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Abstract

This paper investigates the impact of backward participation in global value chains (GVCs) on productivity growth considering the mediating effect of organizational capital and distinguishing between high and low digital intensive sectors (OECD, 2018). Using industry data from EUKLEMS, WIOD and INTAN-Invest, the analysis focuses on a sample of eleven European economies plus the US over the period 1998-2015. Our findings show: a) a positive and statistically significant productivity impact of backward participation; b) a larger marginal effect of backward participation on productivity growth in countries-industries with a higher intensity of organizational capital; c) a larger productivity impact of backward participation and organizational capital in high digital sectors. The results suggest the relevance of managerial capabilities to extract value from participation in global value chains, particularly in high digital intensive sectors.

JEL Classification: F23, O30

Keywords: Organizational capital; global value chains; productivity growth; digitalization

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Introduction

Widespread processes of globalization of value chains have impacted on productivity in advanced and emerging countries. Criscuolo and Timmis (2017) identify several channels through which GVCs can help enhancing productivity. First, there is the classical argument of gains from specialization: in a value chain firms can specialise in the activities (the analogous to product specialization in the classical literature on trade liberalization) in which they are relatively more efficient and outsource the others. A second channel through which participation in GVCs can affect productivity is by allowing firms to have access to a larger variety of cheaper and/or higher quality and/or higher technology imported inputs. Third, GVCs can facilitate knowledge spillovers allowing interaction of domestic firms with foreign multinational firms. Finally, similarly to the case of international trade, GVCs can give firms access to larger markets and increase competition, thus favoring the development of the most productive firms and inducing the exit of the least productive ones.

Empirical research in support of the theoretical predictions linking GVCs to productivity is however limited. Contributions include older strands of work focusing on benefits to countries that initiate offshoring (Feenstra and Hanson 1996; Egger and Egger 2006; Daveri and Jona-Lasinio 2008; Amiti and Wei 2009; Winkler 2010), but also recent efforts that analyze the impact of vertical specialization on countries participating in GVCs (Formai and Vergara Caffarelli 2016, Kummritz 2016, Taglioni and Winkler 2016; Constantinescu et al., 2017). Despite the numerous channels identified in the literature by which GVC participation can positively affect productivity growth, the empirical evidence is mixed.

But under what conditions GVC involvement increases productivity? And are there differences in the impact based on the extent of digitalization of the sectors?

In this paper we argue that the gains in participation from GVC will be highly asymmetric between countries and sectors depending on investment in organizational capital and the extent of sectoral digitalization.

We build our hypotheses referring to an extensive theoretical and empirical literature documenting that the adoption of information technologies (IT) requires changes in firms' organisation (Brynjolfsson and Hitt, 2000), and that it induces higher productivity gains in better-managed firms (Garicano and Heaton 2010, Bloom et al. 2012), because management practices and IT are complements. We extend this literature to the study of the productivity impact of GVC participation by testing whether higher investment in organizational capital magnifies the productivity gains from backward participation in GVC and whether, due to the complementarity between organizational capital and IT, the gains are larger in high digital industries.

The empirical analysis is developed adopting an augmented production function framework and testing our model using industry data from EUKLEMS, WIOD and INTAN-Invest on a sample of eleven European economies plus the US over the period 1998-2015.

Our main findings support the existence of a significant impact of backward participation in GVCs on productivity growth which varies according to investment in organizational capital and the digital intensity of the sector.

The paper is organised as follows: Section 2 reviews the literature and develops the research hypotheses; Section 3 describes the data and provides some descriptive analysis. Section 4 discusses the empirical strategy and the econometric results. Section 5 concludes.

2. Background literature and research questions

In this section we review the main results emerging from two distinct strands of the empirical literature on the productivity impact of GVCs participation and on the role of organizational capital for productivity growth and for value appropriation in GVCs and then we formulate our research question bridging these two research fields.

GVC and productivity growth

The rising relevance of global value chains in modern economies stimulated new research efforts investigating the relationship between firms', industries' and countries' participation in GVCs and productivity gains. Criscuolo and Timmis (2017) identify several channels through which GVCs can help enhancing productivity. First, there is the classical argument of gains from specialization: in a value chain firms can specialise in the activities (the analogous to product specialization in the classical literature on trade liberalization) in which they are relatively more efficient and outsource the others. A second channel through which participation in GVCs can affect productivity is by allowing firms to have access to a larger variety of cheaper and/or higher quality and/or higher technology imported inputs. Third, GVCs can facilitate knowledge spillovers allowing interaction of domestic firms with foreign multinational firms. Finally, similarly to the case of international trade, GVCs can give firms access to larger markets and increase competition, thus favoring the development of the most productive firms and inducing the exit of the least productive ones.

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Focusing on the most recent efforts, Formai and Vergara Caffarelli (2016) investigate the relationship between international fragmentation of production and (labour and total factor) productivity growth for US industries between the 1990s and the 2000s using Input Output data provided by the Bureau of Economic Analysis (BEA). They find that participation in GVCs positively affects labour productivity and TFP in sectors with long and wide production chains in countries specialised in importing intermediate goods.

