Does the participation to global value chains impact on cross-border mergers and acquisitions?

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Abstract

Global value chains (GVC) are recognized to be a major driver of international trade. In this paper we take the analysis one step forward, studying the impact of GVC on foreign direct investment (FDI). Specifically, we test the hypotheses that a higher degree of GVC participation of a supplier sector (e.g., cell-phone assembly in China) to the exports of a user sector (e.g., cell-phone exports from US) 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. Using unique dataset covering 12 supplier and user sectors, for over 22 investor countries and 47 target countries over the period 1995 and 2010, we augment a gravity equation model on sector-level FDI – measured as mergers and acquisitions (M&A) – with a measure of the strength of GVC participation. The results provide strong support to the hypothesis that a higher GVC participation has a positive impact on the size of M&A in both the user and the supplier sectors.

Keywords: global value chains, mergers and acquisitions, sector level

JEL classification: F14, F23, F60

1. Introduction

Despite a drop in recent years, together with trade, foreign direct investment (FDI) remains one of the most outstanding features of the worldwide globalization of economic activities. UNCTAD (2013) documents an exponential growth of both trade and FDI since 2000s: between 2000 and 2017, the value of the total stock of outward FDI more than quadrupled, from 7,4 trillions of US dollars to 30,8 trillions, and the world share of exports that were part of a multi-stage trade process increased by 25% between 2005 and 2010, to reach 57% of world exports.[1]

Part of this increase is explained by two stylized facts. The first fact is the growing role of cross-border production networks, better known as global value chains (GVC), 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.[2] The example of the iPhone is probably the best known among many other possible (Xing, 2011).[3] Other examples include industries such as basic metals, where the value chain involves a sequence of production steps that process inputs and raw materials provided by firms located in different countries. The most complex examples, such as those of electronics, automobiles, and aircraft industries, can involve a high number of inputs provided by several countries and assembly of complex components. McKinsey (2019) documents that value chains exert a high impact on the economy, accounting for about 96 percent of global trade, 69 percent of global output, and 68 percent of global employment. The second fact concerns the growing role of multinational enterprises (MNE) in international production networks. As a matter of fact, most part of the cross-border trade in intermediate components takes place within very complex networks involving foreign affiliates of MNE and foreign partners connected to MNEs through non-equity contractual relationships.

Fostered by the large anecdotal evidence that FDI and GVC are strongly interdependent phenomena, a new and growing strand of academic literature has begun to study how and to what extent. Antràs and Chor (2013) and Alfaro et al. (2017) have recently expanded the theoretical framework of the seminal contribution of Antràs (2003) to study how the optimal

[1] This means, for example, that China imports intermediate inputs that incorporate value added produced by other countries and then it re-exports final products to the rest of the world. Therefore, when we look at the statistics on trade, we observe that the content of the *domestic value added* in Chinese exports is outbalanced by the content of the *foreign added value*.

[2] 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.

[3] iPhones are designed and marketed by Apple in the US, even though their production involves several companies producing parts and components, which are located outside the US. All iPhone components are assembled into final products in China and then exported to the US and to the rest of the world. However, this assembly process accounts for a low share of the iPhone's manufacturing value added.

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.

Given the increasing importance of GVC, it is obvious that the pattern of FDI affects that of international trade. In fact, Ruhl (2015) reports that intra-firm trade is about 30% of total exports in the US, and more than 35% of total imports. Moreover, Unctad (2013) documents that about 80% of world trade concerns global value chains coordinated by MNE. But the literature on the optimal organizational structure of firms' cross-border activities suggests that the opposite channel might also be at work. Changes in the characteristics of their main products, of their major selling markets, or of the institutional environment at home or abroad, might lead a firm to strengthen its control on foreign users or suppliers, possibly by acquiring a participation on the firm. Investment decisions of MNE, for instance, might be addressed towards firms operating in countries and sectors with high levels of GVC participation, as this can facilitate access to specific inputs (e.g., the Chinese company that assembles iPhone and acquires the Japanese company that supplies parts and components) or to global markets (e.g., the Turkish firm in the nut farming sector that acquires the Italian firm in the chocolate manufacturing sector to access its final destination markets), favoring integration in the global economy. Consistent with this hypothesis, in this paper we aim at answering the following research question: to what extent GVC participation affects the pattern of FDI? In particular, we test two main hypotheses.

