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Abstract. Global value chains (GVCs) are a major feature of globalization, with a strong impact on the patterns of international trade. In this paper we take the analysis one step forward, studying the impact of GVCs on cross-border mergers and acquisitions (M&As). We test the two symmetric hypotheses that a higher degree of participation in GVCs of a supplier sector to the exports of a user sector (e.g., the assembly in China of cell-phones eventually exported to US and, in turn, to the rest of the world) encourages: (i) firms in the user sector to acquire foreign participations in the supplier sector; and (ii) firms in the supplier sector to acquire foreign participations in the user sector. Our analysis is based on a unique dataset covering 12 supplier and user sectors, for over 22 investor countries and 47 target countries between 1995 and 2010. Estimating an augmented gravity equation model of cross-border M&As, inflated with a large number of bilateral sector and country fixed effects, we find strong support that a higher GVC participation has a positive impact on the size of M&As in both the user and the supplier sectors.

Keywords: Global Value Chains; Mergers and Acquisitions; Sector level.

JEL classification: F14, F23, F60

1. INTRODUCTION

Foreign direct investments (FDIs) are one of the most outstanding features of the worldwide globalization of economic activities. UNCTAD (2013) documents that between 2000 and 2007 the value of the total stock of outward FDIs more than quadrupled, from 7,4 trillion of US dollars to 30,8 trillion.

A large part of this increase is explained by two facts: the growing role of cross-border production networks and the increasing incidence of multinational enterprises (MNEs) within such networks. Cross-border production networks are better known as global value chains (GVCs), in which firms located in different countries have strong reciprocal links, with the aim of producing a single final product in a sequential chain or within a complex network.[1] The example of the iPhone is probably the best known among many other possible (Xing, 2011): iPhones are designed and marketed by Apple in the US, but most iPhone components are produced by firms in many different countries, assembled into final products in China, and then exported to the US and to the rest of the world. Indeed, although the final product is shipped from a Chinese company, this assembly process accounts for a low share of the iPhone's manufacturing value added.[2] In fact, the world share of exports that were part of a multi-stage trade process increased from 32% of world exports in 2005 to 57% in 2010. Remarkably, most part of the cross-border trade in intermediate components takes place within very complex networks involving foreign affiliates of MNEs and foreign partners connected through non-equity contractual relationships.

Fostered by the large anecdotal evidence that FDIs and GVCs are strongly interdependent phenomena, a new and growing strand of academic literature has begun to study how and to what extent this happens. Antràs and Chor (2013) and Alfaro et al. (2019) have recently expanded the theoretical framework of the seminal contribution of Antràs (2003) to study how the optimal organizational structure of cross-border activities within a GVC depends on the ability to delegate decision rights without losing control. Depending on the characteristics of the goods produced, on the stage of production at which a firm intervenes, and on a number of institutional and organizational characteristics, the optimal organization includes independent exporters, some plants or activities that are loosely integrated within the boundaries of the global firm, and other plants or activities that are instead under the firm control of the top management. A recent paper by Choi (2019) extends the model of Antràs and Chor (2013) to

[1] Among many others, UNCTAD (2013) defines GVC as borderless production systems, characterized by the fragmentation of production processes and the international dispersion of tasks and activities.

[2] For this reason, the statistics on trade in added value show that the content of the domestic added value in Chinese exports is largely outbalanced by the content of imported added value.

study the impact of financial frictions on the allocation of property rights, showing that multinational firms are more likely to acquire input suppliers if they are located in countries with weak financial institutions.

Given the increasing importance of GVCs, there is an obvious link between FDIs and international trade. On the one hand, according to UNCTAD (2013), about 80% of total world trade takes part within GVCs involving a significant role of MNEs. Even for a large developed country like the US, intra-firm trade is about 30% of total exports and more than 35% of total imports (Ruhl, 2015). On the other hand, the opposite channel is also at work, because firms whose international trade takes part mainly within a GVC may be willing to strengthen their control on foreign suppliers or foreign users by acquiring a participation on those firms. For example, the Chinese company that assembles the iPhones may decide to acquire the Japanese company that supplies some of its parts and components, or the Turkish firm that sells most of its nuts to the Italian chocolate company may find it optimal to acquire it.

Consistent with this second channel of transmission, suggesting that international trade within GVCs can have an impact on the pattern of cross-border FDIs, the aim of this paper is to put under empirically scrutiny the following two hypotheses:

1. *the supplier target hypothesis*: firms in sectors with a stronger involvement in GVCs as international suppliers (i.e., those with strong downstream linkages) are more likely to be the targets of cross-border M&As by part of firms operating in the foreign sectors acquiring their products;
2. *the user target hypothesis*: firms in sectors with a stronger involvement in GVCs as international buyers (i.e., those with strong upstream linkages) are more likely to be the targets of cross-border M&As by part of firms operating in the foreign sectors selling them their products.[3]

Our empirical analysis follows a large strand of literature on the determinants of FDIs (see, for example, Di Giovanni, 2005, and Head and Ries, 2008). Consistent with this literature, we test the two hypotheses described above using as dependent variable the total value of M&As of a given sector of the investing country in a given sector of the target country and as the main explanatory variable a GVC participation index. The latter is measured as the ratio of the total value added from a supplier sector in exporting country embodied in the total exports of the user sector in the destination country, and the total gross exports of the destination country. Two crucial issues concerning our measures of FDIs and GVCs must be mentioned at this stage.

[3] In the iPhone GVC example, we are interested not only in the fact that China assembles components and parts and then re-exports to the US (that eventually re-exports to the rest of the world), but also in the fact that China imports a significant share of the value of its exports from other foreign suppliers.

First, firms can integrate cross-border activities within a GVC not only through a merger or an acquisition but also by a greenfield FDI. Our focus on M&As only – similar, for example, to Head and Ries (2008) – is motivated by the fact that very detailed data on these operations are collected by commercial providers, such as Thomson Financial with is SDC database, while no comprehensive data on FDIs disaggregated at the time, sector and country level are available. While this may appear as a weakness of tour analysis, a large evidence documents that a large part of the stock of FDIs is the result of M&A. Moreover, since M&As typically have a lumpy behaviour, we consider their aggregate value across over a decade, exploiting the time dimension of our dataset only to pre-date the measure of participation into GVCs (and for some robustness checks). Second, our index of GVC participation, obtained from the OECD TiVA indicators, is the share of the value added imported by each sector of the user country from each sector of the supplier country, over the total value of exports the user country. As such, it does not consider domestic consumption of the final goods exported. For example, it does account for the value added of Chinese exports in the US exports of iPhones to other foreign countries, but it does not take into account the value added of Chinese exports in the domestic sales of iPhones in the US. While this could potentially affect our results, to the best of our knowledge data on GVC participation that includes also the foreign value added contribution to domestic sales are not yet available. Therefore, either we consider our measure as an imperfect proxy of the participation GVC that also includes domestic sales, or we interpret our results as identifying that part of cross-border M&As that is explained by export driven GVC participation.

Even aggregating our data over across time, information on M&As and GVC participation vary across four dimensions: investor country, investor sector, target country and target sector. This is a major strength of our empirical framework, because it allows to inflate the econometric specification with a large number of fixed effects, permitting to control for a host of potential omitted factors otherwise impossible to measure, that would seriously bias our results.[4] Moreover, as shown by Baldwin and Lopez-Gonzalez (2015), the matrix of GVC linkages is extremely sparse, with few bilateral flows significant on a global scale, a feature that allows a better identification of the links between the patterns of GVCs and those of M&As.

Our analysis provides robust evidence of a causal effect of GVC participation on both upstream and downstream cross-border M&As, thus complementing the vast empirical

[4] For example, we need not control for the value of total imports of a given country from a given sector of foreign country, because this is already captured by a dummy with the same dimension, that is identified by the fact that there are many exporting sectors in each country.

literature on the determinants of FDI, and providing additional evidence of the impact of GVCs on the organization of the cross-border activities of firms.

The rest of the paper is structured as follows. Section 2 briefly summarizes the literature that is relevant for our analysis. Section 3 introduces the empirical methodology and the econometric model. Section 4 describes the sources of our data and how they have been merged to obtain a unique dataset, and presents some descriptive statistics. In Section 5 we present and discuss the baseline results of the empirical analysis and in Section 6 we discuss some robustness checks obtained by splitting the original sample across several dimensions. Section 7 concludes.

