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Javier Lopez Gonzalez
OECD Trade and Agriculture Directorate, Paris

Valentina Meliciani
LUISS University, Rome

Maria Savona
University of Sussex, Brighton

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WHEN LINDER MEETS HIRSCHMAN: INTER-INDUSTRY LINKAGES AND GLOBAL VALUE CHAINS IN BUSINESS SERVICES

JAVIER LOPEZ GONZALEZ[1], VALENTINA MELICIANI[2] AND MARIA SAVONA[3*]

ABSTRACT

The scholarship on Global Value Chains (GVCs) is recently focusing on the international fragmentation of production that involves services and in particular business services (BS). It has been argued that participation in business services GVCs might open up new opportunities for catching up in developing countries. What are the theoretical and empirical bases for such a claim? What are the determinants of a country participating in business services GVCs? This paper puts forward the conjecture that factor endowments and costs are not the only driver for the emergence of BS GVCs and that the specific domestic structure of backward linkages à la Hirschman is of high importance. We empirically test this conjecture on the basis of the World Input Output Data. We then attempt implications in terms of industrial policy for developing countries, particularly on the importance of developing domestic industries with backward linkages with business services before joining BS GVCs as a catching-up strategy. We suggest therefore some caution when considering unconditional participation in BS GVCs as a new development pathway, prior to securing opportunities for sectoral and technological upgrading linked to the presence of a core, backward-linked manufacturing base. Our findings are relevant also in the light of most recent developments of the debate around a "premature de-industrialisation" of developing countries (Rodrik 2015).

KEYWORDS: BUSINESS SERVICES; GLOBAL VALUE CHAINS; HIRSCHMAN LINKAGES; DEVELOPMENT.

JEL CODES: F63; L16; L80; O14.

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[1]OECD Trade and Agriculture Directorate - Development Division, Paris. Email: javier.lopezgonzalez@oecd.org
[2] Department of Business and Management, LUISS University, Rome, Italy. Email: vmeliciani@luiss.it
[3]* **Corresponding author**: SPRU – Science Policy Research Unit, Jubilee Building, University of Sussex, Brighton, BN1 9SL UK - Tel. +44 (0) 1273 877139; Fax +44(0)1273 685865. E-mail: M.Savona@sussex.ac.uk

1. Introduction

International fragmentation of production, which implies that countries specialise in portions of the value chain and trade other portions of it, has led to widespread processes of *globalisation of value chains* over the past two decades (for recent reviews, see Kaplinsky 2013; De Backer and Miroudot 2013; Timmer et al. 2012). Baldwin (Baldwin 2011) has defined these as a 'second unbundling' of globalisation, which has transformed the terms of international competition and shifted the barycentre of the world's global headquarters and peripheries. It is argued that being part of Global Value Chains (GVCs) allows a 'fast track' industrialisation in developing countries, as firms can exploit foreign demand and specialise in tasks along the value chain rather than having to set up entire processes of production from scratch (see also OECD, 2013; Baldwin & López-Gonzalez 2014).

The empirical consensus as to whether foreign demand from headquarter economies is the main determinant for developing countries to be part of GVCs and provides them with an opportunity for a new development path (Gereffi 2015) is, however, mostly limited to manufacturing sectors. Given the increased service content of exports and the servicification of manufacturing (Pilat and Wölfl 2005; Pilat et al. 2008; Lanz and Maurer 2015), it is therefore relevant to ask whether joining service GVCs responds to the same drivers and represents a similar opportunity for developing countries.

The question is all the more relevant in the case of business services (BS)[4], which is the focus of this paper. BS are not only the most dynamic branch of services, but play an essential role in the creation and diffusion of new technologies and non-technological modes of innovation (Guerrieri and Meliciani 2005; Gallouj and Savona 2008; Ciarli, Meliciani, and Savona 2012). Evidence in developed countries shows that BS tend to concentrate where their clients are located (Meliciani and Savona 2014), therefore representing a particular interesting case to analyse within the GVC debate. Most especially in a developing context, domestic BS might therefore represent an essential channel through which technology transfer - due to the presence of Foreign Direct Investments (FDI), trade or GVCs - becomes an opportunity for domestic technological upgrading. Scholars looking at the link between global presence and local upgrading, and more in general the GVC

[4] BS include ICT-related services (ISIC code 72), Research & Development (73) and all intermediate services such as engineering, technical consultancy, legal aid and other business services (74).

scholarship, have however never explicitly focused on business services (Fu, Pietrobelli, and Soete 2011; Pietrobelli and Rabellotti 2011).

A few recent contributions, based on qualitative evidence on specific country cases, consider participation in BS GVC to follow the same pattern behind the idea of a 'second unbundling' of globalisation, and to be opening up new opportunities for catching up in developing countries (Blinder 2006; Gereffi and Fernandez-Stark 2010a and 2010b; Hernández, Mulder, Fernandez-Stark, Sauvé, and López Giral 2014).

This paper aims at contributing to this debate, with the view that specialisation and participation in BS GVCs present specificities compared to the manufacturing sectors. We argue that it is unlikely that countries can join BS GVC by mainly relying on foreign demand from headquarter economies and that in the absence of a strong domestic presence of backward linked industries (particularly manufacturing) to BS, it is more difficult for firms in both developed and developing countries to participate in BS GVCs.

After briefly reviewing the theoretical and empirical literature on GVCs, we revert to two alternative voices often neglected in these circles. We consider the theoretical stands by Hirschman (Hirschman 1958) and (a modified version of) the Linder Thesis (Burenstam Linder 1961) jointly to explain participation in business services GVCs. Based on a joint Hirschman-Linder hypothesis and on empirical evidence on the emergence of BS, albeit in developed countries (Meliciani and Savona 2014), we claim that the higher the domestic intermediate and final demand in BS backward-linked industries (i.e. sectors with the highest intermediate demand for business services), the higher the propensity to participate in BS GVCs.[5]

We test these conjectures using the World Input Output Database, which we draw upon to construct indicators of participation in business service GVCs. In the econometric specification, we also control for demand coming from distance-weighted trade partners in order to test whether countries can exploit foreign demand and enter GVCs in BS by relying on international rather than domestic intermediate and final demand.

Our results support the conjecture that determinants of participation in BS GVCs are different from those that have been identified to matter in the case of manufacturing GVCs. The domestic industrial structure, particularly in industries that are backward-linked to BS, has a central role in explaining participation in BS GVCs over foreign demand. These findings are particularly relevant

[5] As explained more at length below, this conjecture is in line with what Linder claimed to be the case for the composition of final domestic demand favouring trade in similar sectors. Interestingly, albeit from a very different perspective, this resonates with what has most recently been put forward by (Baldwin and Venables 2015).

for developing countries as they challenge the prevailing view that entering BS GVCs responds to the same drivers that work for manufacturing GVCs and presents similar opportunities for development.

We attempt reflections on the implications of our results in terms of industrial policy for development, and suggest some caution when considering unconditional participation in BS GVCs as a new development pathway, prior to securing opportunities for sectoral and technological upgrading linked to the presence of a core, backward-linked manufacturing base. We therefore offer, albeit from a different theoretical perspective, empirical ground to some of the concerns of "premature de-industrialisation" recently put forward by development scholars (Rodrik 2015).

The remainder of the paper is structured as follows: the next section reviews the relevant theoretical and empirical literature on BS GVCs and lays out our main argument in the form of testable research hypotheses. Section 3 details the methodology, particularly the indicators that we construct on the basis of the WIOD (World Input Output Database) with respect to extant measurements of value chains in the literature. We then discuss the econometric results in Section 4 and conclude in Section 5.

2. Trends and theories of GVC in services

2.1 The different phases and geographies of globalization of production

Research interests of trade and GVC scholars spread from the determinants of participation in GVCs (Costinot, Vogel, and Wang 2013; OECD 2013, Kowalski et al. 2015) to their effects on labour markets and wages in participating countries (Feenstra and Hanson 1999; Antras and Rossi-Hansberg 2006; Grossman and Rossi-Hansberg 2006; Hanson 2012; Timmer et al. 2013, Lopez-Gonzalez et al. 2015) and to the governance asymmetries between developed and developing countries (Gereffi, Humphrey, and Sturgeon 2005; Kaplinsky 2000; Schmitz and Strambach 2009), with different implications on the role of GVCs for the purpose of catching up and development.

Starting from the assumption that falling transport and communication costs have been responsible for the increased fragmentation of production across national borders, Baldwin (2011) argues that globalization went through two distinct phases. The 'first unbundling', up until the mid-1980s, was mainly driven by plummeting *transportation* costs and involved competition between sectors, with the supply chain remaining *within national borders*. The 'second unbundling', starting after 1985, and driven by a dramatic drop in *Information and Communication Technology* (ICT) costs, resulted in the unpacking of the factories and led to massive *offshoring*.

This second unbundling shifted the nature of international competition towards *stages of productions* rather than *products* and favoured the spatial distribution of economic activity between 'headquarter' and 'factory economies'. These latter are developing country economies, usually located close to a developed country, which specialize in the low-tech (usually low-skilled) phases of (manufacturing) production chains, while the high-tech (usually high-skilled) segments remain within the boundaries of the headquarter economy.

Examples of the novel map of international division of labour between headquarters and factories abound. For instance, countries such as Mexico, close to the United States; China, close to Japan; Poland and Turkey, close to Germany, have all markedly increased their participation in GVCs. The ensuing organisation of global production therefore centers along three key factory systems: Factory North America, Factory Europe and Factory Asia, each with their headquarter economy[6] (Baldwin and López-Gonzalez 2014).

An interesting pattern of forward and backward linkages between headquarter and factory networks arises: broadly, Figure 1 shows, in red, the selling of intermediates to the listed country, and in blue the buying of intermediates from the listed country (these are presented as negative values only for presentational purposes). In 'Factory North America', the US shows a diverse set of sales of intermediates. This contrasts with the patterns of neighbouring Mexico that predominantly buys from the US. These hub and spoke patterns suggest that Mexico predominantly specialises in buying intermediates from the US, assembles them into final products and then exports them back to American consumers.