Other studies have extended the analysis to a larger sample of countries using the OECD World Input Output tables and measuring backward and forward participation in GVCs at the industry level. In particular, Kummritz (2016) shows that an increase in GVC participation leads to higher domestic value added and productivity in 54 countries independently of their income levels. Based on the preferred instrumental variable specification, he finds that a one percent increase in backward GVC participation generates an increase of 0.11% of domestic value added in the average industry but does not affect labour productivity. On the other hand, a one percent increase in forward GVC participation causes an increase of 0.60% of domestic value added and 0.33% of labour productivity.

Kordalska et al. (2016) on a panel covering 40 countries and 20 industries in the period 1995-2011 find a positive link between TFP growth and the involvement of sectors in global value chains (measured as the share of foreign value added in exports). Stronger effects are found in the manufacturing sectors.

Finally, Constantinescu et al. (2017), using data on trade in value added from the World Input-Output Database, covering 13 sectors in 40 countries over 15 years find that participation in global value chains is a relevant driver of labor productivity. Differently from Kummritz (2016) backward participation in global value chains emerges as a particularly important factor affecting productivity growth.

An alternative approach has been suggested by Timmer (2017) arguing that Global Value Chains challenge the traditional approaches to productivity measurement. He suggests evaluating a production function where final output is produced using domestic and foreign factor inputs. Therefore, in this approach the flow of intermediate inputs will be netted allowing to express the production function of a final good exclusively in terms of factor inputs. The basis for this methodology is the analysis of the cost shares of the production factors that can be identified from synthetic input-output tables. This approach solves the problems linked to tracing the profits for intangible capital assets used in international production.

Global value chains and productivity growth: the mediating role of organizational capital

This paper explores the mediating effect of organizational capital in the relationship between GVC participation and productivity growth. In particular, we investigate whether a higher intensity of organizational capital augments the productivity gains from GVC participation across countries and industries.

This research question draws upon two streams of literature: the studies on the productivity impact of organizational capital and management practices and the role of organizational capital in GVC.

Lev and Radhakrishnan (2005) define organizational capital as "unique systems and processes employed in the investment, production, and sales activities of the enterprise, along with the incentives and compensation systems governing its human resources". They identify this collective resource as the major factor of production "that is unique to the firm and thus capable of yielding abnormal—above cost of capital—returns, thereby generating enterprise growth". (Lev and Radhakrishnan, 2005, p.73).

This resource assumes a crucial role to cope with (and benefit from) fundamental changes in technology. In the context of the productivity paradox associated to the diffusion of information technologies (IT) it was found that only when certain organizational practices were combined with investments in IT, these investments created significant increases in productivity (Bresnahan et al., 2000; 2002). This is because to realize the potential benefits of computerization, investments in additional assets such as new organizational processes and structures may be needed (Brynjolfsson and Hitt, 2000).

Several studies, using different methodologies and different measures of organizational capital[1], have provided empirical evidence of its positive effect on firms' (Tronconi and Vittucci Marzetti, 2011; Hulten and Hao, 2008; Lev and Radhakrishnan, 2005; Black and Linch, 2001), sectoral (Niebel et al., 2016); Chen et al., 2016) and countries' productivity (Jalava et al. 2007; Fukao et al. 2009; Hao et al. 2009; Van Ark et al., 2009; Marrano et al., 2009; Corrado et al., 2009; Roth and Thum, 2013) [2].

These results are consistent with the findings of a related stream of literature investigating the role of management practices (measured through survey data) for productivity gains. In particular Bloom and

[1] Investment in organization capital has been measured in a number of ways in the literature. These include business surveys (Black and Lynch 2005), part of the wage bill of managers (Squicciarini and Le Mouel 2012), the residual from a production function (Lev and Radhakrishnan 2005), selling, general and administrative (SGA) expenses (De and Dutta, 2007; Tronconi and Vittucci Marzetti 2011), revenues for the management consultant industry and trends in the cost and number of persons employed in executive occupations (Corrado et al., 2005; Corrado et al., 2009; Roth and Thum, 2013) ; Eisfeldt and Papanikolaou 2013;

[2] Some of these studies do not disentangle the specific role of organizational capital but include it in a larger category of intangible assets together with brand and training investments.

Van Reenen (2007) find, for a sample of advanced countries, that measures of management practices are strongly associated with firm-level productivity, profitability, Tobin's Q, and survival rates. Moreover Bloom et al. (2017), extending the analysis to 34 countries from over 11,000 firms, model managerial practices as a technology and find that they account for about 30% of total factor productivity differences both between countries and across firms within countries.

But does organizational capital play a specific role in affecting the capability of firms, countries and sectors to experience productivity gains from participation in GVC?

The firm level literature investigating value creation along the value chain has shown that the benefits from participation in GVCs are very uneven across firms and countries. The classic example of the iPod supply chain discussed by Dedrick, et al. (2010) shows that Apple captures between one-third and one-half of an iPod's retail value, Japanese firms such as Toshiba and Korean firms such as Samsung capture another major share while firms and workers in China capture no more than two percent from assembling the product. The capability of the different countries to appropriate a larger share of value is related to the extent of their firms' investment in knowledge-based capital and organizational capabilities to control the value chain. While different intangible assets may contribute to appropriating the benefits from GVC participation (particularly R&D and design at the upstream and marketing and advertising at the downstream of the smiling curve; see Jona et al. 2019) organizational capital is expected to play a major role by being the asset which allows coordinating the different stages of the value chain. Moreover, according to the OECD (2013b), economic competencies, including firm-specific skills such as superior management, brand equity and organisational structure, can be more valuable than other intangible assets as they involve more tacit forms of knowledge and may therefore be more difficult to replicate than innovative property or computerised information.