2. RELATED LITERATURE

The literature on the determinants of FDI can be divided into two main streams: the *business-oriented*, eclectic paradigm first proposed by Dunning (1977 and 1981), and the *economic-oriented* approach, that can be referred originally to the seminal paper of Markusen (1984). According to the first strand of research, FDI are explained by three major sets of determinants: a) ownership advantages, suggesting that firms invest abroad if they have better know-how or organizational capacity compared to competitors in foreign countries; b) location advantages, related to proximity to specific input or output markets; and c) internalization advantages, suggesting that FDIs take place when owning a foreign subsidiary is more profitable than exporting or licensing foreign producers. According to the second strand of research, FDI are explained by the trade-off between plant-level economies of scale, that favour concentration of production and trade, and costs of transport and access to foreign markets, that favour instead producing abroad (Markusen, 1984).

An additional dimension in the research on FDI that is especially relevant for our analysis is the distinction between horizontal and vertical FDI. In horizontal FDI, a firm acquires or settles a foreign subsidiary with the purpose of producing abroad the goods that it would have otherwise exported, so to save on the trade costs associated with exporting. In vertical FDI, a firm acquires or settles a foreign subsidiary that either produces some of its relevant inputs, or instead uses its products as inputs in its manufacturing process. Vertical FDI are typical in the case of GVC, when the production process is fragmented and each stage can be located in a different country, to access specific resources not available elsewhere or to exploit lower factor prices.

Building on the seminal paper by Ronald Coase (1937), a strand of literature studies the determinants of vertical FDI as an aspect of the more general issue of the determinants of firm boundaries and of its organization (Grossman and Hart, 1986). Using this conceptual

framework, Antràs (2003) has adapted an incomplete-contracting, property-rights model to a standard trade model with imperfect competition and product differentiation, being able to account for a large number of features of the patterns of intra-firm international trade. Building on similar grounds, Antràs and Helpman (2004) develop a model with incomplete contracts in which both final-good producers and suppliers located in different countries undertake relationship-specific investments that enhance the value of their firms. Antràs and Chor (2013) extend this analysis building a model of a firm with a continuum of stages of production, which yields a characterization of the optimal allocation of ownership rights along the value chain. More recently, Alfaro et al. (2019) have expanded the model of Antràs and Chor (2013) to study the extent of control that firms should optimally exert over the different segments of their production processes, showing that contractual frictions play an important role in shaping the integration choices of firms around the world. On a similar ground, Choi (2019) shows that input suppliers located in countries with weak financial institutions are more likely to be acquired by MNEs.

The empirical literature on FDIs has focused mainly on aggregate data, at the country of sector level, often within the framework of gravity models. Indeed, gravity models of cross-border capital movements still lack a robust theoretical microfoundation as that provided to international trade models by the seminal contribution of Anderson and van Wincoop (2003), but nonetheless their application dates back at least to Eaton and Tamura (1994), who show that the standard determinants of international trade in gravity models – size (population), income per-capita, and distance – also explain the pattern of FDIs. More recent analyses have expanded the original set of explanatory variables, showing that FDIs are also explained by cultural differences (Di Giovanni, 2005; Head and Ries, 2008), regulatory and institutional characteristics, such as accounting standards, the degree of shareholder protection, taxation (Rossi and Volpin, 2004; Daude and Fratzscher, 2008; Erel et al., 2012), the development of financial markets (Di Giovanni, 2005) and bilateral trade (Erel et al., 2012).

Our analysis contributes to the gravity-based empirical literature on FDI, showing that participation to GVC is an important additional determinant of vertical acquisitions. Recently, two papers closely related to our analysis have showed that FDI are positively associated with the participation of both origin and destination countries to GVC. Using bilateral country level data, Martínez-Galán and Fontoura (2019) show that a stronger participation in GVCs is associated with a larger stock of inward FDIs, and Carriol-Caccia and Pavlova (2019) report that trade openness has a negative impact on M&As between developed countries, but upstream exports have instead a positive relationship with M&As. Our research improves these analyses

because it exploits also the sector-level dimension of the pattern of participation in the GVCs and in that of M&As. This additional dimension allows us so to inflate the econometric specification with a large number of dummies, a methodology that could not have been followed using only country-level data. In addition, similar to Carriol-Caccia and Pavlova (2019), we disentangle the vertical relationships of sectors involved in a GVC by testing the two different hypotheses discussed above, focusing respectively on upstream and downstream linkages.

A large strand of literature has also studied how the institutional characteristics – both in the domestic country (push factors) and in the host country (pull factors) – impact on foreign investment. Bénassy-Quéré et al. (2007) explain several reasons why the quality of institutions may matter for attracting FDIs, and show that overgrown bureaucracy, corruption, underdeveloped credit markets and inefficient legal institutions discourage significantly inward FDIs. Di Giovanni (2005) finds that deep financial markets in the acquisition countries can play a significant role in cross-border M&A. Rossi and Volpin (2004) provide evidence that M&A are more common in countries with better accounting standards and stronger shareholder protection. Hyun and Kim (2010) show that the value of M&A can increase depending on the institutional quality of the host country (and financial deepening of the source country).

Following this strand of literature, we also study the role of institutional characteristics. While it is difficult to disentangle the drivers of the increase in the expansion of cross-border M&As from those with a specific impact on the diffusion of GVCs, as discussed by Hillberry (2011) and Amador and Cabral (2017), within the framework of our analysis it is nonetheless possible to verify if the impact of GVCs on M&A can be moderated by the differences in the institutional environment of the target country. Our hypothesis is therefore that GVC participation affects proportionally more the international transactions of those industries that invest in countries with more efficient institutions.

3. EMPIRICAL METHODOLOGY

To assess if a higher GVC participation of a using sector positively affects upstream cross-border M&As to the suppliers' sector (*the supplier target hypothesis)*, we adopt the following baseline specification:

$$M\&A_{ih,jz} = \beta_1 GVC_{jz,ih} + \delta_{ijh} + \delta_{ijz} + \delta_{ihz} + \delta_{jhz} + \varepsilon_{ihjz} \quad (1)$$

where $M\&A_{ih,jz}$ is the average value of mergers and acquisitions from sector *h* in country *i* to sector *z* in country *j* over the period 2000-2010, and $GVC_{jz,ih}$ is the participation index in GVC of the supplier sector (*z*) in country (*j*) in the user sector (*h*) in country (*i*). More precisely, the GVC participation index is defined as the average value over the period 1995-1999 of the ratio of total value added from the supplier sector (*z*) in origin country (*j*) embodied in the total exports of the user sector (*h*) in destination country (*i*), $EXGR\_BSCI_{jz,ih}$, and the total gross exports of destination country *i*, $EXGR_i$:

$$GVC_{jz,ih} = \frac{EXGR\_BSCI_{jz,ih}}{EXGR_i} \text{x} 100 \qquad (2).$$

In other terms, the GVC participation index is defined as the *imported value added* embodied in sector-level exports, as a share of total gross exports of a country. For instance, it measures the share of value added produced by the electronic component sector in Japan and embodied in exports of the electronic component sector in China, on China's gross exports, or the share of value added produced by the nut farming sector in Turkey embodied in exports of the chocolate manufacturing sector in Italy, on Italy's gross exports. By construction, this index includes at the numerator all the sector pairs selected in our dataset, and at the denominator the total value of exports of country *i*, including all sectors. Finally, as already mentioned above, we inflate our specification including a set of dummies for all possible triple combinations of suppliers' and users' countries and sectors: δ_{ijh}, δ_{ijz}, δ_{ihz}, δ_{jhz}.

Similarly, to test the *user target hypothesis*, predicting that a higher GVC participation of a supplier sector positively affects downstream cross-border M&As to the users' sector, we adopt the following specification, where the explanatory variable is the same as that in equation (1):

$$M\&A_{jz,ih} = \beta_1 GVC_{jz,ih} + \delta_{ijh} + \delta_{ijz} + \delta_{ihz} + \delta_{jhz} + \varepsilon_{ihjz} \qquad (3).$$

Note that the only difference between equations (1) and (3) is that the former has as dependent variable the value of upstream cross-border M&As from sector *h* in country *i* to sector *z* in country *j*, while the latter has the value of downstream cross-border M&As from sector *z* in country *j* to sector *h* in country *i*. Clearly, since the direction of cross-border M&As is opposite in the two specifications, the measure of GVC participation is identical, because otherwise both specifications would test the same hypothesis.

