dependent variables whilst the regulatory regressors are entered separately from columns 1 to 3. The table shows that entry barriers account for a significant factor that inhibits the increased use and employment of services value-added over time across countries. Indeed, column 2 reports a coefficient outcome that is significant at the 1 percent level whilst also in column 4 when entered together with conduct regulation. On the other hand, when entered separately in column 3 the variable measuring conduct regulations has a positive sign but does not hold any bearing on total our servicification variable that sums up all services linkages. However, when putting conduct regulations next to entry barriers it surprisingly does come out as a significant positive factor influencing services linkages in value-added. One potential explanation for this positive result is that regulations targeting the operations of services are for domestic as well as foreign service providers which in effect ensures a level playing field as opposed to giving explicit advantages to domestic firms through the use of entry barriers only.

Table 2 reports the results for when we split up total services value added into the separate linkages. First we take the foreign backward and domestic indirect forward linkages together so as to take stock of the total *indirect* linkages only (VA_Stl). Then these two linkages are broken down separately, i.e. VA_Sbf and VA_Sfi respectively. Finally, we also use the third linkage of domestic direct forward services value added in the last column. The results show that again entry barriers remains a strong force that negatively influences all types of linkages in services value-added whilst conduct regulations selectively has (again) a positive impact on some of the services linkages. In particular, it has a strong negative outcome for when the indirect linkages are summed up in column 1, which in most part is likely due to very significant outcome on domestic indirect forward linkages as shown in column 3. For the other two services value-added linkages of backward foreign and domestic direct, conduct regulation does not hold any important effect.

Our set of control variable exhibits some interesting results. In both Table 1 and 2 we find that internet connectivity has a positive effect on our total set of linkages measuring overall servicification although some nuances are found when putting them into each of the separate linkages. In fact, the level of internet connectivity measures in large part only significant for the direct exported domestic value-added. Surprisingly, high-skills within a country has a negative and significant effect in almost all specifications, which to us is not obvious. More research will need to be done as to why this holds a negative effect, particularly with regards to gross services exports which are otherwise positively correlated with the supply of high-skills (Sáez et al, 2014). Furthermore, the share of R&D services in an economy is positively associated with domestic indirect forward linkages which in world of supply chains are not entirely surprising. Most of the R&D activities are an important ingredient for supply chains and are often employed at the early stages. Finally, upstreamness is also found to have positive influence on most linkages and points out to the fact that countries which are positioned rather upstream in their supply chains in particular see greater *indirect* linkages as opposed to direct linkages.

In Table 3 we use the FDI regulatory restrictiveness indicators which are also broken down into various sub-indicators, namely equity restrictions (eqr), other FDI restrictions (oth) such as those related to land, reciprocity or capital repatriation, restrictions related to the cross-border mobility of key personnel such as managers and directors (pers) and finally regulations covering screening and approval procedures (scr). In the annex Table A.2 provide further details what else are included in these separate sub-categories. On the whole, these regulatory restrictions cover measures of market access restrictions and any departures from national treatment. Table 3 shows that when taking all these measures together (all), this regulatory variable has a negative and signification coefficient sign and has a sizable effect compared to the PMR regulations as reported in column 1. When entering each of the sub-measures separately, we only find equity restrictions having a strong negative effect on our total value-added linkage. On the other hand, however, screening procedures bear a slightly positive influence on services value-added as shown in column 6.

Table 4 shows the results for each linkage again. Results are largely similar in the sense that equity restriction only have negative and significant impact on the indirect linkages (columns 1 to 3), not direct linkages (column 4). Next, although screening procedures have some negative results for foreign backward linkages, it does hold a positive influence on the direct domestic linkages. Finally, our control variables are in line with the results found in previous tables so that

high-skills supply has again a negative coefficient result whereas upstreamness and in some occasions internet connectivity have a positive coefficient outcome.

4 Domestic Upgrading Through Servicification Linkages

We now explain domestic economic upgrading through services linkages as defined in our previous section. This empirical part closely follows the specification of Kummritz *et al*. (2015), but integrates the regulatory restrictiveness policies in services which are sector-specific and which have an effect through indirect linkages, i.e. foreign backward and domestic indirect forward linkages in global value chains. Previous works have pioneered the liberalizing effect of regulatory policies in services through linkages on (firm) performance such as Arnold *et al*. (2016; 2011), Barone and Cingano (2011) and Bourlès *et al*. (2013). This paper takes a value chain perspective and rather than looking at any productivity performance, it takes the approach of looking at total economic performance in terms of total value-added as a dependent variable to analyse economic value chain upgrading.