1. *The supplier's hypothesis*: a higher degree of GVC participation of a supplier sector to the user sector's country gross exports positively affects FDI from the user to the supplier sector.
2. *The user's hypothesis*: a higher degree of GVC participation of a supplier sector to the user sector's country gross exports positively affects FDI from the supplier to the user sector.[4]

Our empirical analysis follows a large strand of the literature on the determinants of FDI (see, for example, Di Giovanni, 2005, and Head and Ries, 2008). Consistent with this literature, we

[4] In the iPhone example, we are interested not only in the fact that in this GVC China assembles components and parts and then re-exports to the US, that sell in the rest of the world, but we are interested in the fact that China is one of the link of the GVC and, as such, it receives a share of the value of its exports from other suppliers (the foreign value added) and provides its domestic value added to other users.

test the two hypotheses described above using as dependent variable the total value of FDI 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 total value added from a supplier sector in origin country embodied in the total exports of a user sector in destination country, and the total gross exports of the destination country.[5]

Similar to Head and Ries (2008), we use data on M&A as a proxy for FDI. Even if the share of greenfield investment has increased in recent years, most of the stock of FDI is the result of M&A. Moreover, data on M&A are available with very detailed information on the time of the operation and on the country and sector of investors and targets from the SDC database produced by Thomson Financial, a feature that unfortunately is not shared by data on FDI. Data on the share of sector-level imported value added its country's total exports, our proxy of GVC participation, is obtained from OECD TiVA indicators, and has the same dimension as that on M&A: it refers to 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. Interestingly, Baldwin and Lopez-Gonzalez (2015) show that the matrix of GVC related international trade is very sparse, with few bilateral flows significant on a global scale. This feature of GVC is particularly relevant for our analysis, because it allows to better identify the links between the patterns of GVC and those of M&A.

Since M&A typically have a lumpy behaviour, we choose to collapse their value across many years, and we exploit the time dimension of our dataset only to pre-date the measure of participation to GVC. However, even in this case, we have data on both the dependent variable and the main explanatory variable that vary across four dimensions: investor country, investor sector, target country, 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.[6]

Our results provide robust evidence that participating in GVC, as a user or a supplier sector, increases the value of its foreign investment in the supplier sector and in the user sector, respectively. This complements the vast empirical literature on the determinants of FDI, and it

[5] Notice that the bidder sector refers to the *supplier* sector in the user's hypothesis and the *user* sector in the supplier's hypothesis.

[6] 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.

provides additional evidence consistent with the hypothesis that GVC alter the optimal organizational structure of firms' cross-border activities.

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 original sources of our data, how they have been merged to obtain a unique dataset, and descriptive statistics. In Section 5 we present and discuss the main results of the empirical analysis. Finally, Section 6 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 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; c) internalization advantages, when owning a foreign subsidiary is more profitable than licensing or selling to foreign distributors. 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 accessing foreign markets, that favour instead producing directly in the foreign markets (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 products 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 different stages of production are located in different countries, to access specific resources not available elsewhere or to arbitrage differences in relative factor prices.

A recent strand of literature has begun to study the determinants of vertical FDI as an aspect of the more general issue of the determinants of firm boundaries (Coase, 1937) and of the optimal organizational structure of a firm (Grossman and Hart, 1986). Using this conceptual framework,

Antràs (2003) adapts an incomplete-contracting, property-rights model to a standard trade model with imperfect competition and product differentiation, capable of replicating a number of features of the patterns of intra-firm international trade. Within a similar framework, Antràs and Helpman (2004) develop a property-rights approach applied to international trade and represent an incomplete contracting world in which both final-good producers and suppliers located in different countries undertake relationship-specific investments that enhance value. Antràs and Chor (2013) extend this analysis presenting a property-rights model of a firm with a continuum of stages of production, capable of yielding a characterization for the optimal allocation of ownership rights along the value chain. More recently, Alfaro et al. (2017) 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.

The determinants of FDI suggested by the literature are not denied by the rise of GVC. While an MNE considering FDI in a location will look at factors such as labor costs, labor market flexibility, cost of the import of machinery and so on, non-equity modalities consider additional factors such as the technology, expertise and productivity of the sub-contractor, its relationships with global buyers and the prevalence of certified local suppliers it may need to use. The local sourcing of intermediate products is one the main channels for foreign direct investment (FDI) spillovers. Amendolagine et al. (2019) investigate document that participation and positioning in the global value chains (GVC) of host countries is associated to local sourcing by foreign investors. Finally, if the production is done by an independent supplier, then the choice of supplier is influenced by the exchange rate or the existence of export credit guarantees (Giroud and Mirza, 2015).