In both specifications, the dependent variable is the average value of M&As in a given time period and the explanatory variable is the average of the GVC participation index during a non-overlapping preceding period. This allows to control for two major issues arising with our empirical specification: first, that the patterns of M&A are characterized by waves (as documented for example by Brakman et al., 2005, and as we will show in Section 4); second, that we may face reverse causality problems, because a larger value of inward M&As from sector *h* of country *i* to sector *z* of country *j* also causes this latter sector to increase its GVC related exports to sector *h* in country *i*. Indeed, Buelens and Tirpák (2017) show that foreign investors play an active role in shaping host economies' export structure and their participation in international production networks.

Other standard determinants of M&A, in a gravity framework, include sector-level GDP in the source and the host country, geographical distance, and additional bilateral control variables such as common border, common language, common religion, common currency or bilateral treaties or agreements. These variables are usually found in the empirical gravity literature as influencing both trade (Baier and Bergstrand, 2009) and FDI (Head and Ries, 2008). However, our empirical framework allows for inflating the specification by including bilateral country dummies for each sector of the origin country (δ_{ijh}), bilateral country dummies for each sector of the destination country (δ_{ijz}), bilateral origin and destination sector dummies for the origin country (δ_{ihz}), and bilateral origin and destination sector dummies for the destination country (δ_{jhz}). These fixed effects absorb all the dimensions of the explanatory variables used in the literature.[5]

An appropriate assessment of the relationship between the GVC participation index and M&A at country-sector level requires the use of disaggregated data. Working at this level implies that our database is inflated by many "zeros", that create well-known problems in the log-linear form of the model to be estimated. However, the exclusion of these observations would lead to a sample selection bias, since the zero flows could be the result of precise economic choices based on the potential profitability of engaging in M&A transactions. Santos Silva and Tenreyro (2011) showed that these problems can be tackled estimating the gravity model using a Pseudo Poisson Maximum Likelihood (PPML) specification, which gives consistent estimates also in the presence of heteroskedasticity, and is reasonably efficient, especially in large samples. Accordingly, in our baseline specification, we estimate our model

[5] Geographical distance, for example, would be perfectly collinear with bilateral country dummies, which would be themselves collinear with the bilateral country dummies for each sector of the country of origin and of destination.

in multiplicative form using the PPML estimator, as for example Fally (2015) and Yotov et al. (2016).

Since the large proportion of zeros in the dependent variable with multiple fixed effects and cluster standard errors leads to computational problems and seriously affects the performance of the estimator, in the PPML estimates we opt for a reduced structure of fixed effects including country-pair fixed effects and country-sector specific fixed effects. However, to test the robustness of these results we also estimate a least-square dummy variables (LSDV) regression with both the reduced and the full structure of fixed effects, finding results broadly consistent with those obtained using the PPML specification.

4. DATA SOURCES

Data on cross-border M&A transactions at the firm-level are obtained from the SDC Platinum Global Mergers and Acquisitions database produced by Thomson financial, which records the number of acquisitions and their value for all deals entailing a change in ownership of at least 5% of total equity, exceeding US$1 million.[6] The dataset allows the analysis of cross-border M&As for a large range of countries, sectors and years. For the purpose of our analysis, and consistently with the literature on cross-border M&As, we focus on the value of the operations, and therefore we do not consider undisclosed and incomplete deals for which the value of transaction is not available.[7] The database also contains information on target and investor profiles (e.g., primary industry at the 3-digits SIC level and location), that are used in our empirical analysis to reconcile transaction data with the GVC participation index.

Data on GVC participation, measured via intermediate imported value added embodied in domestic exports, are obtained from the OECD-WTO TiVA (trade in Value-Added) database, edition 2016.[8] The TiVA indicators are based on the OECD's Inter-Country Input-Output (ICIO) system, which consists of a set of symmetric industry by industry global input-output tables. The standard industry list (STAN) in TiVa is based on International Standard Industrial Classification (ISIC) Rev. 4 and is compatible with the NACE Rev. 2 classification used by EU

[6] The main sources of information of data on M&A are financial newspapers and specialized agencies such as Bloomberg and Reuters. However, until the mid-1980s, Thomson focused very much on M&A for the United States only, and for only the last twenty years or so that (systematic) M&A data gathering took place for other countries (Brakman et al., 2005).

[7] Another excluded group is that of domestic M&A, that is, acquisitions with acquirer and target located in the same country that could still provide access to foreign markets if the target firm is active abroad or if the acquirer is controlled by a foreign firm. However, in the former case we do not know what foreign markets are (possibly) involved, and in the latter case we have no information about foreign controls.

[8] Though we rely on a more restricted sample, the TiVA database includes 61 economies covering OECD, EU28, G20, most East and South-east Asian economies and a selection of South American countries. The industry list covers 34 unique industrial sectors, including 16 manufacturing and 14 services sectors, in the years 1995-2011. OECD-WTO TiVA database is publicly accessible at https://stats.oecd.org/.

member countries. Since our measures of M&A are available at the SIC classification, we reconciled the different series according to the schemes presented in Table A1.

From the TiVa database, we select a set of sectors, origin and destination countries that have stronger GVC and cross-border M&A connections. We make this choice because the full matrix of bilateral connections across sectors and countries includes over 4 million observations and is far too sparse to be analysed. Our original dataset averaged over the two non-overlapping periods considered in the empirical analysis includes 148,896 observations for 12 supplier and user sectors (agriculture, forestry and fishing, mining, construction and manufacturing), for a sample of 22 investor countries and 47 target countries, over the period 1995-2010. However, since we include four set of fixed effects to estimate equations (1) and (3), and in many cases the level of M&A is zero within the same group and singleton observations are thus produced, our estimation sample includes 66,303 observations.[9]

4.1 Descriptive statistics

Figure 1 shows the average global imported value added as a share of global exports. This share is slightly decreasing over the sample period and drops by about 15% in 2008 compared to the initial value of 1995. However, in the two years following the global financial crisis, the index shows a recovery.

Figure 2 reports the pattern of sector-level exported value added as a share of user's country gross exports, for the 12 supplier sectors considered in the econometric analysis, distinguishing those above the sample median (0.1% of exported value added incorporated in total exports; Panel A) from those below (Panel B). All sectors but 'Mining and quarrying' and 'Manufacturing nec, recycling' either experienced a decrease in their GVC involvement as exporters over the sample period, or at best maintained their participation broadly unchanged. The fastest decrease in GVC participation is observed for 'Electrical and optical equipment' and for 'Textiles products, leather and footwear'. We also notice that, globally, 'Chemicals and non-metallic mineral products', 'Electrical and optical equipment', 'Transport equipment', 'Food products, beverages and tobacco', 'Wood, paper, paper products, printing and publishing' and 'Machinery and equipment, nec' present the largest share of exported value added on country's exports.[10]

[9] Keeping singleton groups in regressions with multiple fixed effects and cluster-robust standard errors is computationally inefficient and can overstate statistical significance, thus leading to incorrect inference; Table A2 provides a synthetic description of origin and destination countries used in our empirical analysis.

[10] In interpreting these patterns, it is worth recalling that if firms that previously exported intermediates for final assembly begin to carry out the final assembly process themself, all other things being equal, this causes a fall in its GVC participation index (https://www.oecd.org/sti/ind/TiVA_2015_Guide_to_Country_Notes.pdf).

Figure 3 depicts the evolution of the total value of all cross-border outward M&As. Clearly, there is substantial variation over time, with periods of rapid increase followed by periods of rapid decline. Two merger waves can be identified: the first wave took place over the period 1996-1999, and the second between 2003 and 2007. The decline after the global financial crisis was more rapid than that started in 1999. Over the period analysed, cross-border M&As reached their peak value in 2007.

Since the value of cross-border M&As varies substantially for the world as a whole, as seen in the previous figure, we should observe that this variation is even more substantial at the sector level.

To verify whether this is indeed the case, in Figure 4 we report the evolution of all cross-border M&A over time for each investing sector. Sectors such as: 'Mining and quarrying', 'Food, beverages and tobacco', 'Chemicals and non-metallic mineral products', 'Basic metals', 'Electrical and optical equipment' and 'Machinery and equipment, nec' substantially contributed to the two waves of cross-border M&As over the period. Other sectors report very low levels of deals over the entire period. However, almost all sectors experienced a peak of transactions' value in 2007 followed by a decease.

Considering the contribution of each supplier country to total exports of destination country, Figure 5 reveals that Canada, the USA, Japan and Germany played an important role in GVC, providing the highest VA contribution to exports of destination countries. In most countries the contribution to foreign exports has decreased over the sample period, with the notable exception of China.

Finally, considering the contribution of each investing country to total cross-border M&A transactions, we can identify three groups of countries in Figure 6.