All these previous works have taken a weighted approach in the sense that downstream manufacturing industries or sectors which are more dependent on services linkages in terms of their input structure are likely to be more affected by regulations in services as compared to those which are less services dependent. The main focus in all these empirical set-ups is that domestic backward linkages is taken as a weight which is then interacted with sector-specific services regulations. Since we are interested in the GVC component of these linkages and since the recent literature on services shows that besides these domestic backward linkages of services, firms across the entire economy also increasingly produce and sell services embedded into goods (Crozet and Milet, 2015), we take the approach of establishing a weight that covers foreign backward as well as domestic indirect forward linkages. This means that in our case, we again use trade in value-added data to establish these linkages of value-added of services across the entire set of downstream sectors. Moreover, we do not only look at the manufacturing sector alone, but also take in account all sectors in our empirical strategy including services themselves.

Hence, in the next step of our empirical analysis we compute the foreign backward and domestic indirect forward linkages and interact them with services regulation as previously used so that we obtain our weighted regulatory services value-added linkages index as follows:

$$RL_{ijt} = \sum_s REG_{ist} * VA\_Stl_{ijst} \quad (3)$$

where

$$VA\_Stl_{ijst} = \{VA\_Sbf_{ijst} + VA\_Sfi_{ijst}\} \quad (4)$$

and where *Stl* varies between 0 and 1. In equation (1), the *RL* stands for regulatory linkages in sector *j* of country *i*, which is comprised of the sum of the interaction between sectoral regulatory barriers, called *REG*, for each services sector *s* in each country *i*, with our services linkages coefficients of sector *s* for each sector *j* in country *i*. As said, the services linkage is in turn comprised of backward foreign linkages (*VA_Sbf*) and domestic indirect forward linkages (*VA_Sfi*). The former linkages are the value-added in services that is generated or sourced from upstream sectors which are brought in from abroad and exported. The latter linkages are the domestically generated services value-added that is created within the country itself and hence exported through other domestic sectors. As such we take both types of linkages into account as services restrictions have shown to have an effect on both flows of trade, i.e. imports or value-added on the buyer's side, and exports or value-added on the seller's side.

4.1 Baseline Regressions

Equation (1) is used in our baseline regression which measures the extent to which our regulatory linkages in services have an effect on economic performance or upgrading as part of global value chain participation as put forward in Kummritz *et al*. (2015), but adapted to our case in which we integrate the regulatory linkages. Hence, our baseline equation looks as follows:

$$DVA_{ijt} = \Phi + \theta RL_{ijt-1} + \theta X_{ijt} + \delta_{it} + \omega_{jt} + \varepsilon_{ijt} \quad (5)$$

where *DVA* stands for the domestic value added which is generated in sector *i*, in country *j* and represents economic performance or upgrading. In equation (3) the regulatory linkage (*RL*) is plugged in and used as a dependent variable as explained above. Inside our *RL* term, we use again the OECD's NMR regulations indicators as well as the FDI regulatory restrictions variables as used in equation (2) since this provides us with good time series.

In equation (5) the term *X* controls for the other GVC determinants in the sense that countries also have backward and forward linkages in other sectors in the economy as part of global value chains. Two standard proxies are selected to control for these linkages, namely FVAX and DVAR. The variable FVAX stands for the total foreign value-added embodied in exports, whereas DVAR is the amount of domestic value-added re-exported by third countries. These two variables control for all other GVC activities in terms of linkages that takes place within a particular sector. Moreover, we also correct for the foreign value-added that is used in domestic processing or consumed domestically, FVADP, so as to tease out final goods and services imports or intermediate goods and services imports that is consumed domestically and hence let equation (5) entirely focus on GVC trade as opposed to final goods trade.

Note that since our baseline regression is performed in a panel dimension, we use country-year (δ_{it}) and country-sector fixed effect (ω_{jt}). The ε_{ijt} is the standard error term which is clustered by country-sector. All variables using GVC level variables are put in logs whilst our services linkage variable are also lagged with one year so as to correct for potential reversed causality. All of the GVC variables come from the OECDs TiVA database, which therefore cover for DVA, FVAX, DVAR and finally FVADP. Note furthermore that although FVAX and DVAR are presented in the TiVA database, DVA and DVADP are calculated from the underlying ICIO input-output tables which are used for TiVA. This is because these two variable also contain a production component that is not solely related to exports or imports of value added. As in our previous section, the services linkage variables *VA_Sbf* and *VA_Sfi* are also calculated form the TiVA database and are computed for each country and sector.