(Figure 1 about here)

Abstracting from the risk of a specialisation trap in the low-end segments of the value chain and from any consideration of what are the conditions that ensure successful upgrading of them, this process has been claimed to be a unique opportunity for developing countries. These were able to industrialise for the first time at virtually a fraction of the time-span that developed countries took to take off (Baldwin 2011).

Overall, as Baldwin (2011, p. 33) puts it:

[6] Baldwin (2011) argues that, before the ICT revolution, extreme proximity was essential to coordinating sophisticated manufacturing processes due to the simple communication technology and industrialization meant building the whole supply chain at home. On the contrary, with the second unbundling developing countries can join existing value chains on a global scale.

"*The 2nd unbundling made industrialization less meaningful. Before the 2nd unbundling a nation had to have a deep and wide industrial base before it could export, e.g. car engines. Exporting engines was a sign of victory. Now it is a sign that the nation is located in a particular segment of an international value chain*".

These observations raise several questions. Is it proximity to large headquarter economies which matters for participation in GVCs? What kind of participation does this proximity favour? What is the role of developing internal capacity, productive and innovation capabilities in firms, in order to make the most out of GVCs? Does the role of proximity to large headquarter economies exclusively matter for manufacturing sectors or is there scope for countries to integrate in other sectors such as business services?

2.2 A 'third globalisation unbundling'? Evidences on GVCs in services

Baldwin's (2011) first and second unbundling refer to manufacturing value chains. However, the literature observes the 'servicification' of manufacturing, i.e. the growing service content of exports (Pilat, 2005; Pilat et al. 2008; Lanz and Maurer, 2015; Gereffi and Fernandez-Stark 2010b; Hernández, Mulder, Fernandez-Stark, Sauvé, and López Giral 2014). Evidence shows, for example, that Europe's value added that is used by China to produce exports comes predominantly from the service sectors which China uses to engage in the low-skill manufacturing elements of the value chain (Koopman et al., 2008).

Two other key findings are worth highlighting. The first is the importance of services in general, and business services in particular, which is made evident by comparing figures in terms of value added rather than gross exports, as shown in Figures 2 and 3 below.[7] The second is the concentration of suppliers of intermediate business services across headquarter economies such as the US, Germany, the United Kingdom (UK) as shown in Figure 4. The entries mark the value of the row nation sales of BS to the column nation divided by global trade in intermediate business services.

(Figures 2, 3 and 4 about here)

Overall, developing countries have been the destination of an increasing volume of standardized Information Technology Outsourcing (ITO), including – ranked in terms of value added – infrastructure management activities, software services such as Enterprise Resource Planning (ERP), only most recently also Software and Research and Development (R&D) consultancy. The

[7] Importantly, amongst the service sectors, it is indeed business services that have witnessed a steep growth in terms of value added in exports.

top segments of offshored services are Business Process Outsourcing (BPO) and Knowledge Process Outsourcing (KPO), which are more intensive in high-skilled human capital and knowledge and typically remain within 'headquarter economies', although it has been argued that in most recent years an increasing trade share of these high-skilled activities (or non-routinised tasks) have involved Latin American countries (for a detailed summary of this evidence, see Gereffi and Fernandez-Stark 2010b; Ventura-Dias et al. 2003; Hernández, Mulder, Fernandez-Stark, Sauvé, and López Giral 2014).

This process has been attributed to a combination of decreasing Information Technology (IT) costs, increasing opportunities for standardization of typical IT functions – that therefore require less high-skill content – and a very recent drive to look for 'talents' (i.e. creative, not necessarily technologically-related high skills) across the whole world, a drive that for the first time does not exclude the participation of developing countries (Lewin, Massini, and Peeters 2009).

The tone of the emerging discourse seems to depict a rosy picture, in terms of developmental opportunities for periphery countries to join service GVCs, and the role of industrial policy to favour this process (Gereffi and Fernandez-Stark 2010a and 2010b). However, the reflection on service GVCs is still at its embryonic stage, with much empirical evidence still limited to single industry case-studies which, albeit highly informative, lack generalisability and call for some cautiousness.

2.3 When Linder meets Hirschman: A reappraisal of services GVCs

The study of the effects of structural change on economic performance of countries has traditionally brought about concerns about de-industrialization processes and the erosion of capital accumulation in advanced countries[8]. In some cases, positive expectations on knowledge accumulation and leveraging for the rest of the economy, intrinsic in some business services[9] and the widespread diffusion of ICTs have counter-balanced this view (for a review, see Ciarli, Meliciani, and Savona 2012; Gallouj and Savona 2008; Meliciani and Savona 2014). The empirical evidence on the emergence of Knowledge Intensive Business Services (KIBS) has often coupled with this rhetoric[10].

When it comes to patterns of structural change in developing countries, involving shifts from

[8]A seminal contribution on the topic remains that by Kaldor (1966), followed by Baumol (1967) and Fuchs (1968).
[9]Classical contributions to the opposite stand – i.e. the optimism toward the progress and 'third industrial revolution' are (Fourastié 1949; Bell 2008).
[10]More specifically, concerns about tertiarisation have been *cyclical*: a further evidence of this is the very recent "re-assessment" of the benefits of industry - most likely due to the second public outrage following the tarnish consequences of the latest global financial crisis - as reported in the EC 2013 Competitiveness Report "Towards Knowledge-Driven Re-industrialisation".

agriculture to low-tech industries and services, the empirical evidence is more mixed and controversial (Dasgupta and Singh 2005; Dasgupta and Singh 2006; Bah 2011), and rarely takes into account the global dimensions of structural changes, with notable exceptions (McMillan, Rodrik, and Verduzco-Gallo 2014; Rodrik 2015). Despite this, the theoretical and empirical debates within trade theory and GVCs scholarship seem to suggest that structural changes toward business services in developing countries could be desirable, and eased by joining business service GVCs. By simple extension from the existing evidence on developed countries, scholarly work seems to point to services as the next generation engine to ensure catching up and development (Gereffi and Fernandez-Stark 2010b; Ventura-Dias et al. 2003; Crespi, Tacsir, and Vargas 2014).

The increasing involvement of services in GVCs can be considered as a sort of 'third unbundling', equivalent in importance to the processes of tertiarisation that have followed industrialisation in developed countries, occurring now on a global scale, albeit at different levels of aggregate income (McMillan, Rodrik, and Verduzco-Gallo 2014; Rodrik 2015). For the purpose of identifying the determinants of the emergence of service GVCs, we put forward three questions and attempt to provide a testable framework that can answer them:

1. What are the conditions that explain countries' participation in business service GVCs?
2. Relatedly, does proximity to large headquarter economies matter for participation in BS GVCs? Alternatively, to what extent do countries need to develop their own capacity internally - in the form of domestic presence in high BS user sectors?
3. What are the implications in terms of industrial policy for development?

The basic intuition that we attempt to articulate is that in the absence of a strong domestic presence of backward-linked industries to BS (industries demanding BS as intermediates), it appears unlikely that a (developing) country would join GVC by specialising in business services. To this end, we revive two seminal classical contributions to the theory of international trade and economic development, respectively those of Staffan Burenstam Linder and Albert Hirschman. While we have no pretense to formalize anything here, we hope that this might stimulate further reflection and research.

Both Hirschman (Hirschman 1958) and Linder (Burenstam Linder 1961) represent alternative voices to the mainstream turn that the disciplines of development economics and international trade had taken by the time they produced their seminal contributions (Lundhal 2006).

In a seminal text on economic development, Hirschman (1958) identified the structure of sectoral intermediate linkages within regional economies as the main determinant of specialisation and

growth polarisation. According to Hirschman, there are different types of externalities, depending on whether activities are related to one another by backward or forward inducement mechanisms, i.e. whether certain sectors, by demanding inputs, induce the growth of supplier industries (input-provision or backward linkage effect) or, rather, by supplying output induce the growth of client industries (output-provision or forward linkage effect)[11].

Hirschman took a remarkably original stand with respect to the mainstream growth theory based on factor endowments. Sectoral specialisation and structural change had hitherto rarely been considered of much relevance in explaining growth polarisation across local and national economies[12]. The role of linkages in Hirschman's work serves the purpose of *creating new sectors* by way of scalable intermediate demand, and therefore represents a useful device to explain structural change of the sectoral composition of economies. Hirschman's work, however, remained relatively silent on the conditions and specific mechanisms by which intermediate demand is translated into the creation of new supplier sectors[13], and how this in turn leads to upgrading. Recently, the role of structural change is being increasingly brought back in the development debate (Lin 2012; Stiglitz, Lin, and Monga 2013).

The work of Linder (Burenstam Linder 1961) also emerged as a particularly radical stand against mainstream trade theory following the Heckscher-Ohlin-Samuelson model. The latter explained foreign trade on the basis of cross-country differences in factor endowments, such that trade specialisation would follow endowment abundance so that capital-endowed countries would export capital-intensive goods, while countries with a higher relative endowment of labour would specialise in and trade labour-intensive goods. In this context, Linder put forward what it is now known as the *Linder Thesis*, his main contribution to the theory of international trade.

According to Linder (1961), the Heckscher-Ohlin model was able to explain trade in raw materials, but less so the patterns of trade in manufactured goods between similar nations (in terms of their level of development). Manufacturing trade depended on whether a country reached a certain level of domestic *representative demand* in a particular manufactured good. This benchmark level of domestic demand, in turn, provided the necessary information from purchasers to producers, which eventually allowed them to face competition in foreign markets. Therefore, countries with a similar

[11] "The input-provision, derived demand, or backward linkage effects, i.e. every non primary economic activity, will induce attempts to supply through domestic production the inputs needed in that activity. The output-utilization or forward linkage effects, i.e., every activity that does not by its nature cater exclusively to final demands, will induce attempts to utilize its outputs as inputs in some new activities" (Hirschman, 1958).

[12] These intuitions have on some occasions been taken up and operationalized in the literature (Jones 1976); see also, more recently, Hausmann, Klinger, and Lawrence (2008), although it is out of the scope of this paper to go more in depth into these.