The literature on the determinants of the cross-border boundaries and organization of the firm has typically searched empirical confirmation using firm-level data. The more general empirical literature on FDI has instead focused on aggregate data, at the country of sector level, often within the framework of gravity models. Although gravity models of cross-border capital movements still lack a robust theoretical microfoundation as that eventually provided to international trade models by the seminal contribution of Anderson and van Wincoop (2003), 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 FDI. A more recent strand of empirical literature has expanded the original set of explanatory variables, showing that FDI 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), bilateral trade (Erel, 2008).

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, in a paper closely related to our analysis, Martínez-Galán and Fontoura (2019) have showed that FDI are positively associated with the participation of both origin and destination countries to GVC. However, we improve the analysis of Martínez-Galán and Fontoura (2019) by exploiting the sector-level dimension of our dataset that allows to inflate the econometric specification with a large number of dummies, a methodology that they could not follow since their analysis is based on country-level data. In addition, we account for the vertical relationships of sectors involved in a GVC by testing two different hypotheses discussed in Section 3. Moreover, we analyse how institutional characteristics can moderate the impact of GVC on FDI. Indeed, a large strand of literature has studied how the institutional characteristics – both in the host (pull factors) and in the domestic country (push factors) – impact on foreign investment. Bénassy et al. (2007) explain several reasons why the quality of institutions may matter for attracting FDI, including costs and uncertainty due to poor institutions, and show that bureaucracy, corruption, but also the size of credit and the efficiency of legal institutions are important determinants of inward FDI. 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). While it is difficult to disentangle the drivers of the increase in the expansion of FDI from those with a specific impact on the diffusion of GVC, as discussed by Hillberry (2011) and Amador and Cabral (2016), within the framework of our analysis, these results on the role of institutional characteristics suggest that the impact of GVC on M&A could itself be moderated by the differences in the institutional environment of the target country. Following the literature, our hypothesis is that GVC participation might affect proportionally more the international transactions of those industries that invest in countries with more efficient institutions and higher economic freedom.

3. Empirical methodology

To assess if higher GVC participation from the supplier sector positively affects M&A from the user to the supplier sector (*the supplier's 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* (and from sector *z* in country *j* to sector *h* in country *i*) 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*, $EXGR_i$:

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

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's hypothesis* predicting that a higher GVC participation from the supplier sector positively affects FDI from the supplier to the user sector, we adopt the following specification, where the explanatory variable is the same as that in equation (1):

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

In both specifications, we consider average values of two non-overlapping periods for the dependent and the explanatory variables to deal with two issues arising when analysing the relationship of interest. The first issue is that the patterns of M&A are characterized by waves,

as documented in the literature (see, for example, Brakman et al., 2005) and as we will document in Section 4. The second issue is the endogeneity of GVC due to reverse causality: the higher inward M&A in sector *z* of country *j*, from sector *h* of country *i* (or in sector *h* of country *i*, from sector *z* of country *j*), the higher the GVC participation of this industry to exporting activity of sector *h* in country *i*. For instance, 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. According to our hypotheses, we should expect a positive impact of GVC linkages on M&A transactions.

Other standard determinants of M&A, in a gravity framework, include sector-level GDP in the source and the host country. As for transaction costs, the empirical literature on trade and FDI flows points out the roles of geography settings, i.e. the bilateral distance between the main cities of country *i* and country *j*. In order to capture correctly the costs involved in M&A, additional control variables such as common border, common language, common religion, landlocked, common currency or if the countries have signed a bilateral investment treaty or a free trade agreement, should be introduced in the specification. These variables are usually found in the empirical gravity literature as influencing both trade (Head et al., 2008) and FDI (Bris et al., 2006). 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. 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.[7]

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 the estimation of the gravity model by the Pseudo Poisson Maximum Likelihood (PPML) specification are consistent in the presence of heteroskedasticity and are

[7] In the robustness tests we also estimate a specification including the bilateral country level gravity variables, in place of the set of fixed effects, finding similar results.

reasonably efficient, especially in large samples. Accordingly, we estimate our model in multiplicative form, using the PPML estimator, commonly adopted in recent empirical analyses of gravity models (Fally, 2015, 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 similar to those obtained using the PPML specification.