The first group includes countries with an average share higher than 10%, which are USA and Great Britain. The second group includes countries accounting for at least 5% of world transactions, i.e. Canada, Switzerland, Germany, France and the Netherlands. All other countries account for less than 5% of total transactions.

Table 1 reports the descriptive statistics of the share of GVC participation index and of the M&A transaction values, both for the entire sample and for the sub-sample of sector-countries with non-zero transactions.

Both M&A and GVC participation display a very high variability. In particular, the average value of M&A transactions is 12.38 million dollars, with amounts ranging from zero to over 78 billion dollars. Considering only sectors with a strictly positive value of cross-border M&As, the average increases significantly (332 million dollars), with a minimum value of just 100.000

dollars. GVC participation, our key explanatory variable, shows an average value of 0.004%, with values ranging from 0 to 2.12%.[11]

To test the hypothesis that institutional characteristics affect the impact of GVC participation on M&A we collected data on a number of country specific features. First, we consider governance quality, that we measure using the World Governance Indicators (WGI) of Kaufmann et al. (2007), focusing specifically on rule of law, regulatory quality and control of corruption. The first indicator (*rule of law*) captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, police, and courts, as well as the likelihood of crime and violence. *Regulatory quality* captures the ability of the government to formulate and implement sound policies and regulations, that permit and promote private sector development, allowing swifter contracting and better enforcement. Descriptive statistics of these indicators are reported in Table 2. The lowest values for rule of law are those of Russia (-0.89 and -0.97, respectively), whereas the lowest regulatory quality is that of Vietnam (-0.62). The maximum value for regulatory quality is that of Singapore (1.90), and for rule of law that of Finland (1.95). The *property rights* indicator, which we measure using an index produced by the Heritage foundation, based on the ability to accumulate private property and wealth, ranges from 10.31 in Vietnam to 90.67 in New Zealand.

5. BASELINE RESULTS

5.1 The supplier target hypothesis

The first hypothesis that we put under empirical scrutiny is that firms in sectors with a stronger involvement in GVCs as international suppliers (i.e., those with strong downstream linkages) are more likely to be the targets of cross-border M&As by part of firms operating in the foreign sectors acquiring their products.

Table 3 reports the coefficients of the impact of GVC participation of the supplier sector, averaged over the period 1995-1999, on M&A transactions from the user to the supplier sector, averaged over the period 2000-2010. Results obtained using PPML estimation are reported in column 1, whereas columns 2 and 3 show the results of the LSDV estimation, with different combination of fixed effects: country-pair fixed effects and country-sector specific fixed effects (column 2) and all fixed effects (column 3). The sample includes the cross-section of 66,303 sector-country observations.

[11] These small values are not surprising since this measure is the share of sector imported value added, re-exported to other countries, and importing country's gross exports.

All specifications confirm that sectors with a stronger participation in GVCs as international suppliers experience in the following years a larger amount of cross-border M&As as targets, by firms operating in the foreign sectors using their products. These results are consistent with the evidence provided by Martínez-Galán and Fontoura (2019) at the aggregate level, and show that a higher GVC participation is a channel to increase cross-border M&As.

The coefficient of 3.93 reported in column 1, that is statistically significant at the 10% level, indicates that a one standard deviation variation in the GVC participation index (0.03%) causes an increase in the value of cross-border M&As of about 0.12%.[12] Similar results, reported in column 2, are obtained estimating the supplier's hypothesis using the LSDV. The coefficient of 4.95, statistically significant at the 1% level, indicates a slightly stronger effect, with a one standard deviation increase in the GVC participation index implying an increase in the value of cross-border M&As of about 0.15%. When we include the complete set of fixed effects to account for all possible determinants of M&A (column 3), the impact is lower, but it remains positive and highly statistically significant. The coefficient of 1.46 implies that a one standard deviation increase in GVC participation causes an increase of cross-border M&As of about 0.04%. Our results provide indeed support to the supplier target hypothesis, although the economic impact is rather small. Reassuringly, they are confirmed using different econometric specifications.

Since the LSDV model including the full set of fixed effects gives broadly the same results as the PPML model, and the number of zeros in our data is significant, in the following we adopt the PPML specification as our preferred estimation method.[13]

Figure 3 shows a strong decrease of cross-border M&A transactions after the financial crisis. For this reason, we replicate our analysis distinguishing the impact of the GVC participation index, averaged over the period 1995-1999, in the periods before and after the global financial crisis (2000-2007 and 2008-2010, respectively). Results reported in columns 1 and 2 of Table 4 show that the sign and significance of GVC participation remain unchanged. The coefficient of 3.42 for the pre-crisis period, statistically significant at the 5% level, implies that for a one standard deviation change in GVC participation index, M&A increase by 0.10%, an impact that is comparable to that reported in column 1 of Table 3. However, when we consider the post-crisis cross-border M&As (column 2), the impact is three times larger than

[12] For example, moving from a very low level of GVC participation in a supplier sector in a country, such as Mining and quarrying in Hong Kong, to the level of GVC participation recorded in Norway for the same sector, the value of M&A increases by 0.12%.

[13] Our main results on the impact of GVC are robust to the inclusion of gravity variables (such as distance, common language, colonial links, contiguity and remoteness indexes) in place of the set of country-pair fixed effects. See the result in Appendix.

that of the pre-crisis period. In this case, an increase of the GVC index of one standard deviation (0.03%) causes an increase in the value of cross-border M&As of 0.29%. With the financial crisis, the role of GVCs became a much more relevant determinant of foreign acquisitions than before. Because the value of cross-border M&As shows two major waves during our sample period, we have also analyzed the impact of the average participation in GVCs between 2001-2004 on the value of cross-border M&A transactions between 2005 and 2010 (column 3 of Table 4). Reassuringly, also in this case, we find a positive and statistically significant impact of GVC participation on cross-border M&As.

5.2 The user target hypothesis

The second hypothesis that we test is that firms in sectors with a stronger involvement in GVCs as international buyers (i.e., those with strong upstream linkages) are more likely to be the targets of cross-border M&As by part of firms operating in the foreign sectors selling them their products.

The results reported in Column 1 of Table 5 provide support also to this second hypothesis. The coefficient of 6.45, statistically significant at the 1% level, implies that the impact on cross-border M&As by supplier is about double that on cross-border M&As by user, reported in Table 3. An increase of GVC participation of one standard deviation (0.03%) implies an increase in cross-border M&As by 0.19%. Similar results are obtained estimating a LSDV model, although the coefficients are smaller: 3.29 with the same set of dummy variables as in the LPPM specification, and 0.94 including all fixed effects.

Table 6 confirms that also considering different sample periods to test the user target hypothesis the previous results are broadly unchanged.

As in the case of the supplier target hypothesis, the positive impact of GVCs on cross-border M&As is stronger in the years following the global financial crisis, and it is confirmed across different time periods (as shown by the coefficient of 8.67 and 3.89, respectively).

Taken as a whole, our results show that the involvement in GVCs has a positive and statistically significant impact on cross-border M&As, both upstream and downstream. The economic impact is on average limited, becoming significant only in the case of very high values of the index of GVC participation.[14]

Our econometric specification allows to control perfectly for the impact of country and sector characteristics by means of the fixed effects included. However, as argued above, country and sector characteristics may have an impact on the extent to which GVC participation affects

[14] It is worth recalling that the distribution of the index of GVC participation is extremely skewed, with a mean of 0.004%, a standard deviation of 0.03% and a maximum value of 2.12%.

cross-border M&As. In the following, we will test this additional set of hypotheses.

6. SAMPLE SPLIT BY COUNTRY AND SECTOR CHARACTERISTICS

The 47 target countries included in our sample are extremely heterogeneous in terms of institutional quality, as shown by the descriptive statistics reported in Table 3. When the target country has an institutional environment which is more supportive of market transactions, the effect of GVCs on cross-border M&As is likely to be stronger, because bidder firms face fewer impediments in acquiring their targets.

To verify this hypothesis, we split the sample of target countries into two sub-samples, depending on the level of the institutional quality characteristic considered. Columns 1 and 2 of Table 7 present the results obtained using the PPML estimator on the two sub-samples of target countries with a level of rule of law, respectively, below and above the first quartile. The coefficient estimated in the subsample of target counties with a low level of rule of law is 2.14, significantly smaller than that estimated in the remaining subsample, that is 7.22 (column 2).[15]

In the case of the two other indices, the sample is split depending on whether the level in the target country is above or below the sample median.[16] Columns 3 and 4 show that also higher regulatory quality has a moderating effect on the impact of GVC participation: the coefficient of the equation is 2.23 in countries with low levels of regulatory quality and 7.91 in countries with high levels of this indicator. Similarly, a stronger respect of property rights has a magnifying effect on the impact of GVC participation on foreign M&A, as it is confirmed by the higher value of the coefficients estimated in the subsample of countries whose institutional development is above the median (7.43; column 5) relative to that of countries whose level is below the median (2.66; column 6).