[13] We owe to Martin Bell reflections on structural change within Hirschman's work.

structure of final demand – owing for instance to similar levels of per capita income – tended to have similar structures of trade specialisation. This then helped explain the prevalence of intra-industry trade between similar economies.

A *joint Hirschman-Linder hypothesis* reprises the importance of Hirschman linkages and (a modified version of) the Linder Thesis, applies this to domestic intermediate *and* final rather than final demand only, and considers them jointly in explaining the propensity to join BS GVCs. It proposes that the traditional cost and factor endowments determinants might play a lesser role in explaining the recent processes of global structural change involving services offshoring. Rather, it is the structure of domestic demand for business services and the domestic presence of BS backward linked industries, the domestic *representative final and intermediate demand*, which also affects the propensity and capacity to engage in international value chains in BS, in line with what Linder claimed for final domestic demand.

3. Empirical strategy

We operationalize the joint Hirschman Linder hypothesis by presenting new determinants that explain countries' participation in BS GVCs. Our main variable of interest is therefore the domestic BS value added embodied in gross exports, which represents this form of participation. We consider, among the explanatory variables, traditional ones such as skills, wages and technology, and combine these with new proxies for domestic and foreign business services linked industries to account for intermediate demand and the spatial distribution of headquarter and factory economies.

Data

We use the recently released World Input-Output Database (WIOD - November 2013 release), which covers 40 economies (including all EU-27 countries as well as Australia, Brazil, Canada, China, India, Indonesia, Japan, Korea, Mexico, the Russian Federation, Chinese Taipei, Turkey and the US) and a rest of world aggregate grouping across 35 sectors (20 of which are services, 11 manufacturing, and 4 primary sectors) and 15 years (yearly from 1995 to 2009). The database has two key components: i) an annual inter-country input-output (ICIO) table; and ii) an accompanying set of Socio Economic Accounts (SEAs).[14]

The ICIO table allows us to track not just the direct linkages within and between countries and sectors but also those that arise indirectly through the growing interconnectedness in trade. The

[14]See (Los, Timmer, and de Vries 2012). The ICIO has recently been extended to incorporate data till 2011 but the SEAs only go as far as 2009.

database therefore lends itself to the creation of indicators that capture the extent and nature of GVC participation across different sectors. The SEAs then give us valuable information on the wage bills or indeed the hours worked by labour of different skills within countries, which we exploit and combine with indicators of GVC participation so as to test our hypotheses. Comparative analysis is undertaken across countries at different stages of development to identify whether there are significant differences between developed and emerging economies (for a list of emerging economies in the sample, see table A4).[15]

Finally, we use the Panel Dataset for Cross-Country Analyses of National Systems, Growth and Development (CANA) (Castellacci and Natera 2011) to construct proxies of countries' technology endowment.

Variables

Our choice of indicators is informed by the mushrooming literature on GVCs and is based on inter-country input-output (ICIO) models. The most widely used indicator of GVC participation, and one favoured by the OECD (OECD 2013), is the value added content of exports (which we shorten to VAE).[16] It tracks the origin of value added, by country and sector, which is embodied in gross exports generally focusing on the foreign element which is the factor that has witnessed important changes due to the proliferation of GVCs. A variant of this indicator decomposes value added, similarly across countries and sectors, but according to final demand (Los, Timmer, and de Vries 2012; Erumban et al. 2011). Both involve similar calculation techniques but the former is solely concerned with exporting activities whereas the latter considers the origin of value added in GDP. The difference is important because domestic final demand and gross export vectors differ.

Our interest lies in the determinants of GVC participation in business services. We therefore define our dependent variable as the domestic business service value added in exports (DBSVAE) using the following equation:

$$DBSVAE = V'[I - A]^{-1}EXP$$

Where:

[15] Countries are defined as emerging following the IMF definition in 2009 (the last year in the sample, see https://www.imf.org/external/pubs/ft/weo/2009/02/weodata/groups.htm).
[16] Based on Hummels, Ishii, and Kei-Mu (2001) vertical specialisation indicator and refined by Koopman et al. (2010 and 2014).

V'is an *ni x ni* matrix with *n* countries (n={1,2… 41}) and *i* sectors of activity (i={1,2… 35}). It is populated with elements $v_{ni} = {}^{V_{ni}}/_{Y_{ni}}$ capturing the direct value added (V) share of sector *i* in country *n* in the output (Y) of the industry across the diagonal (with zeros elsewhere).

The $[I - A]^{-1}$ is the traditional Leontief inverse matrix that captures the inter-linkages within and between sectors across all countries. It is obtained from inverting the product of the subtraction of the technical coefficient matrix (A) with elements $a_{ni} = {}^{I_{ni,j}}\Big/_{Y_{ni}}$ from the identity matrix (I). Finally, EXP represents a diagonalised vector of gross exports. The domestic business service element of exports is identified from the individual domestic rows of each country, it captures the domestic business service value added that is exported.[17]

Our independent variables aim to capture different domestic and international linkages arising from the intermediate and final demand for business services. The domestic demand element differentiates between manufacturing (DDEM1) and business services (DDEM2).

$$DDEM = V'[I - A]^{-1}FD$$

The difference between this equation and that of our dependent variable is that we use final domestic demand rather than gross exports. DDEM1 is the sum of the domestic business services rows and therefore captures the business services sector value added whose end use is domestic (where this can include final consumption by households or government as well as investment, i.e. gross fixed capital formation). DDEM2 is constructed by taking the manufacturing rows.

The first variable captures domestic linkages between BS and all other sectors that might favor participation in BS value chains. It directly tests the Linder-Hirschman hypothesis in terms of importance of domestic (intermediate and final) demand for BS value added in exports. The second variable captures the importance of having a strong domestic manufacturing sector in order to enter global value chains in BS. The role of this variable is to capture the complementarity between domestic (intermediate and final) demand for manufacturing and the capability of entering global value chains in business services. These proxies can be used to test the role of linkages arising from domestic BS or domestic manufacturing activities, the importance of which has been recently highlighted in the debate on the strategic role of maintaining a core manufacturing base, argued above (Rodrik 2015).

[17] More recent refinements of GVC indicators (Koopman et al. 2014 and Wang et al. 2013) have noted that the more traditional indicators of participation, such as those used herein, can suffer from double-counting. The emerging evidence suggests that this double counting is likely to be relatively small and therefore should not be an issue in our estimations.

To capture the potential for international linkages we take the domestic business service value added in exports of foreign countries and weight this by distance to the reporting country - DBSVAET. Finally, we do the same but in terms of domestic BS and manufacturing value added in final domestic demand of partner countries.

As control variables, we use first the hourly wage of high-skilled workers which we compute from the SEA's of the WIOD by dividing the aggregate wage bill associated to high-skilled labour by the amount of hours worked by high-skill workers. Second, human capital (HC) which we obtain from the SEAs as the share of direct value added attributed to high-skill labour. And third, technology which is proxied by patents per capita and Internet users per 100 people as taken from (Castellacci and Natera 2011).

Econometric specification

We synthesize our hypotheses in Equation 1. We take into account the role of technology, human capital and wages to explain countries' participation in BS GVCs. To these traditional variables, we add our main variables of interest, the domestic BS and manufacturing value added in final demand.

However, the literature on globalization stresses the fact that in a globalised world domestic demand should matter less and less, as countries operating in global value chains can increasingly rely on international demand. In order to test for this effect, we add to our basic specification the BS (or manufacturing) value added in final demand of distance weighted trade partners. We also take into account the possible existence of sectoral complementarities in participation in global value chains among trade partners by controlling for BS value added in the exports of distance weighted trade partners. Finally, we allow for path dependence in participation in global value chains by adding the lagged dependent variable.

Therefore, the general form of the estimated equation is the following:

$$(1) \quad DBSVAE_{it}=\alpha_1 DBSVAE_{it-1}+\alpha_2 DBSVAET_{it}+\alpha_3 DDEM_{it}+ \alpha_4 DDEMT_{it}+ \alpha_5 W_{it}+$$

$$+\alpha_6 HC_{it}+ \alpha_7 TECH_{it}+ \alpha_i+ \alpha_t+\nu_{it}$$

where:

$DBSVAE_{it}$ is the BS domestic value added in exports for country *i* at time *t*;

DBSVAET is BS domestic value added in exports of distance weighted trade partners;

DDEM is either domestic BS (DDEM1) or domestic manufacturing (DDEM2) value added in final domestic demand;

DDEMT is either domestic manufacturing or domestic BS value added in final domestic demand of distance weighted trade partners;

W is hourly wages of high skilled workers;

HC is the share of direct value added attributed to high skilled labor returns;

TECH is patents per capita and Internet users per 100 people,

α_i and α_t are country and time period fixed effects.

All variables are in logarithms.

In the estimated equation, *W* and *HC* control for the traditional cost/factor endowments determinants of international competitiveness. In particular *W* proxies the cost of high skilled workers and *HC* its endowments[18]. We, therefore, expect that participating in BS GVCs is favoured by relatively low cost/high endowments of skilled workers. We also expect the technological level of the country to have a positive effect on the country's ability to enter BS GVCs representing closeness to the technological frontier.

In the estimated equation $DBSVAE_{it}$ is a function of α_i, and so is $DBSVAE_{i,t-1}$. This makes the Ordinary Least Squares (OLS) estimator biased and inconsistent. The fixed effects (FE) estimator eliminates α_i but will be biased for short time-series since $DBSVAE_{i,t-1}$ will be correlated with the FE-transformed residual by construction. Due to the relatively short time-series of our sample (11 years) we therefore adopt the Arellano-Bond (AB) Generalised Method of Moments (GMM) estimator.

A problem with the original Arellano-Bond estimator is that lagged levels are often poor instruments for first differences, especially for variables that are close to a random walk. (Arellano and Bover 1995) described how, if the original equations in levels were added to the system, additional moment conditions could be brought to bear to increase efficiency. In these equations, predetermined and endogenous variables in levels are instrumented with suitable lags of their own first differences. We, therefore, use the system GMM developed by (Blundell and Bond 1998) that

[18] We run regressions also including wages and productivity of low skilled workers but these were not significant. This is not surprising considering that BS are high value added activities that tend to employ especially high skilled workers.

has been shown to give more reasonable results than first-differenced GMM in the estimation of models with high persistence.