4. Data sources

As mentioned above, as a proxy of FDI at sector level, we use data on cross-border M&A transactions at firm-level provided by the SDC Platinum Global Mergers and Acquisitions database. It records all deals entailing a change in ownership of at least 5% of total equity, exceeding US$1 million, over the period 1985–2010.[8] The Thomson dataset allows the analysis of M&A for a large range of countries, sectors and years. In particular, this source records two related aspects of cross-border acquisitions: the number of acquisitions and their value. For the purpose of our analysis, and consistently with the literature on M&A, we focus on the value of M&A, and therefore we do not consider undisclosed and incomplete deals for which the value of transaction is not available.[9] The database also contains information on target and investor profiles, such as their primary industry at the 3-digits SIC level and its location, that are used in our empirical analysis to reconcile transaction data with the GVC participation index.

Data on GVC participation, via intermediate imported value added embodied in domestic exports, are obtained from the OECD-WTO TiVA (trade in Value-Added) database, edition 2016.[10] The TiVA indicators are based on the OECD's Inter-Country Input-Output (ICIO)

[8] 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).

[9] 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.

[10] 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/.

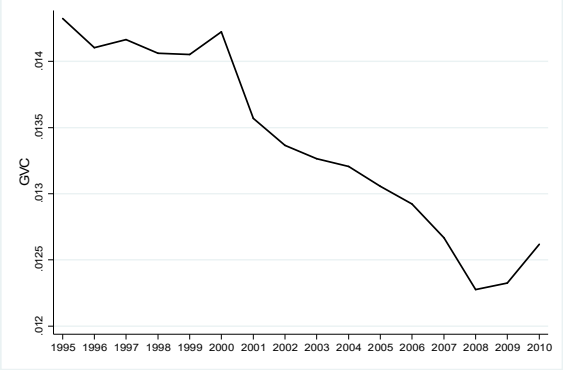
system that consists of a set of symmetric industry by industry global input-output tables. The standard industry list (STAN) in Tiva is based on International Standard Industrial Classification (ISIC) Rev. 4 and is compatible with the NACE Rev. 2 classification used by EU member countries. Since our measures of M&A are available at the SIC classification, we reconciled the different series according to the schemes presented in Table A1 in the Appendix.

From the TiVa database, we select a set of origin and destination countries and sectors that have stronger GVC and M&A connections. We make this choice because the full matrix of bilateral connections across sectors and countries is far too sparse to be analysed. Our original dataset includes 2,382,336 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. The cross-section of data averaged over two non-overlapping periods (1995-1999 for GVC and 2000-2010 for M&A transactions) includes 148,896 observations. Provided that we include four set of fixed effects to estimate equations (1) and (2) and in many cases the level of M&A is zero within the same group (so that many singleton observations are detected), we end up with a dataset including 66,303 observations.[11]

4.1 Descriptive statistics

Figure 1 shows the pattern, over the sample period (1995-2010), of global imported value added as a share of global exports. The share of imported value-added on exports is slightly decreasing over the sample period and that in 2008 it reduced by about 15% compared to the initial value in 1995. However, after the global financial crisis in 2008, the index experienced a two-year increase.

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



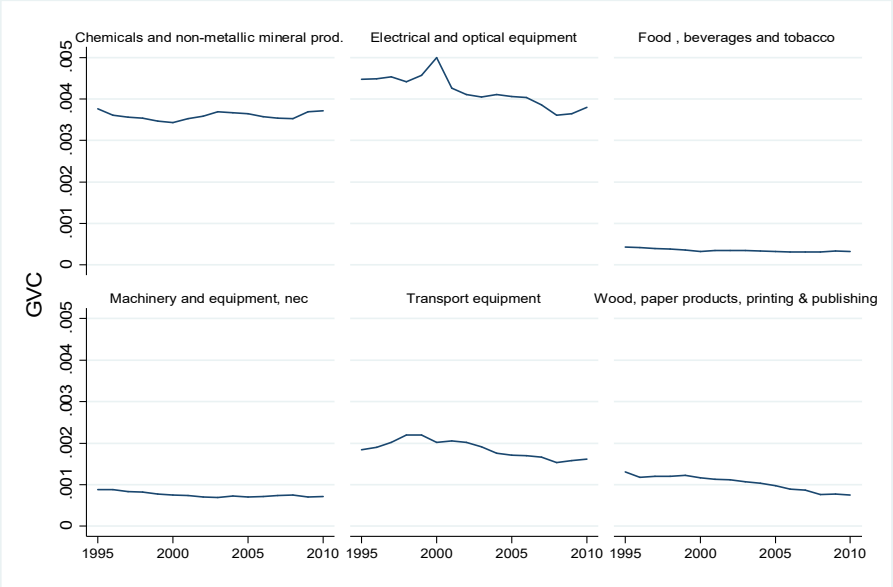
Source: Elaborations on OECD-WTO TiVA database, edition 2016. Accessible at https://stats.oecd.org/

[11] 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 in the Appendix provides a synthetic description of origin and destination countries used in our empirical analysis.