Overall, these results provide a very neat picture on how institutional characteristics affect the size of the impact of participation in GVC on M&A: firms in sectors operating in countries where market-oriented activities find a friendlier environment are better able to take advantage of the GVC involvement. This may happen because the explicit and implicit costs of accessing foreign markets are lower, and because it is easier to find arrangements that facilitate foreign investment. Importantly, this provides strong support to the view that it is precisely in those countries that already face other types of impediments to investment activities that improving

[15] In unreported regressions, available upon request, we have verified that there are no significant differences among the effects of GVCs for target countries in the second, third and fourth quartile of the distribution.

[16] In unreported regressions, available upon request, we have verified that there are no significant differences among the effects of GVCs for target countries between the first and the second quartile, and between the third and the fourth quartile of the distribution.

the institutional quality is most beneficial.

Finally, since the descriptive statistics indicates a high degree of heterogeneity also in terms of the level of GVC participation across sectors (Figure 5), in Table 8 we report the results obtained estimating the user's and supplier's hypotheses on the two sub-sample of destination sectors that show values of the GVC participation index below and above the sample median. The results show that the impact of GVC participation on M&A is statistically significant only for the sub-sample of that have a participation in GVCs above the median. The coefficient of 7.02 obtained testing the supplier's hypothesis confirms a positive and statistically significant impact on M&A (column 2). An increase of GVC participation in sectors more involved in GVCs determines an increase in the value of M&A by 0.14%, whereas the impact for sectors less involved in GVC as importers is negligible, and statistically insignificant. Similar results are obtained testing the user's hypothesis (columns 3 and 4).

7. CONCLUSIONS

Global value chains are a distinctive feature of the process of globalization. By permitting to control for the negative effects of potentially volatile market transactions, they allow to exploit the comparative advantages of each country to a larger extent, therefore producing first order effects on the patterns of international trade.

But the effect of GVCs is not limited to trade in goods and services. Indeed, it is a very short step from deeper cross-border bilateral coordination between sellers and buyers of intermediate goods to stronger forms of partnership, such as M&As. In fact, the growing stream of literature that has applied the analytical framework of the theory of the firm to study the multination corporations has already identified a number of factors that shape the optimal structure of ownership along global value chains.

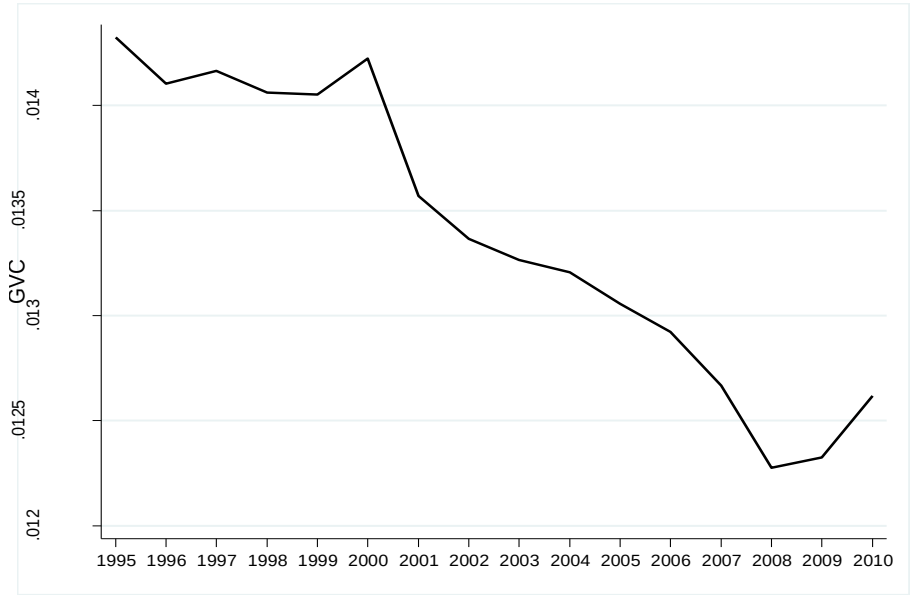
Our paper contributes to this literature by presenting empirical evidence of a causal effect of GVC participation on cross-border M&As. We exploit information on bilateral GVC participation and M&As for 12 sectors of 22 origin countries and 47 destination countries between 1995 and 2010. The structure of our data allows to estimate a gravity equation model inflated with a large number of bilateral sector and country fixed, that permit to limit significantly the impact of potentially omitted factors.

Our results confirm the existence of a highly statistically significant causal impact of GVCs on cross-border M&As, with both firms acquiring or merging with their suppliers and firms acquiring or merging with their buyers. From an economic perspective, the effect is relatively small, but it can be substantial in the case of strongly integrated GVCs. Finally, we find that the

effect is stronger when target firms are located in countries in which market-oriented activities find a friendlier environment, because they have a better rule of law, higher regulatory quality and a better recognition of property rights.

Our analysis thus complements the vast empirical literature on the determinants of firm internationalization, providing additional evidence that GVCs alter the optimal organizational structure of firms' cross-border activities.

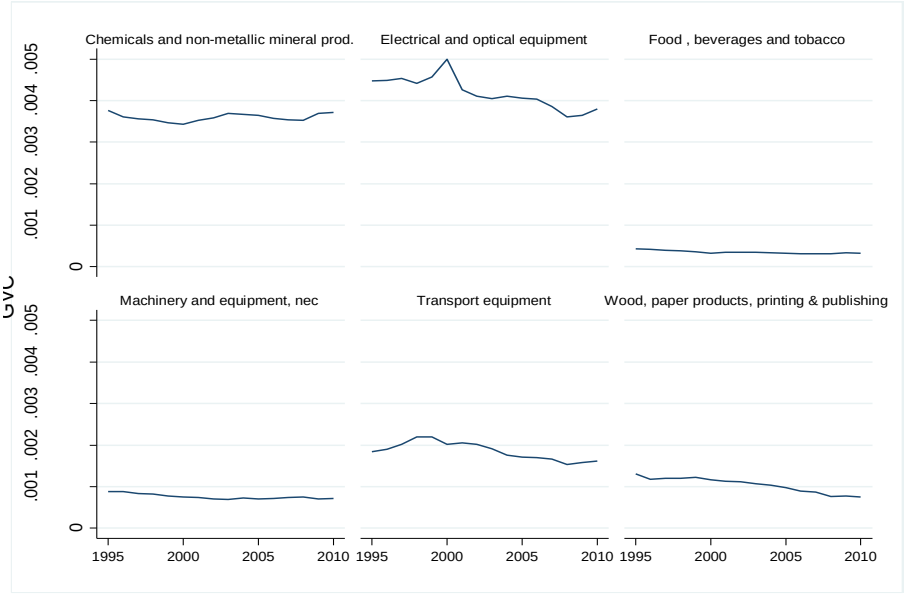
Figure 1 – Global imported value added as a share of global exports, 1995–2010 (percentages).



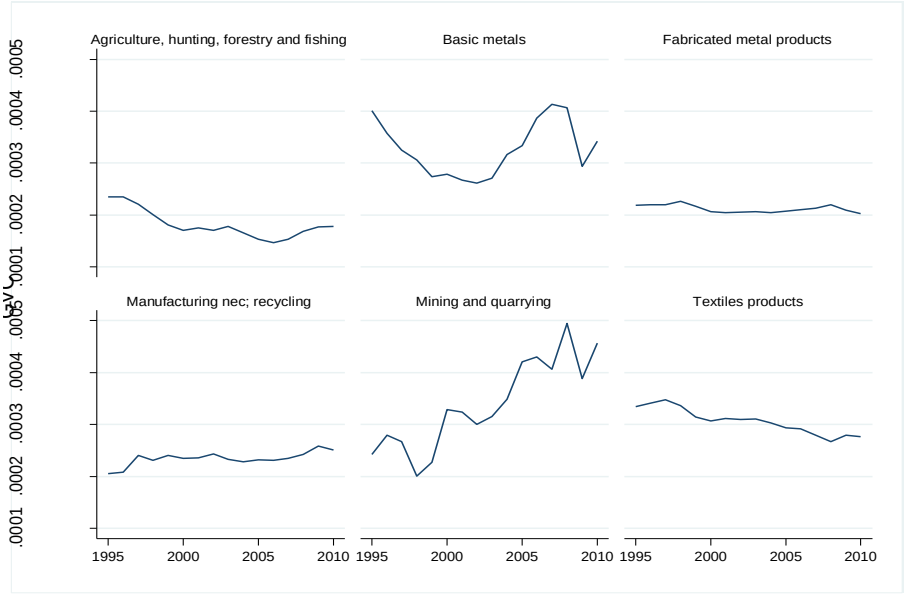
Source: Elaborations on OECD-WTO TiVA database, edition 2016. Accessible at https://stats.oecd.org/.