The system GMM gives consistent estimates provided that there is no second order serial correlation among the errors, we, therefore, choose the number of lags in order to remove second order correlation and we report tests for second order autocorrelation. We also allow domestic BS (DDEM1) and domestic manufacturing (DDEM2) value added in final domestic demand to be endogenous by instrumenting them with suitable lags of their own first differences.

A glance at pattern of Business Services Value Added in Exports in developed and developing countries

We use our indicators to paint a portrait of potential differences between developed and emerging economies[19] in their patterns of participation in business services GVCs (the share of domestic business services value added in export over total exports) and the association between these and their internal and distance-weighted trade-partners demand. Moreover, we contrast this preliminary evidence to the case of participation in manufacturing GVCs.

For developed countries there seems to be a complementarity between domestic business services value added in export (BSVAE) and that of partner countries (left panel of Figure 5). That is to say that countries with a higher domestic BSVAE share cluster with larger poles of BSVAE activity. However this relationship does not hold for emerging economies thereby providing some *prima facie* evidence that the links between developing a competitive BS sector in emerging countries is not contingent on having strong BS neighbours. In contrast, when we look at the link between domestic BS value added in exports and domestic manufacturing value added in final domestic demand (right panel of Figure 5) we find that for both emerging and developing countries there is a positive relationship giving support to the importance of domestic Hirschman linkages. [20]

(Figure 5 about here)

[19] See table A4 for the countries covered and an identification of which have been classified as emerging.

[20] We compare a share to a logged value for several reasons. First, to avoid confounding factors such as size which would drive a positive correlations (i.e. larger countries would have both larger BSVAE and larger domestic demand). Second, because our thesis relates to using domestic or foreign value added links within GVCs where the size element is likely to matter (in the same way that larger countries have smaller foreign value added shares in their exports, the size of the domestic and foreign linkage is likely to matter).

In contrast, when looking at global value chains in manufacturing, the picture is different. In fact, for both developed and emerging countries, there is a positive association between domestic manufacturing value added share in gross exports and that of neighbouring countries (left panel of Figure 6). Moreover, as in the case of business services, there is a positive association between specialisation in manufacturing value chains and domestic capabilities (right panel of Figure 6). This evidence suggests first that there are differences between manufacturing and business services in terms of domestic and international linkages and second that there might be a case for the thesis that countries may be able to integrate into manufacturing value chains also by relying on partner country manufacturing activities (recalling that the preliminary evidence suggests that this is not the case for business services).

(Figure 6 about here)

4. Econometric results

We turn to the regression results for the entire sample of countries, including both advanced and emerging economies and then compare the results of the estimations distinguishing between the two groups of countries.

Table 1 reports the results of the estimation carried out on the whole sample. We start from the simpler specification, where we include only *variables referred to the typical country* (specifications a); we then add first BS (or manufacturing) value added in final domestic demand of distance weighted trade partners (specifications b); finally we also include BS value added in exports of distance weighted trade partners (specifications c). The equation is estimated first by including separately manufacturing value added in final domestic demand (specifications 1) and BS value added in final domestic demand (specifications 2) and then including both these variables (specifications 3).

(Table 1 about here)

Table 1 shows that manufacturing value added in final domestic demand plays a strong, positive role in explaining BS value added in exports. The same occurs also for BS value added in final domestic demand. However, when the two variables are introduced simultaneously in the specification (columns 3a, 3b and 3c), the BS proxy of demand loses significance. The results show the relevance of domestic intermediate linkages (particularly between BS and manufacturing) as determinants of participation in BS international value chains. This evidence is consistent with the finding of the importance of manufacturing demand for regional specialization in BS (Meliciani and Savona 2014) and for the capability of European regions to attract BS foreign direct investments (Castellani, Meliciani, and Mirra 2014).

A second interesting result of the econometric analysis is the negative impact of manufacturing and BS value added in final demand for distance weighted trade partners. This is somehow at odds with the idea that countries can enter global value chains by relying (mainly) on demand coming from trade partner countries, also in the absence of a domestic (final and intermediate) demand. On the contrary, we find that the presence of neighbor partner countries with high demand for BS has a displacing effect on the typical country's BS value added in exports.

However, there appears to be complementarities in BS value added in exports between neighbor partner countries. This suggests that neighboring trade partners tend to specialize in similar segments of the value chain, engaging in intra-industry trade. As a consequence, the net effect of demand coming from partner countries is ambiguous, depending on the strength of the direct negative effect and the indirect positive effect (partner countries demand positively affects their BS value added in exports, which in turn increases one country's BS value added in exports)[21].

Finally, looking at control variables, not surprisingly the availability of high skilled labor strongly and significantly affects BS valued added in exports. Patents, ICT and labor costs are significant only in those specifications that also include variables referred to distance weighted trade partners, signaling the importance of taking into account of the international structure of demand in order to better disentangle the factors affecting countries' capability to enter in BS global value chains.

Table 2 reports the more complete specification (specifications c) separately for advanced and emerging economies.

(Table 2 about here)

[21] In order to disentangle the net effect a proper spatial GMM model should be estimated. This is left for future research.

The results on the positive role of domestic, and particularly manufacturing, demand for BS value added in exports hold for both advanced and emerging economies. Similarly, there appears to be a displacing effect by demand (especially BS value added in domestic demand) of distance weighted trade partners.

The most notable difference across advanced and emerging economies is the lack of significance, for emerging countries, of distance weighted trade partners' BS value added in exports in all specifications. This suggests that while neighbor trade partners from advanced countries tend to specialize in similar segments of the value chain, this does not apply to emerging economies. Therefore, for emerging economies, contrary to the common wisdom, it is even more important to develop domestic capabilities in sectors that are vertically integrated with BS in order to enter BS global value chains. In the absence of such capabilities, having neighbor partners with high levels of manufacturing (BS) value added in final demand might only have a displacing effect.

Finally, for emerging economies, the most important factor for increasing BS value added in exports is the availability of a skilled labor force, while patents and high skilled labor remunerations have their expected positive (negative) signs only in some specifications. Surprisingly, Internet penetration does not appear to discriminate.

We also checked these results by running the same estimations on the domestic manufacturing value added in export respectively in the cases of all countries, advanced and emerging economies (Tables A1, A2 and A3 in Appendix). This allows investigating whether the importance of domestic demand is specific to services or applies also to manufacturing sectors. Most importantly, it allows assessing whether the displacing effect of demand coming from trade partner countries (particularly for emerging economies), found in the case of business services, also applies to manufacturing.

The results show that domestic demand is important also in explaining participation in global value chains in manufacturing, although the effect is robust to including demand from partners only in the case of emerging economies. Interestingly, manufacturing demand of partner countries, when controlling also for BS demand from trade partners, turns out to be positive and significant (see specification 3b separately for emerging and advanced countries), supporting the idea that proximity to a large headquarter economy with a high level of domestic demand for manufacturing helps developing economies entering global value chains in manufacturing (Baldwin and López-Gonzalez 2014). At the same time, proximity to countries with a high domestic demand for business services has a negative impact on participation in manufacturing value chains.

Finally, in the case of manufacturing, the evidence shows the existence of complementary effects also for emerging economies: being surrounded by countries involved in global value chains in manufacturing increases a country's chances to be part of such value chains. Again, when controlling also for these complementary effects (specifications c), the overall effect of being surrounded by partners with strong domestic demand for manufacturing is therefore ambiguous[22].

5. Concluding remarks

Summary of findings

This paper has aimed to add to the literature on Global Value Chains by putting forward and empirically testing the conjecture that the drivers for countries to participate in business services GVCs are different from those attributed to more traditional manufacturing ones. The question has been framed within the recent debate on the development opportunities of joining a business service GVC, sparked in both academic and policy circles. More in general, we believe that part of this debate is linked to the importance of developing domestic capacity and capabilities in sectors that are crucial to facilitate processes and achieve outcomes of sectoral and technological upgrading for development.

Trade theory has moved in the direction of interpreting the emergence of GVC as a change in the object of comparative advantage – now based on *tasks* rather than *products* – while leaving substantially unchanged its determinants, i.e. relative endowment of factors, skills and factors' prices (Antras and Rossi-Hansberg 2006; Grossman and Rossi-Hansberg 2006, 2008 and 2012; Costinot, Vogel, and Wang 2013; Baldwin and Robert-Nicoud 2014).

From an empirical perspective, scholars have argued that proximity to headquarters countries, which tend to offshore the low value adding segments of production to neighbouring factor economies, might be an important driver of participation in manufacturing GVCs (Baldwin 2011; Baldwin and López-Gonzalez 2014). Along these lines, some scholars provide qualitative evidence on country cases that supports the idea of favouring GVC in BS as an opportunity for development. (Gereffi and Fernandez-Stark 2010a and 2010b; Hernández, Mulder, Fernandez-Stark, Sauvé, and López Giral 2014; Hernández, Martínez-Piva, and Mulder 2014).

[22]Here too the net effect of demand coming from partner countries is ambiguous depending on the strength of the direct negative effect and the indirect positive effect (partner countries demand affects positively their manufacturing value added in exports, which in turn positively affects one country's manufacturing value added in exports).

This paper has proposed a different framework to explain the emergence of BS GVCs, tested the related conjecture on the basis of WIOD data, and drawn different implications in terms of conditions to joining BS GVCs in the absence of a core domestic manufacturing base. This has led us to call for some cautiousness when considering BS GVCs as a sort of third unbundling of globalisation of production, one that opens up new opportunities for catching up in developing countries.

Taking stock on prior work on structural change, the economics of services and the determinants of specialisation in business services (Ciarli, Meliciani, and Savona 2012; Meliciani and Savona 2014) we have reverted to two alternative voices, often neglected in both trade and GVCs scholars' circles, those of Hirschman and Linder (Hirschman 1958; Linder 1961). In particular, we reprise the theoretical stands by Hirschman and (a modified version of) the Linder Thesis, and consider them jointly to explain participation in BS GVCs.