In a second step we include various country-wide policy variables in our regression which are found to have a significant impact on the production and tradability of services. For example, the services literature has put forward the importance of high-skilled labour supply in producing services or has emphasized the increased scope of services trade through the use of ICT and the Internet (see for instance Sàez *et al*, 2014). As well, regulatory capacity or more broadly domestic institutional structures in terms of economic governance also plays a significant role in how services can have an effect on domestic economic performance as shown by Beverelli *et al*. (2015). We apply various sets of these intermediating policy variables interacted with our *RL* variable so that an extended baseline regression becomes as follows:

$$DVA_{ijt} = \Phi + \theta(RL_{ijt-1} * C_{it}) + \theta X_{ijt} + \delta_{it} + \omega_{jt} + \varepsilon_{ijt} \quad (6)$$

Hence, equation (6) replicates equation (5) with the only exception that C_i is now included which allows for the varying effect of our regulatory linkage variable across countries determined by set of national characteristics. These country-wide features are hence high-skilled labour supply, ICT connectivity, domestic economic governance, and our GVC-related variable upstreamness. The data for high-skilled labour supply is sourced from Barro and Lee (2012), ICT connectivity comes from the WDI whereas we use rule of law for domestic economic governance to stay close to Beverelli *et al*. (2015) taken from the World Governance Indicators database. Finally, upstreamness is computed from the ICIO input-output tables. Again, in the appendix Table A.3 shows further details for each variable used in our regression analysis.

4.2 Empirical Results

The empirical results of our baseline regression are presented as Table 5 and 6. In each table the baseline regressions are presented but for the two different regulatory indicators of the NMR and FDI respectively. In Table 5 columns 1 to 4 present the effect of the regulatory linkages on domestic value added (DVA) when interacting these regulatory linkages with the sum of foreign backward and domestic indirect forward linkages. In all four columns the regulatory variables for all types of regulations or for the two types of entry and conduct regulations separately, come out highly significant in a negative way. An interesting point to note is that in column 3 conduct regulations have a somewhat higher coefficient size than entry barriers. In column 4, however, this size drops somewhat so that entry barriers have a more important effect economically.

Columns 5 and 6 breaks down the total indirect linkages into the foreign backward and domestic indirect value-added exports separately. Column 5 shows that regulatory entry barriers represent the only significant inhibiting factor greater performance in sector that are more dependent on foreign backward value-added in services. This makes sense as entry barriers prevent domestic industries from sourcing services inputs abroad of which in a next step their value-added is exported. Conduct regulations does not hold any significance for foreign backward linkages on any economic performance or upgrading. On the other hand, column 6 reports the results for domestic forward indirect linkages and shows that industries more reliant on this set of services linkages inhibits performance significantly in case of higher entry as well as conduct regulatory barriers. Again, an interesting result from this specification is that conduct regulations have an economically more important effect as shown by the higher coefficient size.

Table 6 shows the results when using the OECD's FDI regulatory restrictions as part of the regulatory linkages. Columns 1 to 6 report the effects of the sub-indicators by entering them separately and which are interacted with the industry's reliance on the total amount of indirect linkages. Each columns holds a coefficient result that is highly significant. Yet, when entering all FDI restrictions together in column 6 one can see that only a few are left with an economically important effect, namely Other regulatory FDI restrictions which is comprised of the allowance to repatriate of capital flows, any reciprocity requirements, any access to local finance and the permission to establish branches amongst others, as well as restrictions related to Screening and Approval procedures.

Columns 7 and 8 in Table 6 show the results for FDI regulations through foreign backward and domestic indirect forward linkages in services separately. In column 7 both Other FDI regulatory restrictions and Screening approval regulations have a significant inhibiting factor for domestic economic performance for industries heavily dependent on foreign backward linkages. It's interesting to note that equity restrictions do not hold any negative influence in this regard, and even shows a slight positive coefficient outcome. Column 8 reports that the cross-border mobility of foreign key-personal is a significant determining fact for lowering domestic performance or upgrading in sectors employing and exporting greater shares of domestic value-added in services.

The results of equation (6) are reported in Tables 7 and 8 for again the NMR and FDI regulatory restrictions respectively. In both tables we slit up the two types of linkages so as to obtain a better idea whether countries with certain characteristics are more affected by our regulatory policies, depending on whether industries use more foreign backward or domestic indirect linkages. Each column in both tables report one category of country-wide variable with which the regulatory linkages are interacted. In Table 7 it becomes clear that actually for the NMR linkages no significant interaction effects are obtained. As such one can assume that these regulatory policies matter across the board independent of any country group of development stage.