Figure 2 reports the pattern, over the same sample period, of sector-level exported value added as a share of user country's gross exports, for 12 supplier sectors considered, distinguishing those above the sample median (0.1% of exported value added incorporated in total exports) from those below the sample median (*Panel A* and *Panel B*, respectively). 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 the GVC involvement are 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 imported value added on country's exports.[12]

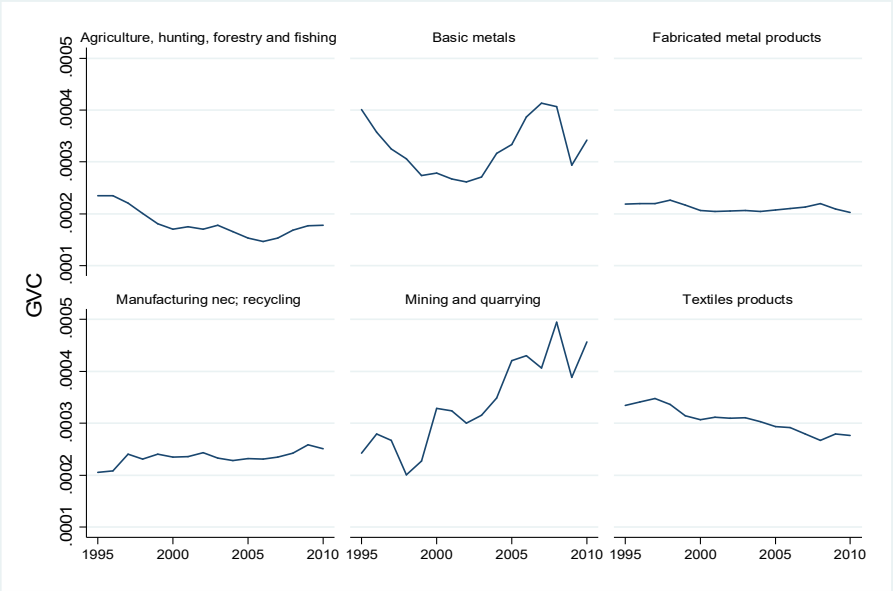
Figure 2 – Sector-level exported value added as a share of user country gross exports, 1995–2010 (percentages).

Panel A



[12] Notice that when comparing such indices across countries and over time, an industry that previously exported intermediates for final assembly may instead chose to carry out the final assembly process itself. All other things being equal, counter-intuitively, this would see a fall in its GVC participation index (https://www.oecd.org/sti/ind/TiVA_2015_Guide_to_Country_Notes.pdf).

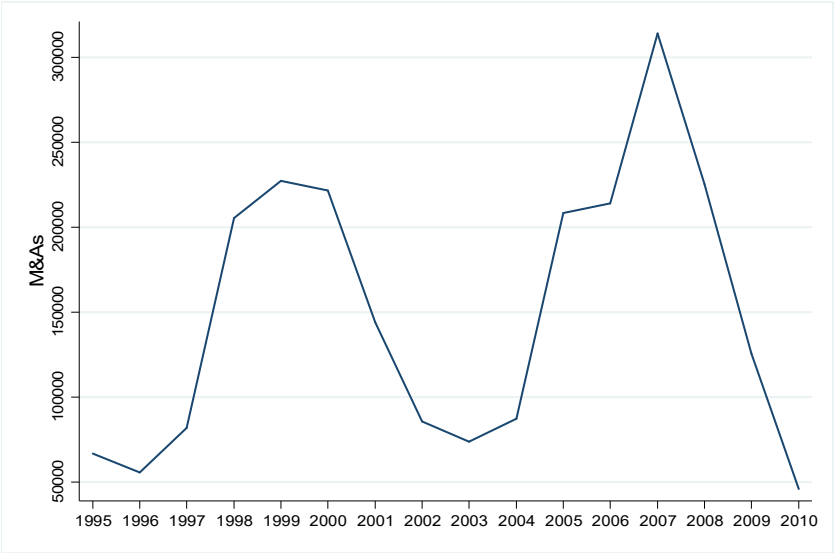
Panel B



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 country gross exports, for sectors above the sample median (0.1%). *Panel B* reports patterns of sector-level imported value added as a share of gross country-level exports, for sectors below the sample median (0.1%).