We have claimed and empirically shown that the higher the domestic presence in BS backward-linked industries, most especially manufacturing sectors, the higher the propensity to participate in BS GVCs, in line with what Linder claimed to be the case for the composition of final domestic demand favouring trade in similar sectors.

In particular, our findings show that our joint Hirschman-Linder hypothesis holds for the (WIOD) sample of developed and emerging countries and, indeed, for the subsample of emerging countries only. Most interestingly, when we look at whether participation in BS GVC is driven by domestic demand of close trade partners, we find that this has a negative effect. This is at odds with the idea that countries can enter BS global value chains by relying on demand coming from partner countries regardless their own domestic intermediate and final demand. This result emerges more clearly for emerging countries, for which it seems that, contrary to the common wisdom, it is even more important to develop domestic capabilities in sectors that are vertically integrated with BS in order to enter BS global value chains.

Overall, we believe that this evidence challenges – or at least helps sparking a new discussion on - the emerging view on the opportunity to favour GVC in BS as a development strategy, by claiming that in the absence of a strong domestic presence of Hirschman backward-linked industries to BS, it is unlikely that a (developing) country would start specialising and enter a GVC in these sectors.

We acknowledge that cases such as (a few states in) India, the Philippines or Uruguay, whereby trade specialisation and participation in service GVCs has been mainly driven by external demand, offer counter-evidence to our findings. These are indeed interesting cases to observe over the next

decades, to assess their long-term development paths. Given the link between domestic and trade specialisation, and in a context where the debate is putting back to the forefront the risks of a "premature de-industrialisation" (Rodrik 2015), it is all the more relevant to provide generalizable evidence on this phenomenon.

Research agenda

This paper has intended to contribute more generally to the debate within GVC scholars on the development opportunities of entering BS GVCs.

Interestingly, the turn that this debate is taking seems to be in contrast with what, most recently, development economists are considering to be the threatening prospect of "premature de-industrialisation" (Rodrik 2015) for developing countries. Empirical evidence in (Dasgupta and Singh 2005; Dasgupta and Singh 2006; Bah 2011) show that most Latin American and African countries are de-industrializing at levels of aggregate incomes that are much lower than those at which developed countries started to shift to services, with consequences that at best are a slow down of aggregate growth and employment. This literature rarely takes into account the role of global trade in these structural changes, with notable exceptions (McMillan, Rodrik, and Verduzco-Gallo 2014; Rodrik 2015). However, the specific role of international fragmentation of production and participation in services GVCs is not really accounted for, most especially from the point of view of how trade-induced changes of domestic sectoral structure are able to be conducive of economic development.

We see therefore two main directions that would be worth pursuing within our research agenda.

The first one is providing an explicit conceptual and empirical link between GVC scholarship and the more general debate over industrial policy for development (Lin 2012; Stiglitz, Lin, and Monga 2013), by accounting for the consequences of increasing international fragmentation of production. For instance, the key message that some scholars have put forward when they look at cases like African countries in contrast to the experience of Latin American countries, is that structural changes have brought about gains in productivity but overall loss of employment (McMillan, Rodrik, and Verduzco-Gallo 2014) or, on the contrary, a "premature de-industrialisation" that has negatively affected productivity growth. Does entering GVCs in BS allow or speed up the processes of technological upgrading of core manufacturing that BS have been found to facilitate internally?

The second, related, one is to provide a better handle of the issues above, which, beyond filling a current knowledge gap, can also contribute to other important, and related, debates seeking to better

understand the impact of participation on the polarisation of income, both within and between countries.[23]

Assessing these processes by means of quantitative analysis allows contributing to a different, established stream of scholarship, interested in the distribution of benefits along the value chains and the income polarisation effects observed as a consequence of value chain globalisation. Kaplinsky (2000), for instance, points to the sources of inequality linked to the spatial distribution of production activities between headquarters and factory economies. It is true, Kaplinsky argues, that being left out of GVCs represents a losing situation. However, the countries that are most likely to lose from the globalisation game are also those that do join and keep participating to GVCs at costly conditions. Many of these gain asymmetries are attributable to issues of *governance* (Kaplinsky 2000; Gereffi, Humphrey, and Sturgeon 2005). Processes of governance entail "*the role of coordination and the complementary role of identifying dynamic rent opportunities and apportioning roles to key players*" (Kaplinsky, 2000, p. 124).

More in general, it would be important to disentangle the inevitable nexus between being a headquarter versus a factory economy, and give empirical content to the dynamics of rent appropriation along different portions of the value chain with the consequent power structure asymmetries among the actors involved. It is in the dynamics of this nexus that different development scenarios might arise for developing countries. This debate needs generalizable, longitudinal and cross-country empirical evidence on the extent of these phenomena, to track the 'upgrading' process and derive sound implications in terms of industrial policy.

[23] See López-Gonzalez, Kowalski, and Achard (2015) and Kowalski et al. (2015) for a preliminary appraisal of the role of GVCs in determining within country wage inequality.

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Tables

Table 1: System GMM estimations of BS value added in exports

	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)
BS value added in exports lagged	0.758	0.705	0.761	0.642	0.616	0.640	0.606	0.522	0.596
	(8.43)***	(6.25)***	(6.93)***	(10.37)***	(5.13)***	(6.55)***	(8.19)***	(3.76)***	(5.02)***
Manufact. VA in final demand	0.245		0.168	0.500		0.353	0.497		0.234
	(3.24)***		(2.09)**	(6.27)***		(3.68)***	(6.58)***		(1.89)*
BS value added in final demand		0.311	0.071		0.492	0.053		0.529	0.181
		(3.25)***	(0.54)		(4.72)***	(0.43)		(5.15)***	(1.06)
Manuf. VA in final dem. partners				-0.721		-0.758	-0.963		0.161
				(-2.95)***		(-5.03)***	(-5.12)***		(0.31)
BS VA in final dem. partners					-0.602			-1.267	-1.303
					(-3.23)***			(-4.14)***	(-1.87)*
BS VA in exports partners						1.059	1.026	1.933	1.555
						(3.16)***	(2.10)**	(2.57)**	(3.01)***
Per capita patents	0.008	0.024	0.034	0.068	0.039	0.075	0.051	0.021	0.062
	(0.33)	(1.09)	(1.16)	(2.07)**	(1.30)	(2.33)**	(1.52)	(0.77)	(2.08)**
Hourly wage of high-skilled	0.080	-0.120	0.023	-0.124	-0.246	-0.207	-0.217	-0.369	-0.133
	(0.85)	(-1.28)	(0.31)	(-0.98)	(-2.51)**	(-2.93)***	(-2.23)**	(-3.31)***	(-1.61)
Internet users per 100 people	0.021	0.021	0.002	0.085	0.071	0.020	0.076	0.064	-0.004
	(0.61)	(0.49)	(0.06)	(2.29)**	(1.64)	(0.57)	(2.15)**	(1.56)	(0.10)
Share of direct VA attributed to	0.431	0.405	0.293	0.381	0.393	0.301	0.392	0.363	0.307
high skilled labor returns	(2.30)**	(2.51)**	(1.64)	(1.91)*	(2.32)**	(1.86)*	(2.00)**	(1.98)**	(1.86)*
Constant	0.456	1.124	0.773	5.088	4.990	0.446	1.306	-1.343	-0.109
	(0.71)	(1.81)*	(1.79)*	(3.54)***	(3.89)***	(0.24)	(0.48)	(0.59)	(0.06)
Arellano-Bond test for AR(2)	-1.54	-1.79*	-1.53	-1.71*	-1.92*	-1.55	-1.66*	-1.59	-1.31
Number of observations	460	460	460	460	460	460	460	460	460

Note: Year dummies included but not reported. Standard errors are heteroscedasticity robust. *, ** and *** indicate significant at 10, 5 and 1% respectively.

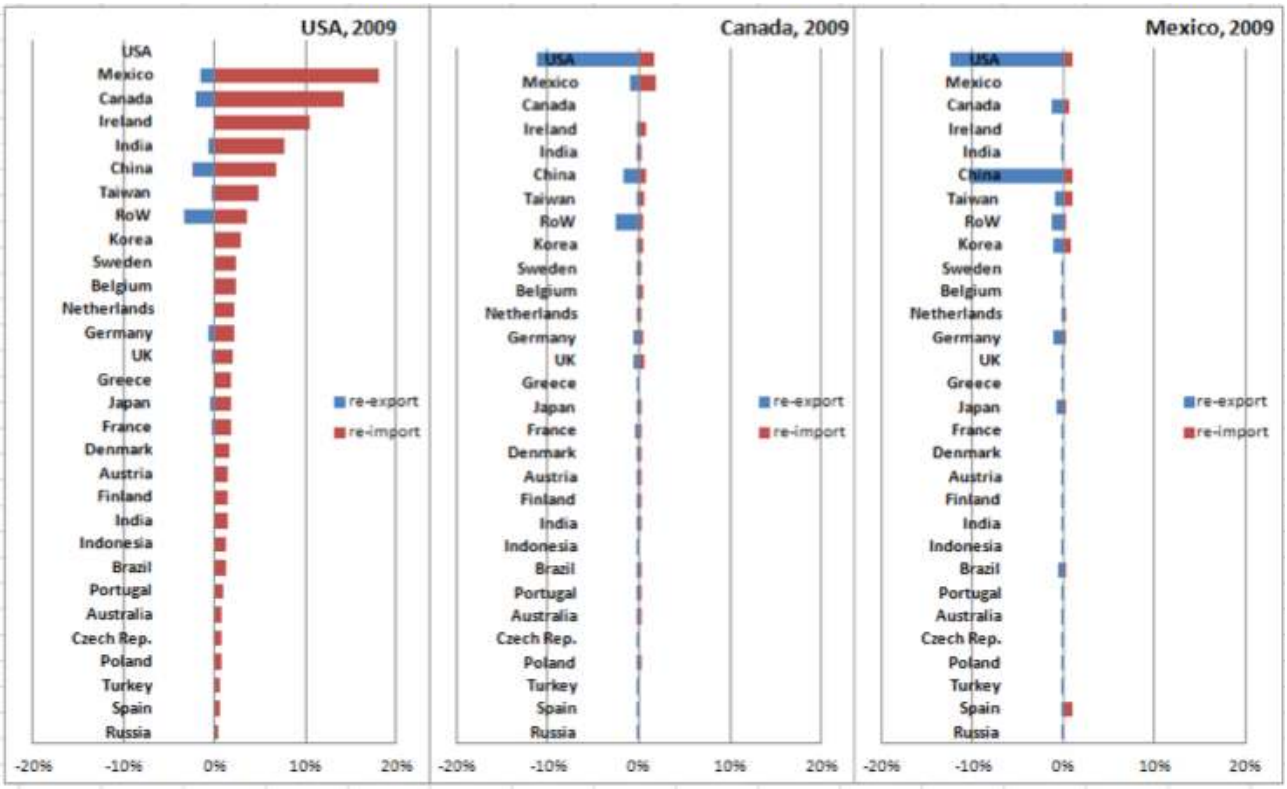
Table 2: System GMM estimations of BS value added in exports for advanced and emerging economies