Nonetheless, Table 8 shows that some regulatory measures related to FDI matter more for countries that carry along greater levels of supply factors important for services, and which therefore inhibits economic performance to a greater degree. For instance, the negative coefficient result in column 3 and 7 shows that countries well-endowed with skills are affected more significantly by FDI regulations so as to increase domestic value-added. In particular, this is true with respect to Equity restrictions and Other FDI regulations. Similarly, countries which are placed more upstream in the supply chain or have a greater internet connectivity face

greater losses of economic performance through their industries which are more dependent on domestic forward indirect linkages in services.

5 Conclusion

This paper has tried to uncover which of the regulatory barriers in services are of major constraint in generating greater levels of value-added in services as part of GVCs. Generally, services play an increasingly crucial role in countries' level of development, either at the buying side or sellers' side. The role of services, or servicification in general, can be broken down into various components, namely value-added that is indirectly exported stemming from abroad (foreign backward linkages), value-added indirectly exported through other domestic sectors (domestic indirect forward linkages) or directly as a services export itself (domestic direct forward). This paper has assessed which regulatory barriers determine these three services linkages by looking at various *types* of regulations such as entry barriers, conduct regulations and various FDI regulations. In a second step, this paper has also looked into how regulatory barriers in services determine domestic economic performance through value-added linkages in services.

The results of the paper show that what explains the extent to which an economy is comprised of the three services linkages are mainly entry barriers. Regulatory entry barriers are strongly associated with lower levels of exported services value-added though all types of linkages. On the other hand, however, regulatory barriers that target the operational procedures of services suppliers show in some instances a positive contribution to explaining these services linkages, particularly regarding the domestic indirect forward linkages in services. We also looked at various FDI regulatory restrictions which can be set out into equity restrictions, other regulations, entry of foreign key personnel, and screening requirements. Here, equity restrictions are the main factor which are negatively associated with lower levels of servicification.

This paper has also shown how and which lower regulatory barriers can enhance the economic performance of countries. We have done so by looking at how much each sector within an economy is reliant on each of these services linkages. Sectors which are more dependent on either backward foreign or domestic indirect forward linkages are therefore more affected by services regulation than other sectors. The results show that this is indeed true and that both entry barriers and conduct regulations play a significant inhibiting role for countries to "upgrade" their production processes. Interestingly, conduct regulations have an economically more important effect than entry barriers. Finally, FDI regulations related to various items such as

capital repatriation or access to local finance, but also the cross-border mobility of foreign personal, play a much more significant role for countries to increase their economic performance as opposed to entry equity restrictions alone.

Together these results show that different regulatory measure matter for different types of services linkages and stages of servicification and as such can help improve the economic performance of countries through their servicification process. Most interesting in this regard is that it's not only entry restrictions that allow for improved performance, other types of behind-the-border barriers that touch upon both domestic as well as foreign services suppliers can matter significantly more in generating higher value-added.

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Table and Figures

Table 1: Total Servicification (backward, indirect and direct forward) and PMR regulations

	(1) ln(VA_Stt)	(2) ln(IVA_Stt)	(3) ln(IVA_Stt)	(4) ln(IVA_Stt)
NMR (all)	-0.0179			
	(0.0152)			
NMR (entry)		-0.0395***		-0.0542***
		(0.0117)		(0.0138)
MNR (conduct)			0.0099	0.0412**
			(0.0175)	(0.0204)
Reg qual	-0.0344	-0.0082	-0.0345	-0.0166
	(0.0766)	(0.0729)	(0.0753)	(0.0719)
Internet	0.0057***	0.0041**	0.0058***	0.0042**
	(0.0019)	(0.0016)	(0.0018)	(0.0016)
High-skills	-0.0148***	-0.0115***	-0.0158***	-0.0120***
	(0.0042)	(0.0040)	(0.0042)	(0.0041)
R&D / GDP	0.0514	0.0493	0.0577	0.0553
	(0.0514)	(0.0510)	(0.0505)	(0.0502)
Upstream	1.2391***	1.3110***	1.1578**	1.2876***
	(0.4739)	(0.4446)	(0.4736)	(0.4449)
ln(GDPpc PPP)	0.9835***	0.9946***	0.9885***	0.9855***
	(0.2342)	(0.2452)	(0.2261)	(0.2369)
Fixed effects	Country-sector year	Country-sector year	Country-sector year	Country-sector year
Observations	624	618	624	618
R-squared	0.9561	0.9570	0.9561	0.9574
RMSE	0.326	0.322	0.327	0.321

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. All services linkages variables are put in logs. Fixed effects by country, sector and year are separately applied. Robust standard errors in parenthesis clustered by country-years. VA_Stt stands for the total value-added linkages in services comprised of foreign backward, domestic forward indirect as well as domestic forward direct value-added in services.