Figure 2 – Sector-level exported value added as a share of user's country gross exports, 1995–2010 (percentages).

Panel A



Panel B

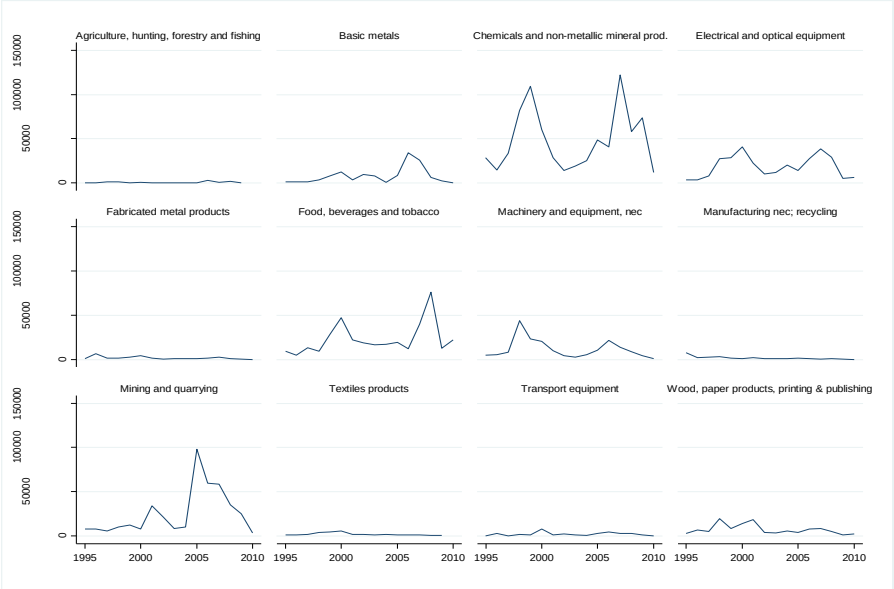


Source: Elaborations on OECD-WTO TiVA database, edition 2016. Accessible at https://stats.oecd.org/*Note*: *Panel A* reports patterns of sector-level exported value added as a share of user's country gross exports, for sectors above the sample median of GVC (0.1%). *Panel B* reports patterns of sector-level exported value added as a share of user's country gross exports, for sectors below the sample median of GVC (0.1%).

Figure 3 – Outward cross-border mergers and acquisitions transaction values (in million dollars), 1995-2010

Source: Elaborations on SDC Platinum Global Mergers and Acquisitions database, Thomson Financial Securities Data.

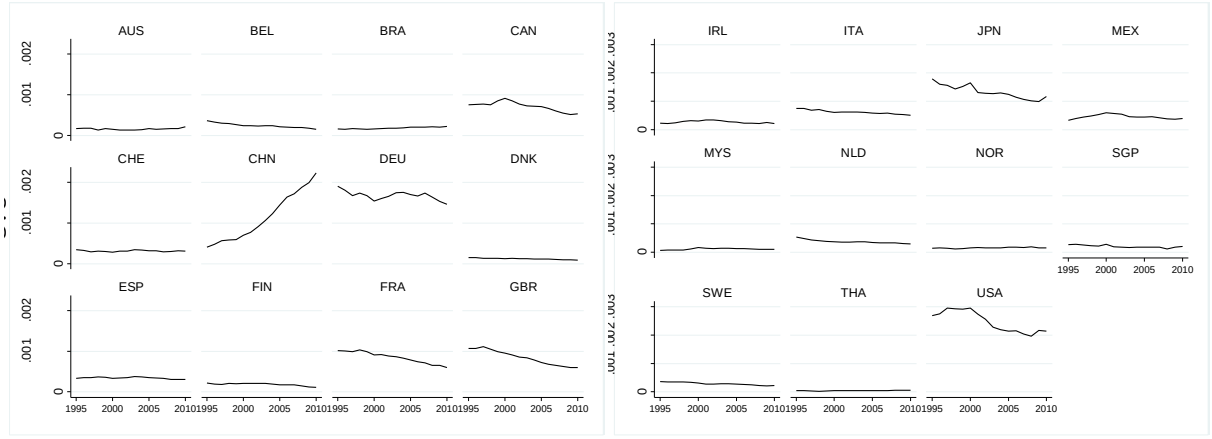
Figure 4 – Outward cross-border mergers and acquisitions transaction values by investor sector (in million dollars), 1995-2010



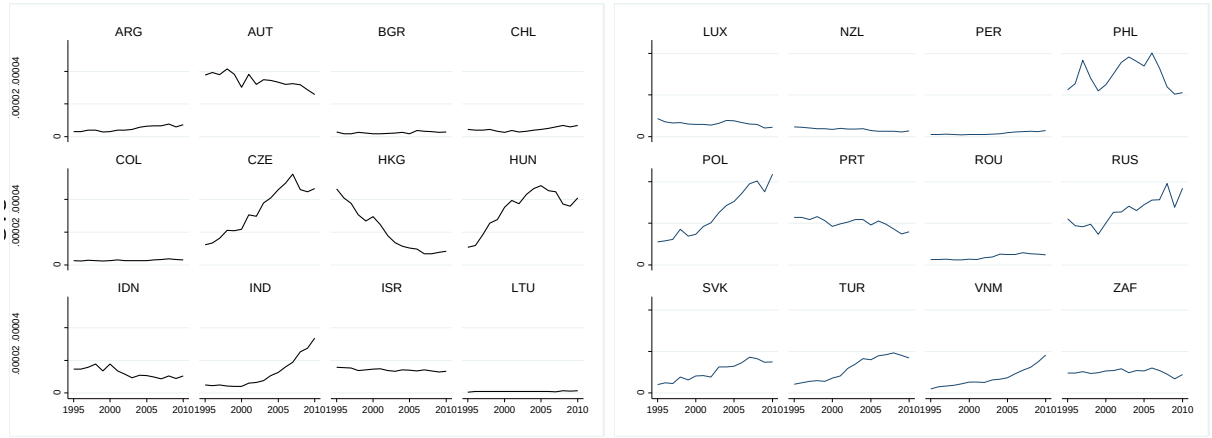
Source: Elaborations on SDC Platinum Global Mergers and Acquisitions database, Thomson Financial Securities Data.

Figure 5 – Country-level value added exported as a share of total exports of the destination country, 1995–2010 (percentages).

Panel A



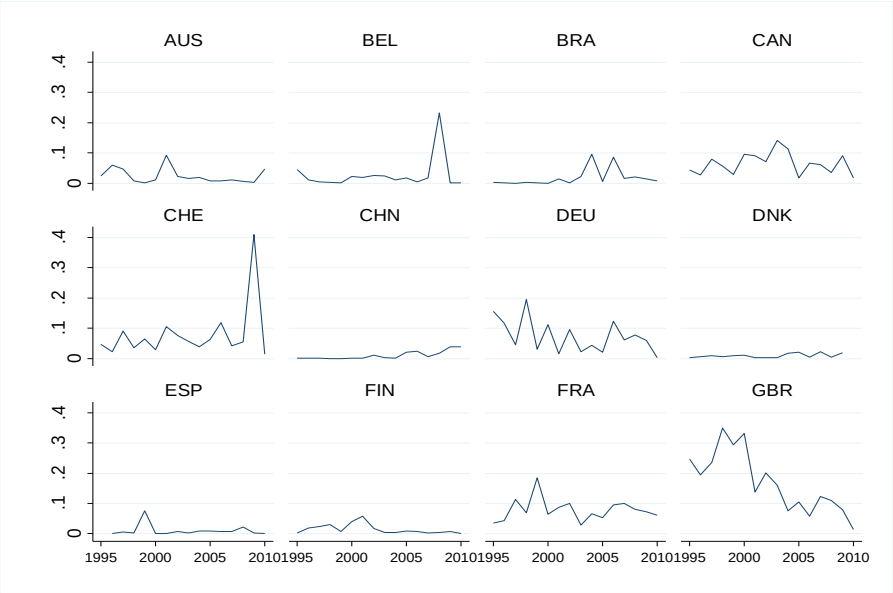
Panel B



Source: Elaborations on OECD-WTO TiVA database, edition 2016. Accessible at https://stats.oecd.org/.
Note: P*anel A* reports the country-level value added exported as a share of total exports of the destination country, for origin countries above the median level of GVC in each year. *Panel B* the country-level value added exported as a share of total exports of the destination country, for origin countries below the median level of GVC in each year.