	Advanced economies			Emerging economies		
	(1c)	(2c)	(3c)	(1c)	(2c)	(3c)
BS value added in exports lag 1	0.715	0.62	0.667	0.571	0.614	0.665
	(9.96)***	(17.79)***	(7.85)***	(4.28)***	(3.48)***	(4.10)***
BS value added in exports lag 2				0.037	-0.021	-0.012
				(0.51)	(-0.27)	(-0.13)
Manufact. VA in final demand	0.15		0.007	0.459		0.222
	(3.33)***		(0.12)	(8.03)***		(1.44)
BS value added in final demand		0.172	0.133		0.449	0.167
		(7.66)***	(1.89)*		(4.44)***	(0.87)
Manuf. VA in final dem. partners	-0.216		-0.004	-0.973		0.154
	(2.76)***		(-0.02)	(-2.20)**		(0.28)
BS VA in final dem. partners		-0.319	-0.267		-1.36	-1.295
		(4.96)***	(-1.34)		(-2.10)**	(-1.51)
BS VA in exports partners	0.801	1.132	0.97	1.194	1.676	1.468
	(3.84)***	(9.16)***	(4.97)***	(1.32)	(1.62)	(1.41)
Per capita patents	0.054	0.079	0.076	0.038	0.04	0.07
	(1.42)	(5.09)**	(2.54)**	(0.71)	(0.84)	(1.91)*
Hourly wage of high-skilled	-0.038	-0.077	-0.071	-0.358	-0.271	-0.104
	(-0.47)	(-2.14)**	(-0.93)	(-5.10)***	(-1.91)*	(-1.26)
Internet users per 100 people	-0.022	-0.028	-0.037	-0.035	-0.084	-0.042
	(-0.58)	(-1.41)	(-1.37)	(-0.48)	(-0.86)	(-0.56)
Share of direct VA attributed to	0.026	0.015	0.026	0.641	0.353	0.314
high skilled labor returns	(0.29)	(0.23)	(0.36)	(2.37)**	(2.39)**	(2.27)**
Constant	-1.816	-2.146	-0.958	0.696	0.578	0.033
	(-2.33)**	(-3.82)***	(-1.28)	(0.17)	(0.19)	(0.01)
Arellano-Bond test for AR(2)	-0.02	0.01	-0.02	-1.41	-1.52	-1.26
Number of observations	285	285	285	163	163	163

Note: Year dummies included but not reported. Standard errors are heteroscedasticity robust. *, ** and *** indicate significant at 10, 5 and 1% respectively. In the case of emerging economies, we introduce two years lag of the dependent variable to get rid of second order autocorrelation in the residuals.

Figures

Figure 1 – Markets for intermediates across countries, 2009



Source: Baldwin and Lopez-Gonzalez (2014)

Figure 2 - Share of Gross Exports by Category

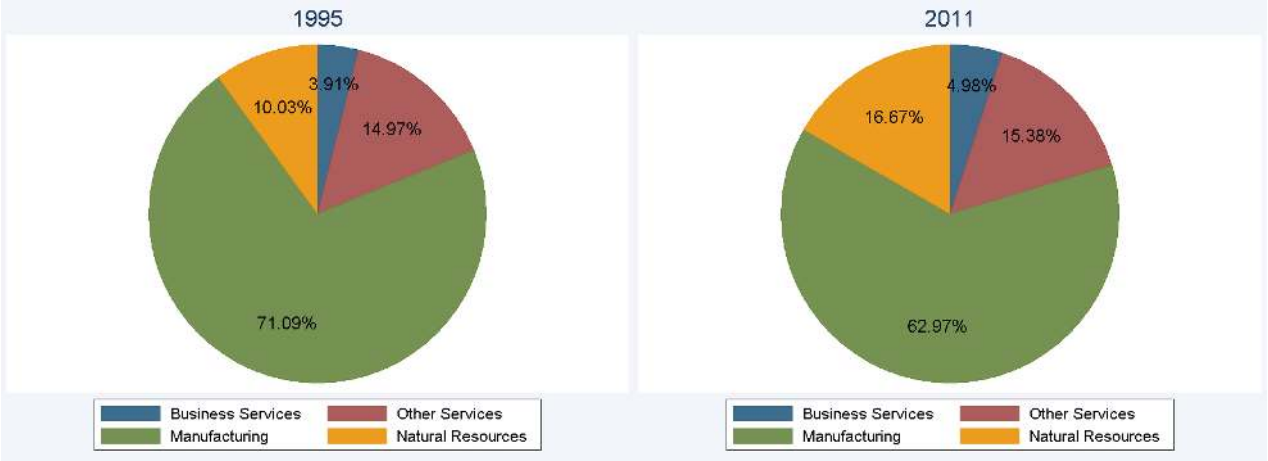
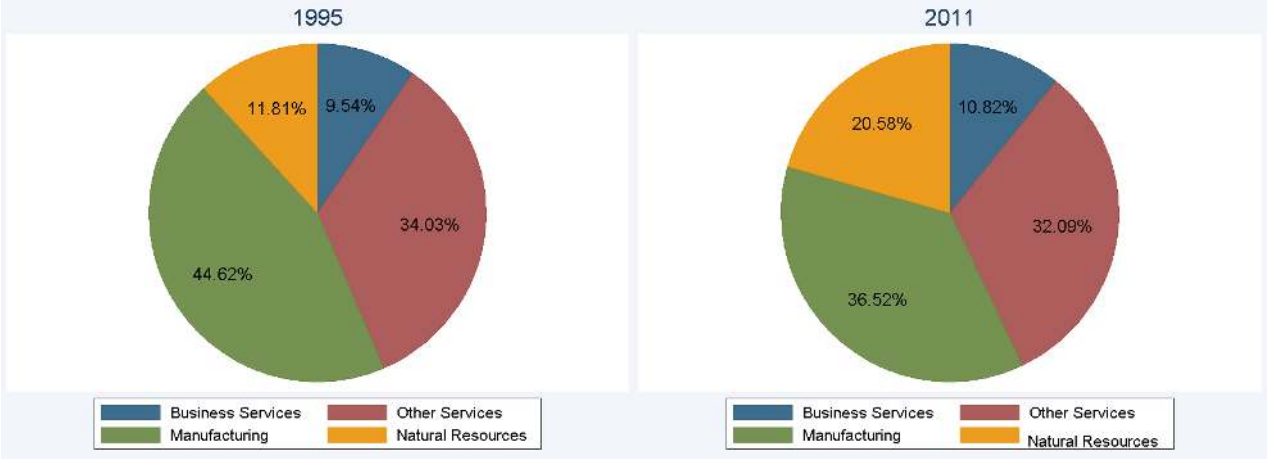


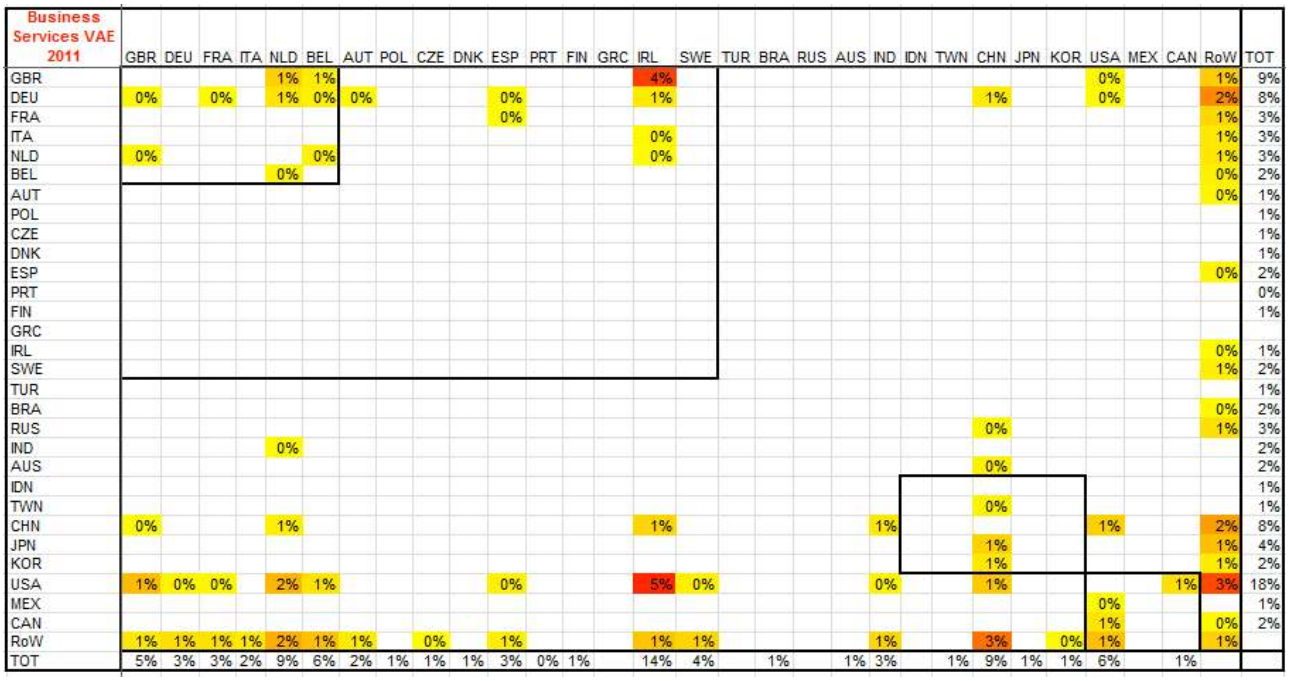
Figure 3 - Share of Value Added in Gross Export by category



Source: Own calculations using WIOD

Note: Gross exports show direct exports across selected sectors. Value added figures show the contribution of each sector towards the creation of these gross exports. Business Services are identified as sector c30 in the WIOD which corresponds to ISIC sectors 71-74.