Table 2: Servicification (backward, indirect and direct forward) and PMR regulations

	(1) ln(VA_Stl)	(2) ln(VA_Sbf)	(3) ln(VA_Sfi)	(4) ln(VA_Sfd)
NMR (entry)	-0.0587***	-0.0389***	-0.0636***	-0.0602**
	(0.0117)	(0.0149)	(0.0173)	(0.0292)
MNR (conduct)	0.0413**	-0.0204	0.0957***	0.0349
	(0.0167)	(0.0217)	(0.0232)	(0.0341)
Reg qual	0.0013	0.0170	-0.0365	-0.0360
	(0.0761)	(0.1005)	(0.0792)	(0.1236)
Internet	0.0027	0.0022	0.0033*	0.0077**
	(0.0019)	(0.0025)	(0.0019)	(0.0032)
High-skills	-0.0128**	-0.0122	-0.0154***	-0.0080
	(0.0054)	(0.0083)	(0.0045)	(0.0084)
R&D / GDP	0.0851	0.0683	0.1129**	-0.0055
	(0.0567)	(0.0732)	(0.0547)	(0.0808)
Upstream	1.7951***	0.9006**	2.3562***	0.2246
	(0.4169)	(0.3874)	(0.6455)	(0.9764)
ln(GDPpc PPP)	1.0401***	1.1138***	1.0004***	0.8949***
	(0.2724)	(0.3371)	(0.2145)	(0.2320)
Fixed effects	Country, sector & year	Country, sector & year	Country, sector & year	Country, sector & year
Observations	618	618	618	618
R-squared	0.9568	0.9480	0.9333	0.8979
RMSE	0.312	0.342	0.427	0.593

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. All services linkages variables are put in logs. Fixed effects by country, sector and year are separately applied. Robust standard errors in parenthesis clustered by country-years. VA_Stl stands for the total indirect value-added linkages in services comprised of foreign backward (VA_Sbf) and domestic forward indirect (VA_Sfi) value-added in services. VA_Sfd denotes the domestic forward direct value-added in services.

Table 3: Total Servicification (backward, indirect and direct forward) and FDI regulations

	(1) ln(VA_Stt)	(2) ln(VA_Stt)	(3) ln(VA_Stt)	(4) ln(VA_Stt)	(5) ln(VA_Stt)	(6) ln(VA_Stt)
FDI reg (all)	-0.2637***					
	(0.0695)					
FDI reg (eqr)		-0.3027***				-0.3049***
		(0.0741)				(0.0728)
FDI reg (oth)			0.1194			0.0687
			(0.7292)			(0.7321)
FDI reg (per)				-0.0555		0.5243
				(0.8875)		(0.8805)
FDI reg (scr)					0.6464*	0.6058*
					(0.3484)	(0.3305)
Reg qual	-0.0687	-0.0718	-0.0640	-0.0640	-0.0691	-0.0779
	(0.0714)	(0.0707)	(0.0702)	(0.0701)	(0.0694)	(0.0702)
Internet	0.0035	0.0035	0.0031	0.0031	0.0026	0.0031
	(0.0021)	(0.0021)	(0.0022)	(0.0022)	(0.0023)	(0.0022)
High-skills	-0.0156***	-0.0150***	-0.0150***	-0.0152***	-0.0152***	-0.0142***
	(0.0046)	(0.0047)	(0.0046)	(0.0047)	(0.0046)	(0.0049)
R&D / GDP	-0.0021	0.0009	0.0078	0.0072	0.0145	0.0095
	(0.0494)	(0.0488)	(0.0495)	(0.0492)	(0.0499)	(0.0491)
Upstream	1.1476***	1.1403***	1.1069***	1.1099***	1.1113***	1.1362***
	(0.4077)	(0.4090)	(0.4133)	(0.4122)	(0.4150)	(0.4146)
Ln(GDPpc PPP)	1.2389***	1.2554***	1.2691***	1.2673***	1.3129***	1.2991***
	(0.1012)	(0.0996)	(0.1022)	(0.1054)	(0.1108)	(0.1013)
Fixed effects	Country, sector & year	Country, sector & year	Country, sector & year	Country, sector & year	Country, sector & year	Country, sector & year
Observations	1,520	1,520	1,520	1,520	1,520	1,520
R-squared	0.9365	0.9367	0.9359	0.9359	0.9360	0.9369
RMSE	0.404	0.404	0.406	0.406	0.406	0.403

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. All services linkages variables are put in logs. Fixed effects by country, sector and year are separately applied. Robust standard errors in parenthesis clustered by country-years. VA_Stt stands for the total value-added linkages in services comprised of foreign backward, domestic forward indirect as well as domestic forward direct value-added in services.