Bloom et al. (2018) present a heterogeneous-firm model in which management capabilities have a positive effect on both production efficiency and product quality. They test the model on US and Chinese firms and find that firms that are better managed are more likely to export and earn higher export revenues and profits. This provides indirect evidence of the possible benefits of managerial capabilities in mediating the impact of GVC participation on productivity.

Therefore, we expect that participation in GVCs will generate more value added in sectors and countries where firms invest more in organizational capital.

Gereffi et al. (2005) identify different types of global value chain governance (hierarchy, captive, relational, modular, and market) which range from high to low levels of explicit coordination and power asymmetry. The key insight is that coordination and control of global-scale production systems, despite their complexity, can be achieved without direct ownership. In captive value chains there is a high degree of explicit coordination and a large measure of power asymmetry with the lead firm (or top management) being the dominant party. This control requires high managerial capabilities on the side of the leading firm as in the case of hierarchies. In order to achieve a more balanced power between the firms in the GVC, suppliers need to develop specific assets, including organizational capabilities, as in relational and modular value chains.

Organizational capital is also strategic in the coordination of global value chains. International fragmentation of production requires the coordination of the various stages of production which are spatially dispersed (Baldwin 2016). To realize the matching of production teams and ideas, GVC integration requires managerial capabilities and a dense circulation of information flows to communicate specifications, standards, technical know-how in addition to costs and other items (Gereffi et al. 2005). The efficient organization of production in GVCs is thus mostly based on investments in managerial capabilities (Durand and Milberg 2018).

The studies discussed so far suggest that the impact of GVC participation on productivity may depend on investment in organizational capital. Moreover, we argue that this impact will differ across sectors and will be stronger in digital sectors. In fact, organizational investment and ICT investment are highly complementary (Brynjolfsson et al. 2002). Bloom et al. (2012) compared investment in IT of European and American firms and showed that European firms did not experience the same gains from computers as they were not able to change organizational and management practices. Finally, more recently Haskel and Westlake (2017) provide several examples of complementarity between different intangibles including software and organizational capabilities.

Based on this discussion, the purpose of this paper is to investigate the single and mediated impact of GVC participation and investment in organizational capital on productivity growth and to analyse whether the effect varies across sectors with different digital intensity.

3. Data and descriptive statistics

3.1 Intangible assets

Data on intangible investment are from INTAN Invest[3] providing harmonized estimates of intangible investments covering three broad groups of asset categories originally proposed by Corrado et al. (2005):

[3] INTAN-invest is a research collaboration dedicated to improving the measurement and analysis of intangible assets (www.intannvest.net)

computerized information, innovative property and economic competencies[4]. Computerized information includes computer software and databases. Innovative property refers to the innovative activity built on a scientific base of knowledge as well as to innovation and new product/process R&D more broadly defined. Economic competencies indicate spending on strategic planning, worker training, redesigning or reconfiguring existing products in existing markets, investment to retain or gain market share and investment in brand names.

The Systems of National Accounts (2008) currently incorporates in the asset boundary only an array of intangible assets namely R&D, mineral exploration, computer software and databases, entertainment, literary and artistic originals, under the category 'intellectual property products'. The remaining intangibles identified by Corrado et al (2005) as investments, are treated as intermediate expenditures in official statistics. The INTAN Invest initiative[5] provides estimates for both National Account and Non-National Account intangible investment.

A relevant characteristic of the INTAN-Invest measures of intangibles is that they are consistent with National Account principles and are entirely based on official statistics. In this paper, we select from the INTAN database information for the following set of intangible assets: R&D, Design, Advertising and Market research (Brand), Training and Organizational capital[6]. The main original data source to build indicators for these intangibles is Eurostat. Investment in Advertising and Market Research, Design and Organizational Capital are calculated adopting an expenditure approach and resorting to expenditure data by industry from the Use Tables, compiled according to the new classification system (NACE Rev2/CPA 2008). Additional information about data sources and estimation methods can be found in Corrado et al. (2018).

3.2 Measures of GVC participation

The measure of backward participation used in our analysis is obtained from the World Input Output Database (WIOD). The indicator is based on the work of Koopman et al. (2010, 2014) extending the work of Hummels et al. (2001) and Johnson and Noguera (2012). Hummels et al. (2001) compute an index of vertical specialization accounting for the use of imported inputs in producing goods that are then

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[4] For a detailed description of the methodology, see Corrado et al. (2018). These indicators have been used in many studies especially for assessing their contribution to GDP and productivity growth (see e.g. Corrado et al. 2009, 2013, 2016, 2017).