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

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

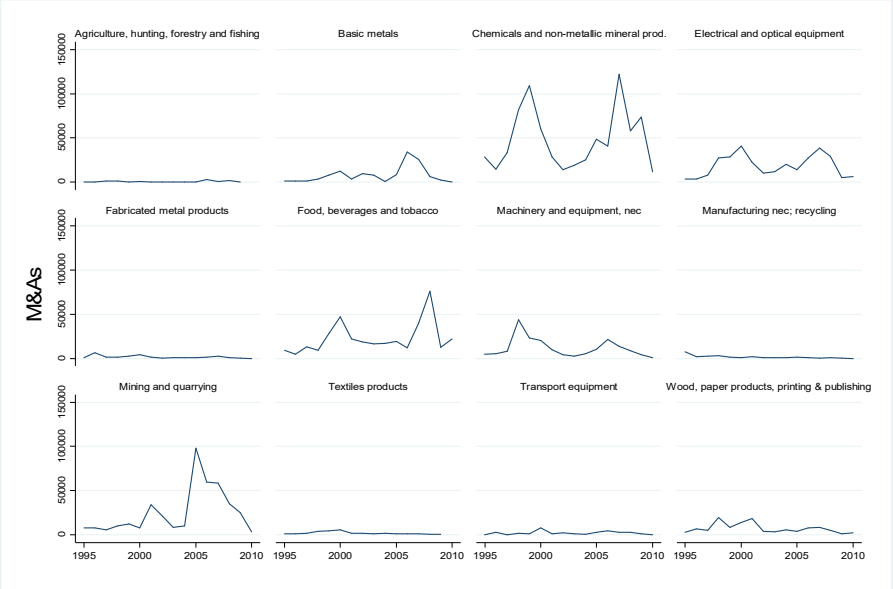


Source: Elaborations on SDC Platinum Global Mergers and Acquisitions database, Thomson Financial Securities Data.

Since the value of cross-border M&A 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 M&A 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.

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

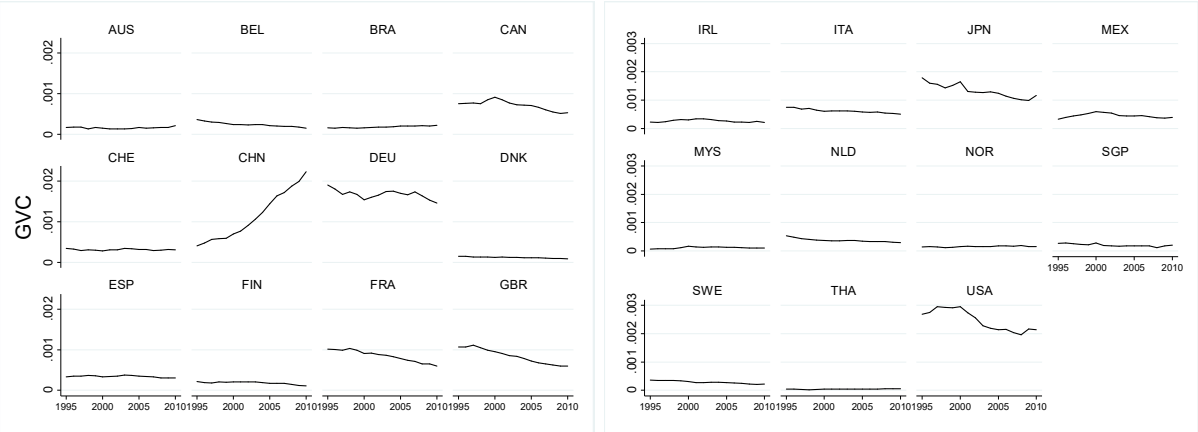


Source: Elaborations on SDC Platinum Global Mergers and Acquisitions database, Thomson Financial Securities Data.