Figure 6 – Outward cross-border mergers and acquisitions as a share of total transaction values, 1995-2010.

Panel A



Panel B

Source: Elaborations on SDC Platinum Global Mergers and Acquisitions database, Thomson Financial Securities Data.

Table 1 – Descriptive statistics

Variable	Mean	S.D.	Min	Max	N. obs.
Cross-border M&A	12.38	422.4	0	78,381	66,303
Cross-border M&A > 0	332.39	2164.93	0.1	78,381	2,469
GVC participation	0.004	0.03	0	2.12	66,303

Notes: M&A are in million dollars and GVC in percentages.

Table 2 – Summary statistics of country characteristics

Variable	Mean	S.D.	Min	Max
rule of law	0.96	0.916	-0.896	1.959
regulatory quality	1.02	0.74	-0.625	1.902
property rights	70.832	21.25	10.313	90.667

Note: data on *rule of law* and *regulatory quality* are collected by the World Governance Indicators (WGI) project and are available at https://info.worldbank.org/governance/wgi/#home. Data on *property rights* are collected by the Heritage Foundation and are accessible at https://www.heritage.org/index/explore.

Table 3 – Supplier target hypothesis: baseline results over the entire period.

	(1) PPML	(2) LSDV	(3) LSDV
GVC	3.93*	4.95***	1.46***
	(2.04)	(0.71)	(0.44)
N	66,303	66,303	66,302
adj. R^2		0.100	0.306
Fixed effect groups	*ij ih jz*	*ij ih jz*	*ijh ijz ihz jhz*

Note: this table reports the baseline PPML results (column 1) and the LSDV results (columns 2 and 3) estimated on the entire sample, averaging GVC participation index over the period 1995-1999 and M&A transaction from the user to the supplier sector over the period 2000-2010. Dependent variable in LSDV models is *log*(1 + *value of transaction*). Included (unreported) fixed effect are country-pair fixed effects and country-sector specific fixed effects in columns 1 and 2; and country pairs and exporting sector, country pairs and importing sector, sector pairs and exporting country, sector pairs and importing country in column 3. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 – Supplier target hypothesis: different sample periods.

	(1) 1995-1999 for GVC and 2000-2007 for M&A PPML	(2) 1995-1999 for GVC and 2008-2010 for M&A PPML	(3) 2001-2004 for GVC and 2005-2010 for M&A PPML
GVC	3.42**	9.79***	4.13***
	(1.60)	(3.03)	(1.27)
N	58,549	19,276	45,449
Fixed effect groups	*ij ih jz*	*ij ih jz*	*ij ih jz*

Note: this table reports the baseline PPML results estimated on different periods. In column 1, the GVC participation index is averaged over the period 1995-1999 and M&A over the pre-crisis period (2000-2007); in column 2, the GVC participation index is averaged over the period 1995-1999 and M&A over the post-crisis period (2008-2010). In column 3, GVC is averaged over the period 2001-2004 and M&A over the second wave (2005-2010). Included (unreported) fixed effect are country pair fixed effects and country-sector specific fixed effects. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 – User target hypothesis: baseline results over the entire period.

	(1) PPML	(2) LSDV	(3) LSDV
GVC	6.45***	3.29***	0.94***
	(1.45)	(0.48)	(0.32)
N	66,303	66,303	66,302
adj. R^2		0.091	0.305
Fixed effect groups	*ij ih jz*	*ij ih jz*	*ijh ijz ihz jhz*

Note: this table reports the baseline PPML results (column 1) and the LSDV results (columns 2 and 3) estimated on the entire sample, averaging GVC participation index over the period 1995-1999 and M&A transaction from the supplier to the user sector over the period 2000-2010. Dependent variable in LSDV models is *log*(1 + *value of transaction*). Included (unreported) fixed effect are country pair fixed effects and country-sector specific fixed effects in columns 1 and 2; and country pairs and exporting sector, country pairs and importing sector, sector pairs and exporting country, sector pairs and importing country in column 3. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 6 – User target hypothesis: different sample periods.

	(1) 1995-1999 for GVC and 2000-2007 for M&A PPML	(2) 1995-1999 for GVC and 2008-2010 for M&A PPML	(3) 2001-2004 for GVC and 2005-2010 for M&A PPML
GVC	6.27***	8.67***	3.89***
	(1.35)	(2.09)	(1.40)
N	58,549	19,276	45,449
Fixed effect groups	*ij ih jz*	*ij ih jz*	*ij ih jz*

Note: this table reports the baseline PPML results estimated on different periods. In column 1, the GVC participation index is averaged over the period 1995-1999 and M&A over the pre-crisis period (2000-2007); in column 2, the GVC participation index is averaged over the period 1995-1999 and M&A over the post-crisis period (2008-2010). In column 3, GVC is averaged over the period 2001-2004 and M&A over the second wave (2005-2010). Included (unreported) fixed effect are country pair fixed effects and country-sector specific fixed effects. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7 – User target hypothesis: sample split by institutional quality of target country

	(1)	(2)	(3)	(4)	(5)	(6)
	Rule of law		Regulatory quality		Property rights	
	Low	High	Low	High	Low	High
	PPML		PPML		PPML	
GVC	2.14***	7.22***	2.23***	7.91***	2.66***	7.43***
	(0.74)	(1.54)	(0.46)	(1.57)	(0.68)	(1.60)
N	13,729	52,574	26,787	39,516	29,885	36,418
Fixed effect groups	*ij ih jz*		*ij ih jz*		*ij ih jz*	

Note: this table reports the PPML results estimated on two sub-samples of countries for each characteristic, averaging GVC participation index over the period 1995-1999 and M&A transaction from the supplier to the user sector over the period 2000-2010. *Low* sub-sample includes countries in the first quartile of rule of law, or below the median of regulatory quality and property rights. *High* sub-sample includes the remaining countries. Included (unreported) fixed effect are country pair and country-sector. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8 – Supplier target and user target hypothesis: sample split by sector level of GVC

	(1)	(2)	(3)	(4)
	low GVC sector	high GVC sector	low GVC sector	high GVC sector
	supplier's hypothesis		user's hypothesis	
	PPML	PPML	PPML	PPML
GVC	3.07	7.02***	1.31	7.96***
	(14.26)	(1.96)	(1.14)	(1.33)
N	20,468	30,888	20,468	30,888

Note: this table reports the PPML results estimated on two sub-samples of sectors, averaging GVC participation index over the period 1995-1999 and M&A transaction over the period 2000-2010. *Low* sub-sample includes sectors with imported value added as a share of gross country-level exports below the sample median (0.1%). *High* sub-sample includes sectors with imported value added as a share of gross country-level exports above the sample median (0.1%). Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

APPENDIX

Table A1: Correspondence between TIVA STAN classification and SIC 3 digits.

TIVA STAN classification	SIC
C01T05 - Agriculture, hunting, forestry and fishing	011; 013; 016; 017; 018; 019; 021; 024; 025; 027; 029; 071; 072; 075; 076; 078; 081; 083; 085; 091; 092; 097
C10T14 - Mining and quarrying	101; 102;103; 104; 106; 109; 122; 123; 124; 131; 132; 138; 141; 142; 144; 145; 147; 149
C15T16 - Food products, beverages and tobacco	201; 202; 203; 204; 205; 206; 207; 208; 209; 211; 212; 213; 214
C17T19 - Textiles, textile products, leather and footwear	221; 222; 223; 224; 225; 226; 227; 228; 229; 231; 232; 233; 234; 235; 236; 237; 238; 239; 267; 311; 313; 314; 315; 316; 317; 319
C20T22 Wood, paper, paper products, printing and publishing	241; 242; 243; 244; 245; 249; 261; 262; 263; 265; 271; 272; 273; 274; 275; 276; 277; 278; 279
C23T26 Chemicals and non-metallic mineral products	291; 299; 281; 282; 283; 284; 285; 286; 287; 289; 301; 302; 305; 306; 295; 321; 322; 323; 324; 325; 326; 327; 328; 329
C27 - Basic metals	331; 332; 333; 334; 335; 336; 339
C28 - Fabricated metal products	341; 342; 343; 344; 345; 346; 347
C29 - Machinery and equipment, nec	348; 349; 351; 352; 353; 354; 355; 356; 358; 359; 363; 371; 374; 376; 379
C30T33 - Electrical and optical equipment	357; 365; 366; 367; 381; 382; 384; 385; 386; 387; 361; 362; 364; 369
C34T35 - Transport equipment	372; 373; 375
C36T37 - Manufacturing nec; recycling	251; 252; 253; 254; 259; 308; 391; 393; 394; 395; 396; 399

Table A2: List of countries.