[6] The database used in this paper resorts to R&D expenditure from BERD and not to R&D National Account data to be coherent with the EUKLEMS (2012) figures that were not yet adjusted to the new European System of National Accounts (ESA 2010). Moreover, we do not use INTAN data on software since we include total Information and Communication Technologies (ICT) capital taken from EUKLEMS.

exported. However, this indicator does not take into account that a country exports intermediates that are used to produce final goods absorbed at home. By using input–output data for source and destination countries simultaneously, Johnson and Noguera (2012) overcome this limitation and compute the ratio of value added to gross exports as a measure of the intensity of production sharing. Finally, Koopman et al. (2010, 2014) provide a full decomposition of value added including returned domestic value added (domestic value added that comes back incorporated in foreign inputs produced with domestic inputs) and the indirect exports to third countries. He proposes two measures of participation. These are the backward and the forward participation indicators, which are respectively the importing and exporting elements of GVCs (see Figure A1). The figure illustrates how gross exports can be decomposed into many different constituent elements. At their most basic, gross exports are composed of domestic and foreign value added which can themselves be further decomposed using Input-Output tables. For example, the domestic value added that is embodied in exports can serve to produce final goods and services (element (1) in figure A1) or it can be used to produce intermediates which are then used domestically (2) or exported (3+4). Forward participation refers to the domestic value added in foreign exports (3+4) while backward participation refers to the foreign value added in domestic exports (5+6).
In this paper we focus on backward participation which is closer to traditional indicators of offshoring activity (such as the share of imported inputs in producing goods that are then exported). A variant of this indicator decomposes value added, similarly across countries and sectors, but according to final demand (Timmer et al. 2013; Los et al. 2015). This tracks not just the value added traded in the production of exports, but also that used to satisfy domestic and international final demand[7]. Both measures (one based on exports and one on final demand) 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 relevant because domestic final demand and gross export vectors are significantly different. Since both measures have their pros and cons, we report the main econometric estimates using both the indicator of backward linkages based on exports and the other based on final demand. We focus on foreign value added in domestic exports over total exports (backward participation) for comparisons with other studies (this is the measure of participation mostly used by the OECD, OECD 2013b) but we report

[7] To provide an example of the difference in the two indicators, imagine that the total demand for BMW cars is 100 of which 60 are sales to German customers while 40 are exports. The cars are assembled outside Germany using a variety of components such as car body parts, interior and exterior components, some of which are made in Germany, but others abroad. Out of the total value of each car two thirds is domestic (German) value added and one third is foreign value added. Using the export indicator the foreign value added in domestic exports of German cars would be (1/3)*40 while using the final demand indicator it would be (1/3)*100 (counting also the cars that are consumed by German customers).

also estimates based on foreign value added in domestic final demand over total final demand (backward participation based on final demand) to test the robustness of our findings. Much work on GVCs to date uses the backward participation indicator and identifies one of the most salient features to be the rise in the share of foreign value added used to produce exports (see for example OECD, 2013, Taglioni and Wrinkler, 2016, Baldwin and Lopez-Gonzalez, 2015; Kowalski et al. 2015).

3.3 The database

The database employed in this paper merges data on tangible capital inputs, ICT capital as well as standard growth accounting variables such as output and labour input from EUKLEMS[8] (see O'Mahony and Timmer 2009, for details) with data on intangibles from INTAN-Invest. Data cover the period 1998-2014 for 9 European countries (AT, DE, DK, ES, FI, IT, NL, SE, UK) and 18 industries NACE REV 2.

3.4 Descriptive analysis

In this section we merge the evidence on backward participation, organizational capital and productivity taking account the extent of digital intensity in the above mentioned three sectoral groups.

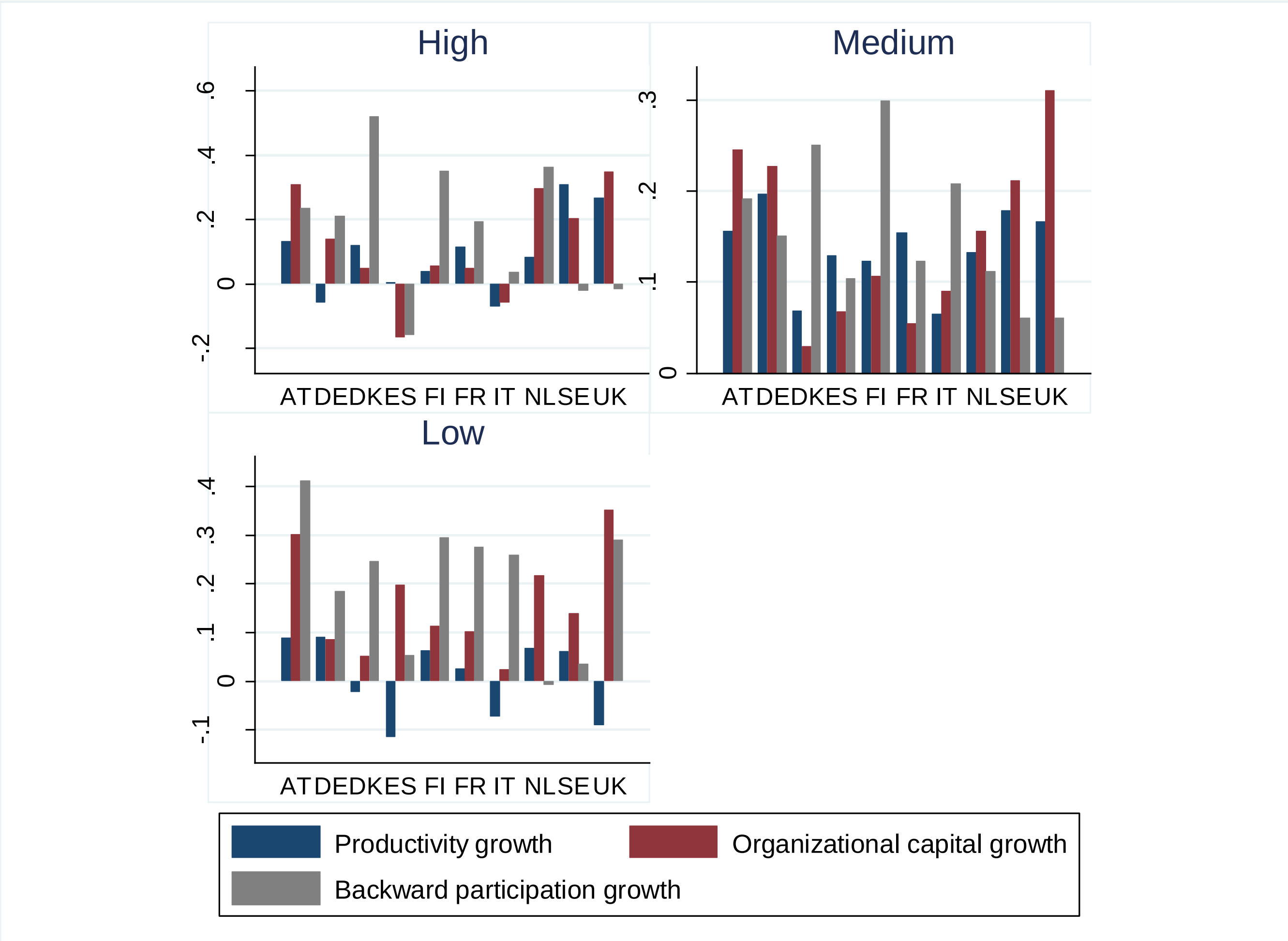
Figure 1 shows the average rate of growth of our main variable of interest: backward participation (based on export), organizational capital, and labor productivity for the countries in our sample distinguishing between high, medium and low digital intensive sectors. We exclude from our analysis the years of the crisis (2008/2009) to examine the long-time trend removing the disturbance effects caused by the exogenous shock.