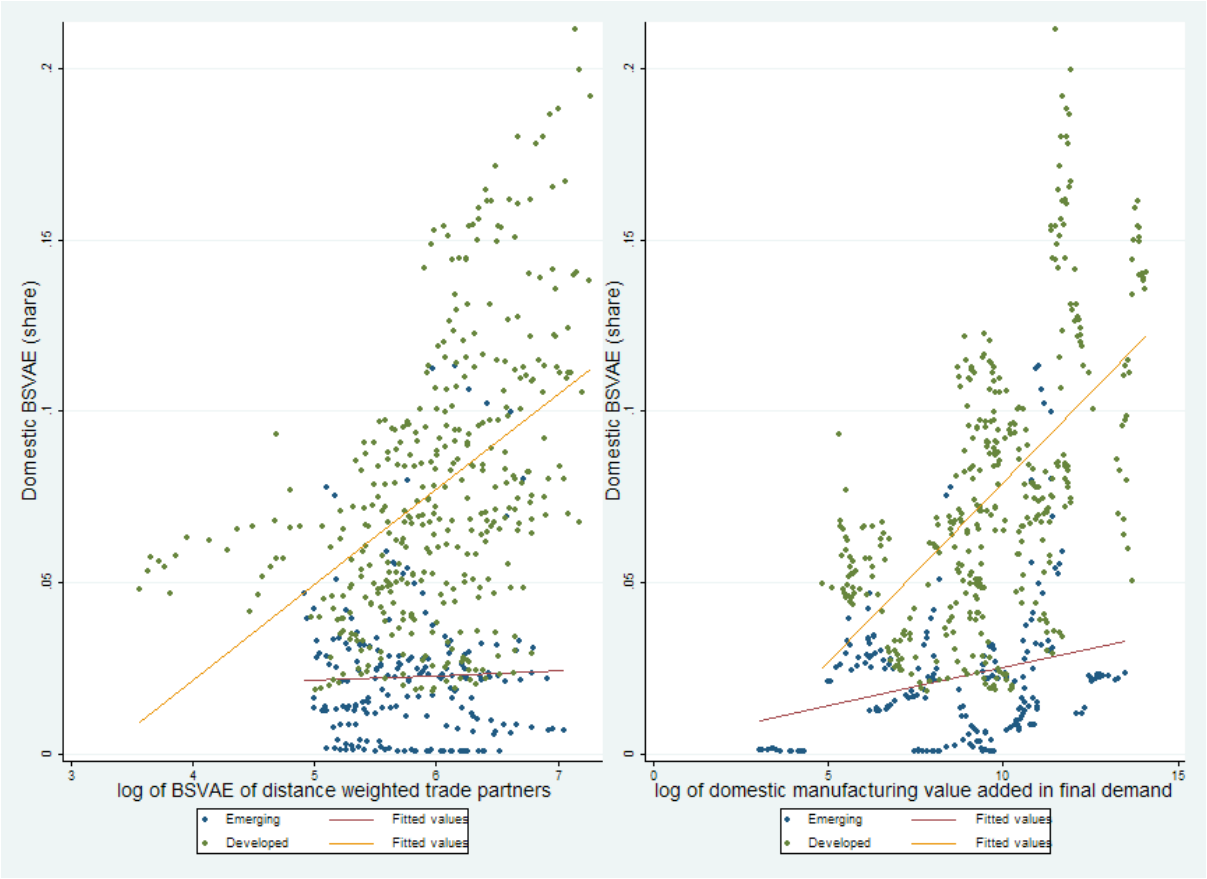
Figure 4 – Business Services Value Added in Export (BSVAE)



Business Services VAE 2011	GBR	DEU	FRA	ITA	NLD	BEL	AUT	POL	CZE	DNK	ESP	PRT	FIN	GRC	IRL	SWE	TUR	BRA	RUS	AUS	IND	IDN	TWN	CHN	JPN	KOR	USA	MEX	CAN	RoW	TOT
GBR					1%	1%									4%												0%			1%	9%
DEU	0%		0%		1%	0%	0%				0%				1%									1%			0%			2%	8%
FRA											0%																			1%	3%
ITA															0%															1%	3%
NLD	0%					0%									0%															1%	3%
BEL					0%																									0%	2%
AUT																														0%	1%
POL																															1%
CZE																															1%
DNK																															1%
ESP																														0%	2%
PRT																															0%
FIN																															1%
GRC																															
IRL																														0%	1%
SWE																														1%	2%
TUR																															1%
BRA																														0%	2%
RUS																								0%						1%	3%
IND					0%																										2%
AUS																								0%							2%
IDN																															1%
TWN																								0%							1%
CHN	0%				1%										1%						1%						1%			2%	8%
JPN																								1%						1%	4%
KOR																								1%						1%	2%
USA	1%	0%	0%		2%	1%					0%				5%	0%					0%			1%					1%	3%	18%
MEX																											0%				1%
CAN																											1%			0%	2%
RoW	1%	1%	1%	1%	2%	1%	1%		0%		1%				1%	1%					1%			3%		0%	1%			1%	
TOT	5%	3%	3%	2%	9%	6%	2%	1%	1%	1%	3%	0%	1%		14%	4%		1%		1%	3%		1%	9%	1%	1%	6%		1%		

Source: Own calculations using WIOD

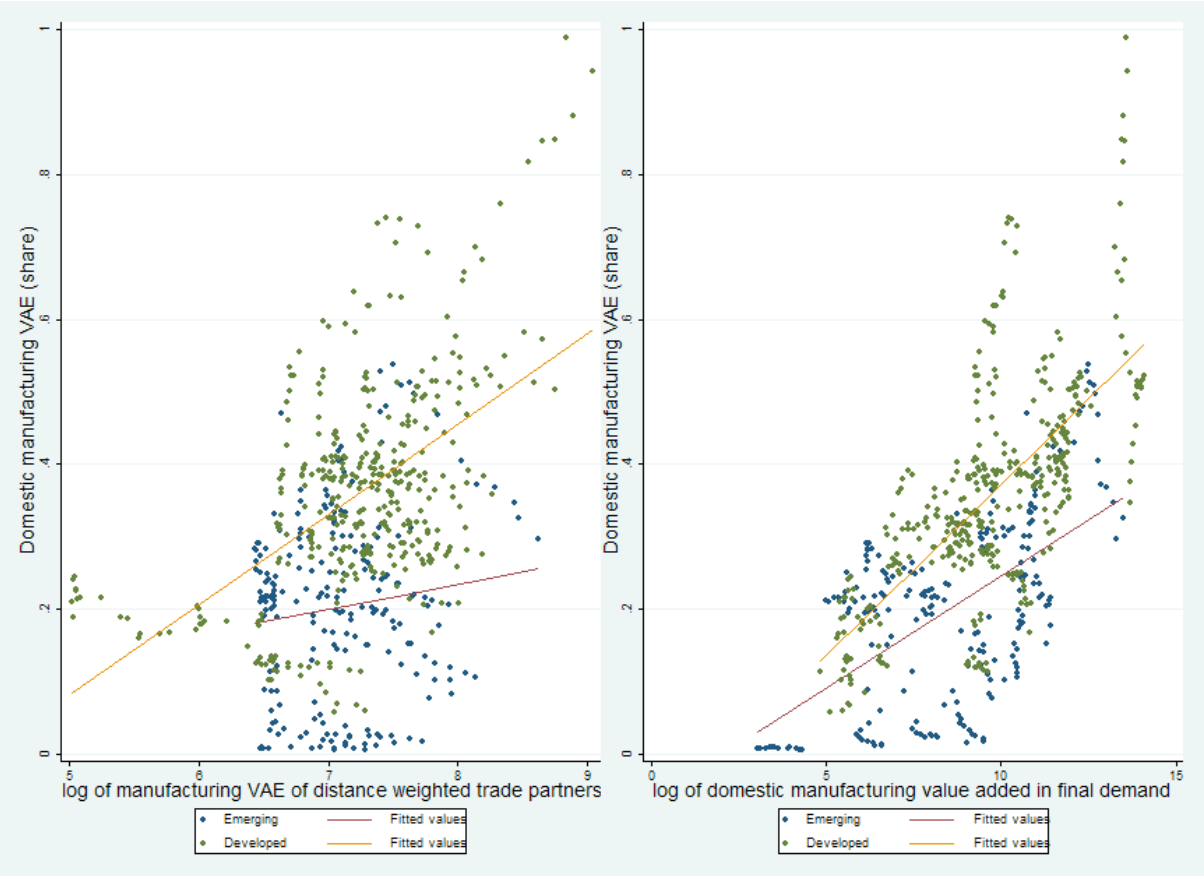
Figure 5 –Domestic Business Services Value Added in Export and domestic and foreign linkages.



Source: Own calculations using WIOD

Note: The vertical axis represents the share of domestic business services value added in gross exports. The left panel relates this to the log of BSVA of distance weighted trade partners to capture international linkages. The right panel then uses the log of manufacturing value added in final demand to represent domestic linkages.

Figure 6 –Domestic Manufacturing Value Added in Exports and domestic and foreign linkages



Source: Own calculations using WIOD

Note: The vertical axis represents the share of domestic business services value added in gross exports. The left panel relates this to the log of BSVA of distance weighted trade partners to capture international linkages. The right panel then uses the log of manufacturing value added in final demand to represent domestic linkages.