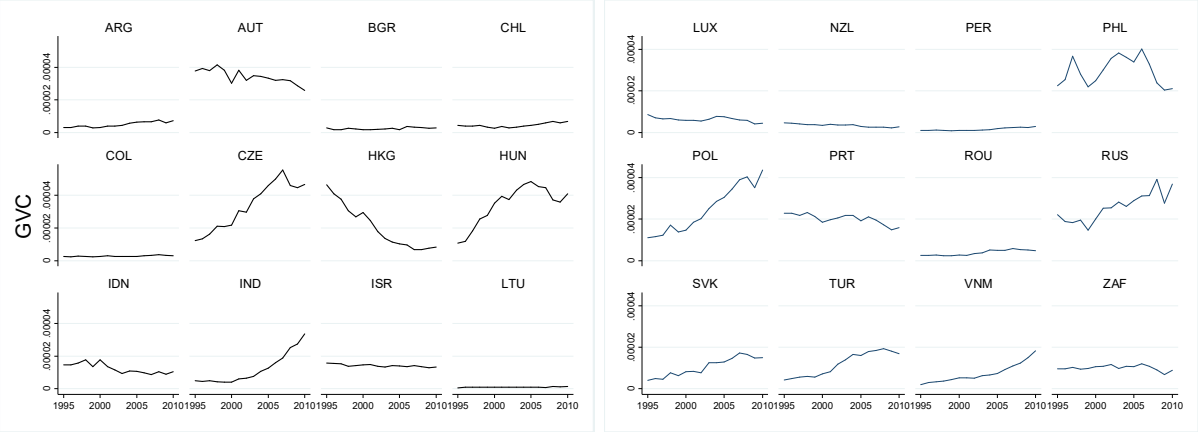
Considering the contribution of each supplier country to total exports of destination country, Figure 5 reveals that Canada, the USA, Japan and Germany played an important role in GVC, providing the highest VA contribution to exports of destination countries. In most countries the contribution to foreign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

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

Panel A



Panel B

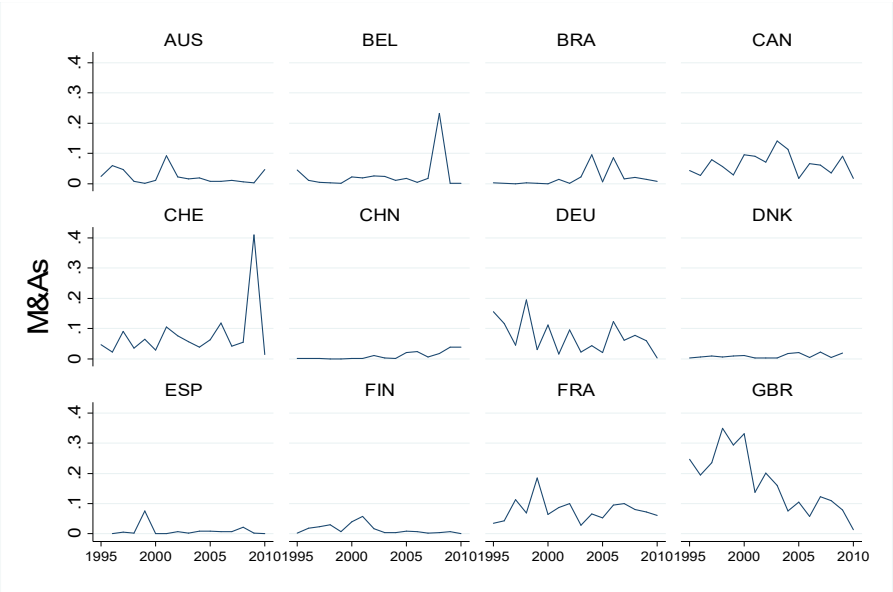


Source: Elaborations on OECD-WTO TiVA database, edition 2016. Accessible at https://stats.oecd.org/
Note: P*anel A* reports the country-level value added exported as a share of total exports of the destination country, for origin countries above the median level in each year. *Panel B* the country-level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