In the medium digital intensive sector, all countries have experienced, on average, positive growth of labour productivity, organizational capital and backward participation. United Kingdom, Austria, Germany, and Sweden show the fastest organizational capital accumulation and, also, the highest average labour productivity growth, while backward participation is higher for Finland, Denmark, and Italy.

The high digital sector presents a higher variation across countries. Labor productivity has increased in most of the countries in our sample, except for Italy and Germany, while organizational capital accumulation has decreased only in Italy and Spain. Differences in backward participation across countries are more marked, with Denmark and Finland growing fast and Spain, Sweden and UK showing a negative rate of growth.

Figure 1 - Productivity, backward participation, and organizational capital in the digital sectors

[8] http://www.euklems.net



Source: Author's calculation on EUKLEMS, WIOD and INTAN Invest data. Labor productivity is measured as real value added per hours worked.

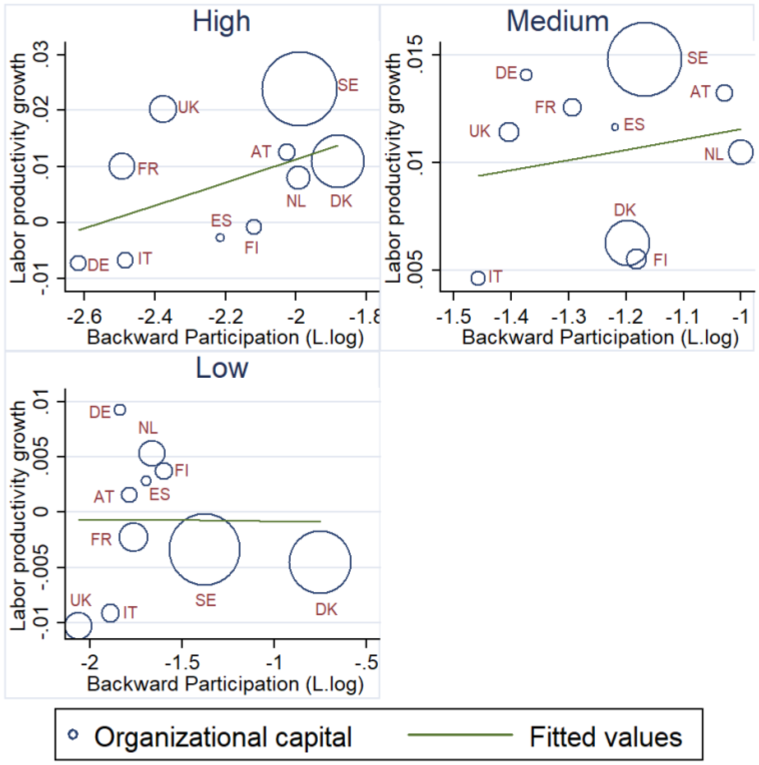
In the low digital intensive sector, there is more variation in the labour productivity growth. Denmark, Spain, Italy, and UK slowed down, while other countries show positive growth rate even if not very high. Backward participation growth raised in Austria and the UK while slowed down in the Netherlands. Finally, intangible capital accumulation is relatively fast in Austria and the UK (in the same line of backward participation) while it is almost stable in Denmark and Italy. On a general base for the high and medium digital intensive sectors (except for Germany in high) organizational capital accumulation and labor productivity growth move always in the same direction while, this relation is less strong in the low digital sector. Backward participation shows a more heterogeneous behavior.