Origin Countries	Destination Countries
Australia; Belgium; Brazil; Canada; China; Denmark; Finland; France; Germany; Hong Kong; Ireland; Italy; Japan; Mexico; Netherlands; Norway; Singapore; Spain; Sweden; Switzerland; United Kingdom; United States of America	Argentina; Australia; Austria; Belgium; Brazil; Bulgaria; Canada; Chile; China; Colombia; Czech Republic; Denmark; Finland; France; Germany; Hong Kong; Hungary; India; Indonesia; Ireland; Israel; Italy; Japan; Lithuania; Luxembourg; Malaysia; Mexico; Netherlands; New Zealand; Norway; Peru; Philippines; Poland; Portugal; Romania; Russian Federation; Singapore; Slovakia; South Africa; Spain; Sweden; Switzerland; Thailand; Turkey; United Kingdom; United States of America; Viet Nam

Inclusion of gravity variables

For a further robustness check we test if our main results on the impact of GVC are robust to the inclusion of gravity variables in place of the set of fixed effects. The gravity variables included in equations (1) and (3) are the following:

- the nominal GDP, in US dollars, of country *i* and *j*, respectively GDP_i and GDP_j;
- the nominal GDP per capita, in US dollars, of country *i* and *j*, respectively $GDPpc_i$ and $GDPpc_j$;
- the geodesic weighted distance between country i and country j, *DISTij*;
- the dummy *Colony* equal to 1 if *i* and *j* are linked by colonial ties;
- the dummy *Common language* equal to 1 if *i* and *j* share the same official language;
- the dummy *Contiguity* equal to 1 if *i* and *j* share a land border;
- the degree of openness calculated as the sum of imports and exports divided by the nominal GDP, in US dollars, of country *i* and *j*, respectively $OPENNESS_i$ and $OPENNESS_j$;
- the remoteness indexes of country *i* and *j*, respectively REM_i and REM_j, to control for multilateral resistances and constructed as the logarithms of GDP-weighted distance averages (Baier and Bergstrand, 2009).

Data on GDPs, import and exports are retrieved from the World Bank database (https://databank.worldbank.org/source/world-development-indicators) and data for the remaining explanatory variables are from the Cepii dataset (http://www.cepii.fr/).

Tables A3 and A4 show that our main results on the impact of GVC are robust to the inclusion of gravity variables. Our variables of interest for testing both supplier's and user's hypotheses still have positive and significant coefficients. The estimated coefficients for the market size variables (proxied by GDPs) are positive and statistically significant, consistent with the literature that, by far, widely accepted the market size as a determinant of FDI flows (Chakrabarti, 2001).

As for transaction costs, the empirical literature on trade and FDI flows points out the roles of geography settings. The coefficient of the bilateral distance between the main cities of country i and country j denoted by (*DIST*) is negative and significant capturing correctly the higher transport costs implied by the distance that adversely affects FDI. In the same vein, the positive and statistically significant coefficients of variables *Colony*, *Common language* and *Contiguity* imply that if two countries are linked by colonial ties, share the same language or a land border, the transaction costs to invest are lower and stimulate FDI flows between those two countries.

We also include a proxy for trade openness that is a relevant factor in the decision to invest, given that most investment projects are directed towards the tradable sector. As trade openness is an indicator of the absence of trade barriers, its coefficient is predicted to be positively signed, but the opposite effect is predicted when an M&A is motivated by the desire to avoid high trade barriers, reduce transport costs and gain access to foreign consumers (tariff-jumping hypothesis).

Finally, in accordance with the literature, the coefficients are positive and statistically significant of the remoteness indexes, that indicate the geographic position of countries along markets, are positive and significant, confirming that, all else equal, FDI will be larger between countries that are more isolated from the rest of the world than between countries that are situated closer to the rest of the world.

Table A3 – Supplier target hypothesis: baseline results over the entire period.

	(1) PPML	(2) LSDV	(3) LSDV
GVC	2.08***	5.13***	3.41***
	(0.27)	(0.72)	(0.55)
ln*GDP*$_i$	0.29	0.12***	0.14***
	(0.86)	(0.03)	(0.03)
ln*GDP*$_j$	2.75***	0.21***	0.22***
	(0.94)	(0.04)	(0.04)
ln*GDPpc*$_i$	0.17	0.05***	0.05***
	(0.16)	(0.01)	(0.01)
ln*GDPpc*$_j$	0.63***	0.02***	0.02***
	(0.13)	(0.00)	(0.00)
ln*DIST*$_{ij}$	-0.66*	-0.03***	-0.04***
	(0.36)	(0.01)	(0.01)
Colony	0.74	0.12**	0.12**
	(0.64)	(0.05)	(0.05)
Common language	-0.06	0.05**	0.05**
	(0.43)	(0.02)	(0.02)
Contiguity	-0.79	0.00	0.01
	(0.53)	(0.03)	(0.03)
Openness$_i$	0.24	0.00	-0.00
	(0.22)	(0.01)	(0.01)
Openness$_j$	0.09	-0.02**	-0.02**
	(0.22)	(0.01)	(0.01)
ln*REM*$_i$	-0.14	0.07**	0.08***
	(0.84)	(0.03)	(0.03)
ln*REM*$_j$	2.20**	0.16***	0.17***
	(0.92)	(0.03)	(0.03)
N	66,303	66,303	66,302
adj. R^2		0.072	0.200
Fixed effect groups	*hz*	*hz*	*hz*

Note: this table reports the baseline PPML results (column 1) and the LSDV results (columns 2 and 3) estimated on the entire sample, averaging GVC participation index over the period 1995-1999 and M&A transaction from the user to the supplier sector over the period 2000-2010. Dependent variable in LSDV models is *log*(1 + *value of transaction*). Included (unreported) fixed effect are sector specific fixed effects in columns 1 and 2; and sector pairs fixed effects in column 3. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4 – User target hypothesis: baseline results over the entire period.

	(1) PPML	(2) LSDV	(3) LSDV
GVC	1.91***	3.36***	1.86***
	(0.29)	(0.49)	(0.35)
ln*GDP*$_i$	0.38	0.14***	0.15***
	(0.86)	(0.03)	(0.03)
ln*GDP*$_j$	2.70***	0.22***	0.24***
	(0.93)	(0.04)	(0.04)
ln*GDPpc*$_i$	0.21	0.05***	0.05***
	(0.17)	(0.01)	(0.01)
ln*GDPpc*$_j$	0.61***	0.02***	0.02***
	(0.13)	(0.00)	(0.00)
ln*DIST*$_{ij}$	-0.66*	-0.04***	-0.04***
	(0.36)	(0.01)	(0.01)
Colony	0.74	0.12**	0.12**
	(0.64)	(0.05)	(0.05)
Common language	-0.05	0.05**	0.05**
	(0.43)	(0.02)	(0.02)
Contiguity	-0.78	0.01	0.02
	(0.53)	(0.04)	(0.04)
Openness$_i$	0.19	-0.01	-0.01
	(0.21)	(0.01)	(0.01)
Openness$_j$	0.13	-0.01	-0.01
	(0.22)	(0.01)	(0.01)
ln*REM*$_i$	-0.00	0.10***	0.10***
	(0.84)	(0.03)	(0.03)
ln*REM*$_j$	2.12**	0.16***	0.17***
	(0.91)	(0.03)	(0.03)
N	66,303	66,303	66,303
adj. R^2		0.061	0.192
Fixed effect groups	*hz*	*hz*	*hz*

Note: this table reports the baseline PPML results (column 1) and the LSDV results (columns 2 and 3) estimated on the entire sample, averaging GVC participation index over the period 1995-1999 and M&A transaction from the user to the supplier sector over the period 2000-2010. Dependent variable in LSDV models is *log*(1 + *value of transaction*). Included (unreported) fixed effect are sector specific fixed effects in columns 1 and 2; and sector pairs fixed effects in column 3. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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