Appendix - System GMM estimations of manufacturing value added in exports

Table A1 - All sample

	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)
Manufacturing value added in exports lagged	0.633	0.788	0.706	0.562	0.777	0.658	0.44	0.678	0.592
	(4.00)***	(4.81)***	(4.78)***	(3.87)***	(4.75)***	(4.25)***	(2.74)***	(3.95)***	(3.71)***
Manufact. VA in final demand	0.337		0.375	0.489		0.351	0.505		0.464
	(2.56)**		(3.71)***	(4.41)***		(3.66)***	(4.42)***		(4.03)***
BS value added in final demand		0.22	-0.115		0.252	-0.02		0.238	-0.104
		(1.50)	(-1.51)		(1.81)*	(-0.19)		(1.85)*	(-1.15)
Manuf. VA in final demand partners				-0.393		0.385	-1.454		-0.958
				(-2.23)**		(1.24)	(-3.30)***		(-2.23)**
BS VA in final demand partners					-0.107	-0.698		-0.797	-0.073
					(-0.79)	(-1.85)*		(-2.69)***	-0.24
Manufact. VA in final exports partners							2.202	1.505	1.563
							(2.84)***	(2.40)**	(2.68)***
Per capita patents	0.031	-0.008	0.037	0.062	-0.007	0.048	0.044	-0.037	0.034
	(1.64)	(-0.33)	(1.95)*	(2.67)***	(-0.28)	(2.07)**	(2.07)**	(-1.27)	(2.00)**
Hourly wage of high-skilled	0.048	-0.001	0.139	-0.057	-0.012	0.17	-0.105	0.111	0.069
	(0.57)	(-0.01)	(1.95)*	(-0.56)	(-0.14)	(1.74)*	(-1.2)	(1.27)	(0.99)
Internet users per 100 people	0.072	0.163	0.047	0.103	0.165	0.04	0.00	0.094	-0.002
	(2.09)**	(3.00)***	(1.52)	(3.70)***	(3.13)***	(1.12)	(0.01)	(1.95)*	-0.06
Share of direct VA attributed to	0.2	0.013	0.066	0.107	-0.026	-0.021	0.305	0.048	0.086
high skilled labor returns	(1.75)*	(0.06)	(0.47)	(0.70)	(-0.14)	(-0.14)	(1.81)*	(0.21)	(0.51)
Constant	0.931	-0.434	0.492	3.355	0.132	2.613	-4.157	-5.533	-3.525
	(1.56)	(-0.41)	(0.91)	(2.86)***	(0.09)	(1.93)*	(-1.48)	(-1.91)*	-1.59
Arellano-Bond test for AR(2)	-1.33	-1.95	-1.24	-1.49	-1.99	-1.32	-0.97	-1.60	-1.16
Number of observations	460	460	460	460	460	460	460	460	460

Note: Year dummies included but not reported. Standard errors are heteroscedasticity robust. *, ** and *** indicate significant at 10, 5 and 1% respectively

Table A2 - Emerging economies

	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)
Manufacturing value added in exports lagged	0.728	0.902	0.774	0.703	0.908	0.771	0.616	0.883	0.701
	(3.40)***	(4.61)***	(3.68)***	(3.41)***	(4.62)***	(3.60)***	(2.90)***	(5.28)***	(3.22)***
Manufacturing value added in exports lag 2	-0.114	-0.182	-0.12	-0.106	-0.180	-0.127	-0.129	-0.199	-0.132
	(-1.67)*	(-2.53)**	(-1.51)	(-1.53)	(-2.51)**	(-1.46)	(-2.70)***	(-3.15)***	(-1.94)*
Manufact. VA in final demand	0.369		0.458	0.430		0.409	0.438		0.474
	(2.89)***		(3.94)***	(3.86)***		(3.20)***	(3.52)***		(3.19)***
BS value added in final demand		0.275	-0.125		0.256	-0.061		0.172	-0.116
		(2.33)**	-0.91		(2.01)**	(-0.44)		(1.59)	(-0.88)
Manuf. VA in final demand partners				-0.255		0.628	-1.850		-1.464
				(-1.20)		(1.76)*	(-2.49)**		(-1.55)
BS VA in final demand partners					0.070	-0.825		-0.679	-0.101
					(0.29)	(-2.04)**		(-2.63)***	(-0.28)
Manufacturing value added in exports partners							3.042	1.860	2.641
							(2.33)**	(3.74)***	(2.08)**
Per capita patents	0.041	0.003	0.035	0.037	0.002	0.043	0.011	-0.012	0.002
	(1.76)*	(0.12)	(1.22)	(1.58)	(0.10)	(1.50)	(0.48)	(-0.48)	(0.06)
Hourly wage of high-skilled	0.02	0.106	0.088	-0.022	0.108	0.193	-0.050	0.264	0.085
	(0.18)	(0.97)	(0.84)	(-0.18)	(0.99)	(1.52)	(-0.48)	(1.97)**	(0.97)
Internet users per 100 people	0.002	-0.014	0.05	-0.001	-0.021	0.022	-0.043	-0.058	-0.021
	(0.05)	(-0.20)	(0.76)	(-0.01)	(-0.27)	(0.28)	(-0.63)	(-0.57)	(-0.26)
Share of direct VA attributed to	0.208	0.03	0.125	0.185	0.070	-0.001	0.173	0.001	0.080
high skilled labor returns	(1.30)	(0.16)	(0.79)	(1.02)	(0.36)	(-0.01)	(0.88)	(0.00)	(0.50)
Constant	1.221	0.454	0.439	2.668	-0.257	1.675	-8.303	-7.574	-8.124
	(1.96)**	(0.39)	(1.04)	(2.68)***	(-0.17)	(1.32)	(-1.83)*	(-3.51)***	(-1.87)*
Arellano-Bond test for AR(2)	-1.00	-1.50	-0.88	-0.96	-1.50	-0.89	-0.87	-1.35	-0.76
Number of observations	163	163	163	163	163	163	163	163	163

Note: Year dummies included but not reported. Standard errors are heteroscedasticity robust. *, ** and *** indicate significant at 10, 5 and 1% respectively

Table A3 - Advanced economies

	(1a)	(2a)	(3a)	(1b)	(2b)	(3b)	(1c)	(2c)	(3c)
Manufacturing value added in exports lagged	1.000	1.025	1.004	1.006	1.018	1.010	0.847	0.901	0.860
	(8.34)***	(10.28)***	(8.73)***	(8.38)***	(9.76)***	(8.18)***	(6.79)***	(6.21)***	(7.55)***
Manufacturing value added in exports lag 2	-0.105	-0.071	-0.054	-0.100	-0.072	-0.076	-0.106	-0.120	-0.070
	(-1.18)	(-0.85)	(-0.55)	(-1.08)	(-0.86)	(-0.70)	(-1.09)	(-1.10)	(-0.81)
Manufact. VA in final demand	0.058		0.092	0.021		0.004	0.073		0.114
	(1.81)*		(2.46)**	(0.67)		(0.09)	(1.62)		(1.76)*
BS value added in final demand		-0.007	-0.066		-0.014	-0.006		0.017	-0.048
		(-0.64)	(-2.17)**		(-0.76)	(-0.22)		(0.46)	(-1.05)
Manuf. VA in final demand partners				0.096		0.421	-0.296		-0.258
				(1.3)		(3.92)***	(-2.23)**		(-1.25)
BS VA in final demand partners					0.045	-0.409		-0.161	-0.047
					(0.57)	(-3.15)***		(-1.15)	(-0.27)
Manufacturing value added in exports partners							0.930	0.706	0.818
							(5.63)***	(7.27)***	(4.95)***
Per capita patents	-0.010	0.025	0.006	-0.031	0.024	-0.014	-0.024	0.002	-0.002
	(-0.42)	(1.25)	(0.32)	(-1.29)	(1.21)	(-0.60)	(-1.04)	(0.08)	(-0.06)
Hourly wage of high-skilled	-0.023	-0.067	0.005	0.024	-0.058	0.112	0.031	0.070	0.042
	(-0.77)	(-2.28)**	(0.14)	(0.79)	(-1.68)*	(2.55)**	(0.61)	(1.16)	(0.86)
Internet users per 100 people	0.075	0.084	0.060	0.069	0.079	0.065	0.073	0.062	0.062
	(2.42)**	(3.09)***	(2.74)***	(2.25)**	(3.34)***	(2.55)**	(2.93)***	(2.82)***	(3.75)***
Share of direct VA attributed to	0.028	-0.002	-0.076	0.023	-0.013	-0.108	0.047	-0.069	-0.038
high skilled labor returns	(0.28)	(-0.03)	(-1.1)	(0.22)	(-0.18)	(-1.56)	(0.52)	(-0.66)	(-0.55)
Constant	0.347	0.776	-0.035	-0.449	0.558	-0.174	-3.529	-2.618	-2.976
	(0.69)	(1.39)	(-0.08)	(-0.62)	(0.84)	(-0.25)	(-3.57)***	(-2.23)**	(-3.55)***
Arellano-Bond test for AR(2)	-1.32	-1.54	-1.38	-1.22	-1.53	-1.26	-0.24	-0.53	-0.72
Number of observations	263	263	263	263	263	263	263	263	263

Note: Year dummies included but not reported. Standard errors are heteroscedasticity robust. *, ** and *** indicate significant at 10, 5 and 1% respectively

Table A4: WIOD country coverage

European Union			**North America**	**Asia and Pacific**
Austria	Germany	Netherlands	Canada	China*
Belgium	Greece	Poland*	United States	India*
Bulgaria*	Hungary*	Portugal		Japan
Cyprus	Ireland	Romania*	**Latin America**	South Korea
Czech Republic	Italy	Slovak Republic	Brazil*	Australia
Denmark	Latvia*	Slovenia	Mexico*	Chinese Taipei
Estonia*	Lithuania*	Spain		Turkey*
Finland	Luxembourg	Sweden		Indonesia*
France	Malta	United Kingdom		Russian Federation*

* Emerging economies are identified according to the IMF classification in 2009 (https://www.imf.org/external/pubs/ft/weo/2009/02/weodata/groups.htm)