The main goal of our analysis is to investigate the productivity impact of GVC participation tacking into account the complementary role of organizational capital. Therefore, figure 2 shows data on backward participation vs labour productivity growth distinguishing between high, medium, and low digital intensive sectors across the sample countries. The size of the dots represents the average per hour worked organizational capital in our time span.

Correlation between productivity and backward participation growth is significantly positive in the high and medium digital intensive sector while, in the low digital industries there is no a clear correlation. Focusing on organizational capital, notice that countries with the highest growth rate of productivity and backward participation are also those with the highest intensity of organizational capital in the high digital sector. On the other hand, this relationship is less straightforward in medium and low digital intensive sectors.

The data suggest that the links between backward participation and labour productivity vary substantially with the extent of sectoral digitalization. At the same time, the contribution of managerial capabilities to extract value from participation in global value chains seems to be relevant mainly in the high digital intensive sector. Therefore, a deeper investigation of the multiple dimensions of this relationship is warranted. This is the goal of the next section.

Figure 2 - Labour productivity, Organizational capital and Backward participation



Source: Author's calculation on EUKLEMS, WIOD and INTAN Invest data

4 Empirical strategy

4.1 Econometric approach

Jona-Lasinio and Meliciani (2019) tested the impact of GVC participation taking into account the mediating effect of intangible capital and found a statistically significant effect for non-R&D intangibles, among which a major role is played by organizational capital. This paper offers a deeper exploration of the relationship between GVC participation, organizational capital and productivity growth providing estimates of a production function augmented with a measure of backward GVC participation.

First, we test the direct linkage between productivity growth and the intensity of organizational capital. Then we evaluate the extent to which the productivity returns from participation are conditional to the intensity of organizational capital across countries-industries. We adopt a difference-in-difference empirical approach following Rajan and Zingales (1998) who estimated the impact of financial development on economic growth in a model with country-industry interactions. Thus, our empirical specification is as follows:

$$(1) \qquad \Delta \ln(Y/H)_{i,c,t} = \alpha_1 \Delta \ln(K^J/H)_{i,c,t} + \alpha_2 \Delta \ln(K^I/H)_{i,c,t} + \alpha_3 \ln(P_{gvc})_{i,c,t-2} + \alpha_4 \ln(K^{org}/H)_{i,c} + \alpha_5 \ln(P_{gvc})_{i,c,t-2} * \ln(K^{org}/H)_{i,c} + \lambda_i + \lambda_t + \eta_{i,c,t}\,.$$

where variables vary by country c, industry i and time t; Y denotes value added adjusted to include intangible capital (as in Corrado, Hulten, and Sichel 2005, 2009), H is total hours worked, K^J is for J=ICT, NonICT capital, K^I is for I=Total intangible, and non-R&D intangibles[9], while K^{org} refers to Organizational capital, P_{gvc} is backward participation and $\ln(K^{org}/H)_{i,c}$ denotes country-industry's average (log) intensity of organizational capital, and λ_i , λ_t are industry and time dummies. The interaction variable is symmetric with respect to the interacted terms as it does not say anything about the causality between $\ln(K^{org}/H)$ and $\ln(P_{gvc})$ (Brambor, Clark and Golder, 2006). Thus, we simply assume that organizational capital is our conditional variable affecting the effect of backward participation on productivity growth.

Overall, existing empirical evidence demonstrates that intangible capital affects productivity growth via multiple mechanisms: directly, increasing capital deepening and interacting with other complementary assets (Corrado et al 2013 and 2018); and indirectly, being a driver of innovation and generating spillovers, mainly from non-R&D[10] intangible assets (Corrado et al 2017). Most of these analyses find also that among the asset categories of intangibles, economic competencies and in particular organizational capital is the main driver of productivity growth.

Notice that the term we use to capture the differential impact of participation on productivity growth in sectors intensive of organizational capital is the time average of organizational capital intensity of all industries and countries interacted with the level of GVC participation in industry i country c, at time t-2. The adoption of the average intensity in the interaction implies some restriction as it bounds the elasticity of labor productivity as organizational capital intensity rises.

If our proxy for organizational capital intensity in equation (1) is correct, we should find $\alpha_5 > 0$, indicating that each country industry experiences relatively higher productivity growth when participation in GVC is complemented by higher organizational capital intensity. We include also the industry dummies to control for the possible correlation between specific industry characteristics and our measure of capital intensity. Ultimately, the estimation of equation (1) can be affected by structural identification problems

[10] Non-R&D assets include Organizational capital, Training, Brand and Design.

related to measurement error, multicollinearity, and endogeneity of factor inputs. Thus, we also test our results with IV and GMM estimation (Ackerberg et al 2015).

4.2 Empirical results

Table 1 shows estimates of equation 1.