Table 4: Servicification (backward, indirect and direct forward) and FDI regulations

	(1) ln(VA_Stl)	(2) ln(VA_Sbf)	(3) ln(VA_Sfi)	(4) ln(VA_Sfd)
FDI reg (eqr)	-0.3910***	-0.1848***	-0.4947***	-0.1381
	(0.0796)	(0.0431)	(0.1526)	(0.1180)
FDI reg (oth)	-0.5762	-0.0332	0.5835	2.5085**
	(0.7979)	(0.4442)	(1.4139)	(0.9939)
FDI reg (per)	0.6894	0.1992	2.4294	-1.3050
	(1.0223)	(0.4265)	(1.6113)	(1.2226)
FDI reg (scr)	-0.0114	-0.6874*	0.0787	1.3523***
	(0.3077)	(0.3602)	(0.4620)	(0.4906)
Reg qual	-0.0344	-0.0242	-0.0552	-0.1215*
	(0.0860)	(0.1172)	(0.0736)	(0.0618)
Internet	0.0022	0.0019	0.0024*	0.0039*
	(0.0021)	(0.0038)	(0.0014)	(0.0024)
High-skills	-0.0159***	-0.0177*	-0.0110*	-0.0090
	(0.0059)	(0.0091)	(0.0056)	(0.0067)
R&D / GDP	0.0048	-0.0039	0.0657	-0.0157
	(0.0579)	(0.0900)	(0.0490)	(0.0494)
Upstream	1.6387***	1.1109***	2.0728***	-0.2128
	(0.3649)	(0.3145)	(0.5685)	(0.9766)
ln(GDPpc PPP)	1.2941***	0.9866***	1.5129***	1.3849***
	(0.1098)	(0.1647)	(0.1138)	(0.1082)
Fixed effects	Country, sector & year	Country, sector & year	Country, sector & year	Country, sector & year
Observations	1,520	1,520	1,520	1,520
R-squared	0.9437	0.9639	0.8802	0.8523
RMSE	0.387	0.314	0.614	0.717

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. All services linkages variables are put in logs. Fixed effects by country, sector and year are separately applied. Robust standard errors in parenthesis clustered by country-years. VA_Stl stands for the total indirect value-added linkages in services comprised of foreign backward and domestic forward indirect value-added in services. VA_Sfd denotes the domestic forward direct value-added in services.

Table 5: Baseline regressions economic performance (upgrading) and regulatory PMR linkages

	(1)	(2)	(3)	(4)	(5)	(6)
		Total indirect linkages (VA_StI)			Foreign backward linkages (VA_Sbf)	Domestic indirect linkages (VA_Sfi)
	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)
RL NMR (all)$_{t-1}$	-0.0225***					
	(0.0028)					
RL NMR (entry)$_{t-1}$		-0.0178***		-0.0117***	-0.0289***	-0.0100**
		(0.0021)		(0.0030)	(0.0080)	(0.0045)
RL NMR (conduct)$_{t-1}$			-0.0226***	-0.0104**	-0.0026	-0.0173***
			(0.0032)	(0.0045)	(0.0105)	(0.0067)
GVC controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year
Observations	11,758	11,758	11,758	11,758	11,758	11,758
R-squared	0.8569	0.8569	0.8567	0.8571	0.8563	0.8563
RMSE	0.157	0.157	0.157	0.157	0.157	0.157

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. Domestic value-added are put in logs. GVC controls contain the variables FVAX, DVAR as well as FVADP, all put in logs. The regulatory linkages (RL) variables are lagged with one year and forms the multiplication of the regulatory indicator variables weighted by each services linkages: VA_StI, VA_Sbf and VA_Sfi separately as shown in the respective columns. VA_StI stands for the total indirect value-added linkages in services comprised of foreign backward (VA_Sbf) and domestic forward indirect (VA_Sfi) value-added in services. Fixed effects by country-year and sector-year applied. Robust standard errors in parenthesis clustered by country-sector.