Table 1 – Benchmark estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	All sample			All sample		
VARIABLES	Total Intangibles			Intang Excl R&D		
DlnKH_intan	0.155***	0.154***	0.245*			
	(8.071)	(8.018)	(1.655)			
DlnKH_intan_xrd				0.142***	0.139***	0.210***
				(6.860)	(6.777)	(2.890)
DlnKH_rd				-0.001	-0.000	-0.060
				(-0.126)	(-0.051)	(-1.628)
DlnKH_ICT	0.047***	0.047***	0.026	0.042***	0.043***	0.032
	(4.930)	(5.002)	(0.692)	(4.070)	(4.188)	(0.719)
DlnKH_NonICT	0.179***	0.176***	0.079	0.182***	0.179***	0.121
	(7.382)	(7.279)	(0.662)	(7.422)	(7.320)	(0.702)
DlnLH	0.107***	0.106***	-0.302	0.098**	0.098**	0.022
	(2.824)	(2.800)	(-0.795)	(2.549)	(2.544)	(0.231)
lnKH_og_avg	**0.002****	**0.008*****	**0.070****	0.002	**0.008****	**0.067****
	(2.095)	**(2.591)**	**(1.988)**	(1.567)	**(2.372)**	**(2.447)**
log_backp = L,	0.003	**0.020****	**0.160***	0.004	**0.021****	**0.165****
	(1.299)	**(2.413)**	**(1.876)**	(1.566)	**(2.460)**	**(2.197)**
c.lnKH_og_avg#cL2.log_backp		**0.003****	**0.030***		**0.003****	**0.030****
		(2.112)	**(1.902)**		**(2.080)**	**(2.376)**
Observations	1,507	1,507	1,440	1,374	1,374	1350
R-squared			0.080			0.074
Number of ctrysec	126	126		115	115	
Year and Ind FE	gls		IV	gls		IV
z-statistics in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

All regression models contain industry and time fixed effects and are estimated by GLS. Column 1 estimates equation (1) with no interaction terms as our benchmark specification. The standard inputs and intangible capital have positive and statistically significant coefficients coherent with previous empirical literature (Corrado et al 2017).

Column 2 checks for the complementary effect of organizational capital and participation on productivity growth looking at the level effect of the interaction between the intensity of organizational capital per hour and lagged backward participation. The conditional effect of organizational capital on participation is confirmed also by the IV estimates in column 3 where the interaction coefficient is higher also suggesting a downward endogeneity bias affecting both backward participation and organizational capital in standard GLS estimates.

To judge the robustness of our findings, in Table 2, we also test the benchmark specification only for services and for high and low digital intensive sectors. The identification of high and low digital intensive sectors follows the classification proposed by Berlingieri et al (2019).

Table 2 – Testing industry characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
	Intangibles excl R&D					
VARIABLES	tot services		High digital	Low digital	High digital	Low digital
DlnKH_intan_xrd	0.156***	0.155***	0.249***	0.091***	0.250***	-0.041
	(7.782)	(7.713)	(7.982)	(3.189)	(3.184)	(-0.280)
DlnKH_rd	-0.003	-0.002	-0.014	0.014	0.007	0.026
	(-0.290)	(-0.264)	(-0.892)	(1.127)	(0.174)	(0.394)
DlnKH_ICT	0.044***	0.045***	0.026*	0.056***	-0.070	0.019
	(4.345)	(4.456)	(1.757)	(3.637)	(-0.783)	(0.180)
DlnKH_NonICT	0.200***	0.198***	0.211***	0.184***	0.253***	0.208
	(8.285)	(8.172)	(5.796)	(4.960)	(2.654)	(1.345)
DlnLH	0.097***	0.098***	0.095*	0.116**	0.047	-0.512
	(2.704)	(2.708)	(1.713)	(2.293)	(0.144)	(-1.143)
lnKH_og_avg	0.001	0.006	**0.024*** **	0.000		
	(0.897)	(1.528)	**(3.234)**	(0.091)		
lnKH_og_avg,L					**0.038*** **	0.007
					(3.627)	(0.806)
log_backp = L,	**0.004***	**0.017***	**0.052*** **	0.011	**0.083*** **	0.030
	(1.896)	**(1.860)**	**(3.069)**	(0.761)	**(3.215)**	(1.082)
cL2.log_backp#c.lnKH_og_avg		0.002	**0.009*** **	0.001		
		(1.414)	**(2.997)**	(0.314)		
cL2.log_backp#c.L2.lnKH_og_avg					**0.014*** **	0.003
					(3.090)	(0.821)
Observations	1,278	1,278	624	654	610	637
Number of ctrysec	107	107	52	55	0.284	0.040
Year and Ind FE	gls				IV	
z-statistics in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Note: All regressions contain country, industry and time fixed effects and controls for K^{NonICT} and Labor composition.

The table shows that the main determinants of productivity growth hold also for service sectors, with intangible investment playing a positive and significant role. However, when considering all sectors together irrespective of their digital intensity, we find no complementary effect between organizational capital and backward participation (columns 1 and 2).

Columns 3 and 4 test the complementarity effect of organizational capital and backward participation distinguishing between high and low digital industries. The estimates support the assumption of a strong complementarity in high digital intensive sectors. In low digital intensive industries, most of the variables are not statistically significant. These results indicate stronger productivity effects of GVC integration complemented by investment in organizational capital in high digital intensive sectors. In columns 5 and 6 we check the robustness of results in columns 3 and 4 lagging at time t-2 organizational capital intensity to investigate possible slower effect of managerial capabilities. Results in column 5 confirm a stronger lagged mediating impact of organizational capital.

Overall, ss already shown by Jona-Lasinio and Meliciani (2019), our findings support the evidence that managerial practices have a positive impact on firms' productivity and profitability (Bloom and Van Reenen 2007; Bloom et al. 2016) also when we consider GVC participation.

Conclusions

Our analysis aims at assessing the role of organizational capital in the relationship between participation in GVC and productivity growth. We bridge the microeconomic literature on the role of organizational capital in GVC with the sectoral studies on the impact of GVC participation on productivity growth.