Table 6: Baseline regressions economic performance (upgrading) and regulatory FDI linkages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Total indirect linkages (VA_StI)						Foreign backward linkages (VA_Sbf)	Domestic indirect linkages (VA_Sfi)
	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)
RL FDI reg (all) $_{t-1}$	-0.0159***							
	(0.0031)							
RL FDI reg (eqr) $_{t-1}$		-0.0184***				-0.0067	0.0197*	-0.0094
		(0.0039)				(0.0046)	(0.0102)	(0.0060)
RL FDI reg (oth) $_{t-1}$			-0.1150***			-0.0738*	-0.2314***	-0.0643
			(0.0318)			(0.0390)	(0.0862)	(0.0446)
RL FDI reg (per) $_{t-1}$				-0.1078***		-0.0156	0.1105*	-0.0979**
				(0.0259)		(0.0301)	(0.0600)	(0.0391)
RL FDI reg (scr) $_{t-1}$					-0.0479***	-0.0306***	-0.0832***	-0.0168
					(0.0096)	(0.0102)	(0.0239)	(0.0133)
GVC controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year
Observations	11,758	11,758	11,758	11,758	11,758	11,758	11,758	11,758
R-squared	0.8554	0.8553	0.8554	0.8552	0.8554	0.8558	0.8556	0.8556
RMSE	0.157	0.157	0.157	0.158	0.157	0.157	0.157	0.157

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. Domestic value-added are put in logs. GVC controls contain the variables FVAX, DVAR as well as FVADP, all put in logs. The regulatory linkages (RL) variables are lagged with one year and forms the multiplication of the regulatory indicator variables weighted by each services linkages: VA_StI, VA_Sbf and VA_Sfi separately as shown in the respective columns. VA_StI stands for the total indirect value-added linkages in services comprised of foreign backward (VA_Sbf) and domestic forward indirect (VA_Sfi) value-added in services. Fixed effects by country-year and sector-year applied. Robust standard errors in parenthesis clustered by country-sector.

Table 7: Baseline regressions economic performance (upgrading) and regulatory PMR linkages * C

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Foreign backward linkages (VA_Sbf)				Domestic indirect linkages (VA_Sfi)			
	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)
RL NMR (entry) * C	0.0269	0.0052	-0.0004	-0.0000	0.0299	0.0029	-0.0004	0.0000
	(0.0459)	(0.0084)	(0.0007)	(0.0004)	(0.0346)	(0.0044)	(0.0003)	(0.0002)
RL NMR (conduct) * C	0.0265	-0.0138	-0.0015	-0.0004	-0.0214	-0.0065	0.0001	-0.0001
	(0.0518)	(0.0123)	(0.0011)	(0.0005)	(0.0464)	(0.0082)	(0.0006)	(0.0003)
C variable	Upstrm	Rulaw	Skills	Internet	Upstrm	Rulaw	Skills	Internet
GVC controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interaction controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year
Observations	11,758	11,572	11,758	11,381	11,758	11,572	11,758	11,381
R-squared	0.8565	0.8572	0.8567	0.8588	0.8564	0.8571	0.8564	0.8587
RMSE	0.157	0.155	0.157	0.155	0.157	0.155	0.157	0.155

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. Domestic value-added are put in logs. GVC controls contain the variables FVAX, DVAR as well as FVADP, all put in logs. The regulatory linkages (RL) variables are lagged with one year and forms the multiplication of the regulatory indicator variables weighted by each services linkages: VA_Sbf and VA_Sfi separately as shown in the respective columns and is comprised of foreign backward (VA_Sbf) and domestic forward indirect (VA_Sfi) value-added in services. Fixed effects by country-year and sector-year applied. Robust standard errors in parenthesis clustered by country-sector. The C variable denotes with which country-wide variable our RL variable of Regulatory Linkage is interacted.

Table 8: Baseline regressions economic performance (upgrading) and regulatory FDI linkages * C

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Foreign backward linkages (VA_Sbf)				Domestic indirect linkages (VA_Sfi)			
	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)	ln(DVA)
RL FDI (egr) * C	-0.0230	-0.0012	-0.0032**	0.0000	0.0268	0.0047	0.0004	0.0002
	(0.0595)	(0.0128)	(0.0012)	(0.0005)	(0.0353)	(0.0083)	(0.0007)	(0.0003)
RL FDI (oth) * C	0.1239	0.1296	-0.0118**	0.0020	-0.6667***	-0.0350	-0.0083***	-0.0037**
	(0.3955)	(0.0859)	(0.0059)	(0.0035)	(0.2555)	(0.0487)	(0.0031)	(0.0018)
RL FDI (per) * C	-0.4838	-0.1137	0.0021	-0.0033	0.1125	0.0111	-0.0054	0.0021
	(0.4099)	(0.0803)	(0.0095)	(0.0035)	(0.2802)	(0.0526)	(0.0063)	(0.0021)
RL FDI (scr) * C	0.2607**	-0.0340	-0.0019	-0.0023*	0.0409	-0.0033	0.0004	-0.0004
	(0.1327)	(0.0252)	(0.0015)	(0.0012)	(0.0758)	(0.0132)	(0.0008)	(0.0006)
C variable	Upstrm	Rulaw	Skills	Internet	Upstrm	Rulaw	Skills	Internet
GVC controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interaction controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year	Country-year; sector-year
Observations	11,758	11,572	11,758	11,381	11,758	11,572	11,758	11,381
R-squared	0.8557	0.8565	0.8563	0.8581	0.8558	0.8564	0.8560	0.8581
RMSE	0.157	0.155	0.157	0.155	0.157	0.155	0.157	0.155

Note: *** p<0.01, ** p<0.05, * p<0.1. Years cover 1995-2011. Domestic value-added are put in logs. GVC controls contain the variables FVAX, DVAR as well as FVADP, all put in logs. The regulatory linkages (RL) variables are lagged with one year and forms the multiplication of the regulatory indicator variables weighted by each services linkages: VA_Sbf and VA_Sfi separately as shown in the respective columns and is comprised of foreign backward (VA_Sbf) and domestic forward indirect (VA_Sfi) value-added in services. Fixed effects by country-year and sector-year applied. Robust standard errors in parenthesis clustered by country-sector. The C variable denotes with which country-wide variable our RL variable of Regulatory Linkage is interacted.

Annex

Table A1: Type of NMR regulatory barrier by sector

Regulatory barriers NMR		
Sector	**Type**	**Barrier**
Electricity and Gas	Entry barriers	Entry barriers
(ISIC Rev 3 40,41)	Conduct barriers	Public ownership
		Vertical integration
		Market structure
Telecom and Post	Entry barriers	Entry barriers
(ISIC Rev 3 64)	Conduct barriers	Public ownership
		Market structure
Rail, Airline and Road	Entry barriers	Entry barriers
(ISIC Rev 3 60-63)	Conduct barriers	Public ownership
		Vertical integration
		Market structure
		Prices (Post)
Retail	Entry barriers	Licenses or permits
(ISIC Rev 3 50-52)		Regulation of large outlet
	Conduct barriers	Protection of existing firms
		Shop opening hours
		Price controls
		Promotion/ discount
Professional services	Entry barriers	Exclusive or shared exclusive rights
(ISIC Rev 3 74)		Education requirements
		Compulsory chamber membership
		Quotas
	Conduct barriers	Regulations on prices and fees
		Regulations on advertising
		Regulations on the form of business
		Inter-professional co-operation

Source: OECD and authors own calculations. See Koske (2015) for further details.

Table A2: Type of FDI regulatory barrier by sector

Regulatory barriers FDI		
Sector	**Type**	**Barrier**
Electricity (ISIC Rev 3 40,41)	Equity limits	No foreign equity allowed for start-ups or acquisitions
Construction (ISIC Rev 3 45)	Screening and approval	Approval required for new FDI/acquisitions below and above USD 100mn or corresponding to more or below 50% of total equity
Distribution (ISIC Rev 3 50-52)		Notification with discretionary element
Transport (ISIC Rev 3 60-63)	Restrictions on key foreign personnel/directors	Foreign key personnel not permitted
Hotels & Restaurants (ISIC Rev 3 55)		Economic needs test for employment of foreign key personnel
Media (ISIC Rev 3 90-93)		Time bound limit on employment of foreign key personnel
Communications (ISIC Rev 3 64)	Other restrictions	Nationality/residence requirements for board of directors
Financial services (ISIC Rev 3 65-67)		Establishment of branches not allowed/local incorporation required
Business services (ISIC Rev 3 74)		Reciprocity requirement
Real estate (ISIC Rev 3 70)		Restrictions on profit/capital repatriation
		Access to local finance
		Acquisition of land for business purposes
		Land ownership not permitted but leases possible

Source: OECD and authors own calculations. See Kalinova (2010) for further details.

Table A3: Country-wide characteristics and control variables

Country-wide characteristics		
Variable	**Description**	**Source**
DVA	Domestic value-added	TiVA
FVAX	Amount of foreign value-added embodied in exports	TiVA
DVAR	Amount of domestic value-added re-exported by third countries	TiVA
FVADP	Amount of foreign value-added for domestic processing	ICIO Tables
Reg qual	Regulatory quality: the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	World Governance Indicators
Rulaw	The extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	World Governance Indicators
Internet	Internet users (per 100 people) who have used the Internet (from any location) in the last 12 months. Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.	WDI
High-skills	Percentage of people with a tertiary education degree (completed)	Barro and Lee (2012)
R&D / GDP	Research and Development expenditure as a share of GDP	WDI
Upstreamness	Countries position in the value chain by measuring distance to final demand	Computed following Antras et al (2012)
GDP pc PPP	Gross Domestic Product per capita, PPP (current international $)	WDI

Figure A1: Figure 1: Total servicification linkages for various income groups (1995-2011)