Using country-industry-time data, we find a positive and statistically significant impact of backward participation on productivity growth. We also find that the productivity returns from GVC participation increase with investment in organizational capital. Finally, we look at differences across sectors distinguishing between high digital and low digital sectors. We find that organizational capital has a direct and mediating role on productivity growth only in high digital sectors. These results confirm the complementarity between management practices and IT (Brynjolfsson and Hitt, 2000; Garicano and Heaton 2010, Bloom et al. 2012).

Overall, our findings suggest that the productivity impact of GVC participation strongly depends on investment in organizational capital especially in high digital intensive sectors. The strong asymmetries in managerial capabilities across countries and sectors may, therefore, lead to very asymmetric productivity gains from GVC participation (Durand and Milberg 2018).

The results of this paper suggest that further analysis considering different modes of participation (backward and forward) and position in GVC, and different intangible assets, including the role of training, would help qualifying further the conditions under which participation in GVC fosters productivity growth.

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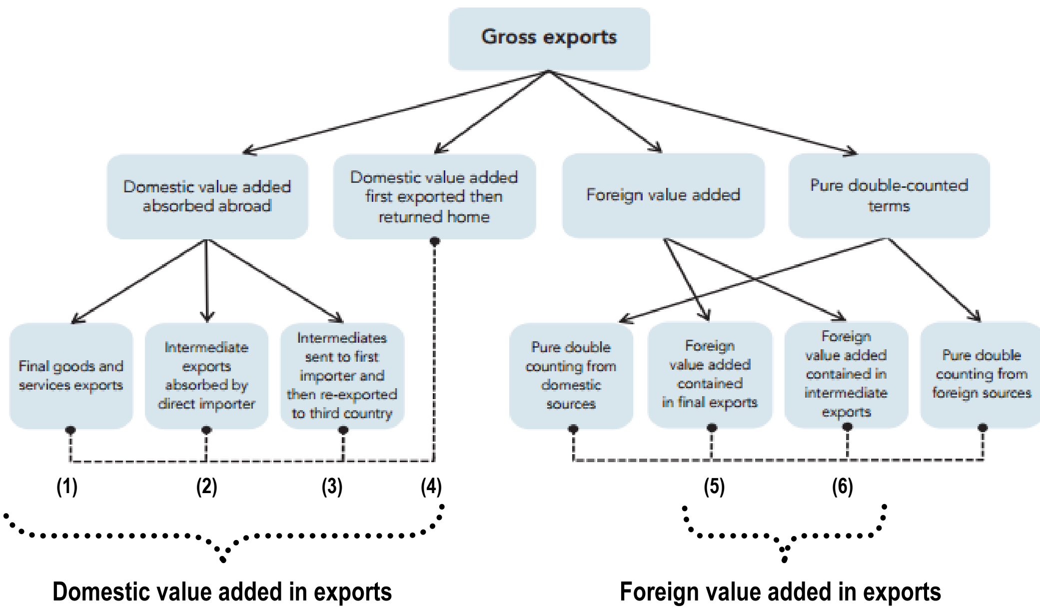
Appendix (TBC)

Figure A-1 Gross trade accounting framework



Source: adapted from WBG-IDE-OECD-UIBE-WTO (2017)

Table A1 –Testing 3 classes of digital intensity

	(1)	(2)	(3)	(4)	(5)	(6)
	Intangibles exc R&D					
VARIABLES	**High**	**Medium**	**Low**	**High**	**Medium**	**Low**
DlnKH_intan_xrd	0.396***	0.095***	0.133**	0.537**	0.196	-0.328
	(7.790)	(3.651)	(2.429)	(2.126)	(1.209)	(-0.772)
DlnKH_rd	-0.026	-0.002	0.021	-0.132	-0.197	0.188
	(-1.383)	(-0.123)	(1.026)	(-1.232)	(-1.238)	(0.531)
DlnKH_ICT	0.018	0.061***	0.029	-0.041	0.010	0.027
	(0.884)	(4.237)	(1.260)	(-0.557)	(0.167)	(0.254)
DlnKH_NonICT	0.156***	0.121***	0.245***	0.219	0.220	0.174
	(2.810)	(3.719)	(3.683)	(0.811)	(0.920)	(0.385)
DlnLH	0.290**	0.111**	-0.048	1.362*	0.210	-1.984
	(2.267)	(2.547)	(-0.453)	(1.735)	(0.959)	(-1.232)
lnKH_og_avg	**0.031****	0.006	0.008	**0.122****	**0.087****	0.235
	(2.356)	(1.341)	(0.779)	(2.149)	**(2.054)**	(0.859)
log_backp = L,	**0.065***	0.014	0.045	**0.316****	0.155	0.526
	(1.917)	(1.314)	(1.179)	(2.114)	(1.378)	(0.737)
c.lnKH_og_avg#cL2.log_backp	**0.011***	0.002	0.006	**0.056****	**0.036****	0.109
	(1.843)	(1.239)	(0.994)	(2.041)	**(2.020)**	(0.807)
Observations	360	552	462	350	552	450
Number of ctrysec	32	47	47	32	47	47
Year and Ind FE		**GLS**			**IV**	
z-statistics in parentheses						
***** p<0.01, ** p<0.05, * p<0.1**						

Note: All regressions contain country, industry and time fixed effects. To control for endogeneity of capital inputs we all specifications have been tested with GMM.