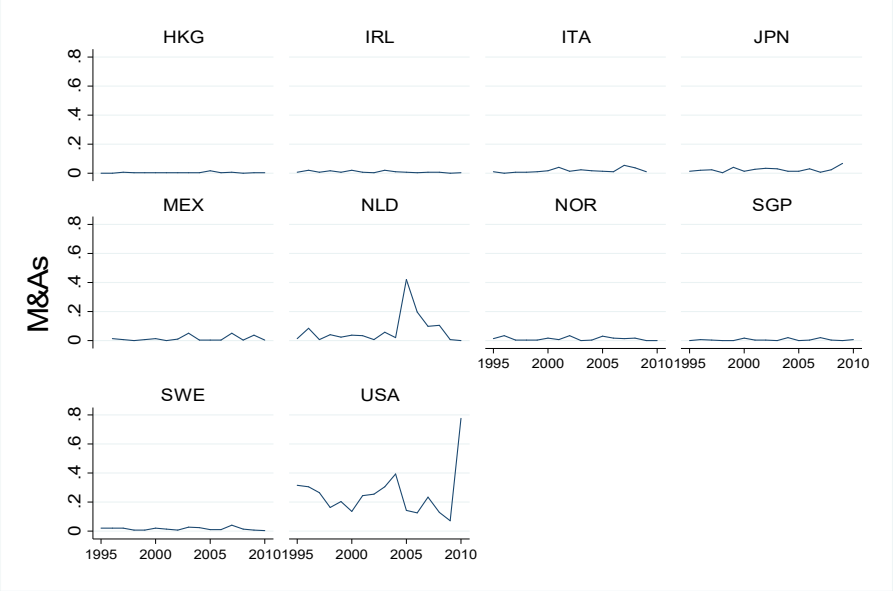
Finally, considering the contribution of each investing country to total M&A transactions over the period, we can identify three groups of countries in Figure 6.

Figure 6 – Outward 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.

The first group include countries with an average share higher than 10%: this group includes only two countries, 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. Moreover, all other countries account for less than 5% of total transactions.

While previous figures provide a clear view of the evolution of our key variables at the aggregate and disaggregate levels, 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 positive transactions.

Table 1 – Descriptive statistics

Variable	Mean	S.D.	Min	Max	N. obs.
M&A	12.380	422.40	0	78,381	66,303
M&A > 0	332.390	2164.93	0.1	78,381	2,469
GVC	0.004	0.03	0	2.120	66,303

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

Both M&A and GVC participation display a very high variability. In particular, M&A transaction values accounts for about 12.38 million dollars, with values ranging between zero and 78 billion dollars. Considering only positive values of M&A, the average increases significantly (332 million dollars), with values ranging between 100 thousand and 78 billion dollars. GVC participation, our key explanatory variable, shows an average value of 0.004%, with values ranging between 0 and 2.12%. These 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.

In addition to data on M&A and GVC participation, 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, the police, and the 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. *Control of corruption* refers to the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests. High levels of control of corruption are likely to make it less difficult to enforce contracts, and therefore less difficult to invest in a country. Descriptive statistics of these indicators are reported in Table 2. The minimum values for both rule of law and control of corruption are for Russia (-0.89 and -0.97, respectively), whereas the lowest regulatory quality is in Vietnam (-0.62). The maximum value of regulatory quality is for Singapore 1.90,

that of corruption is found for Denmark (2.38) and for rule of law Finland show the highest value (1.95). The *property rights* indicator that we measure using an index produced by the Heritage foundation, based on the ability to accumulate private property and wealth, ranges between 10.31 in Vietnam to 90.67 in New Zealand.

In addition to these single indexes, we also adopt the indicator of economic freedom produced by the Heritage Foundation as equally weighted and averaged scores on 12 components of economic freedom that can be grouped into four broad categories: rule of law (property rights, government integrity, judicial effectiveness), government size (government spending, tax burden, fiscal health), regulatory efficiency (business freedom, labor freedom, monetary freedom), open markets (trade freedom, investment freedom, financial freedom). Our exercise is motivated by the fact that countries with a higher level of economic freedom are more likely to allow a swifter reaction of M&A to the new incentives provided by participation to GVC. Table 2 shows that in our sample the Heritage index of economic freedom has an average value of 67.51, on a 1-100 scale, with values ranging from 45.57 in Vietnam to 89.35 in Hong Kong.

Table 2 – Summary statistics of country characteristics

Variable	Mean	S.D.	Min	Max
rule of law	0.960	0.916	-0.896	1.959
regualtory quality	1.020	0.740	-0.625	1.902
control of corruption	1.034	1.046	-0.967	2.376
property rights	70.832	21.250	10.313	90.667
economic freedom	67.510	9.385	45.570	89.349

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

5. Baseline results

This section reports and discusses the results obtained estimating equation (1) and (3).

5.1 The supplier's hypothesis

Table 3 reports the coefficients of the impact of GVC participation of the user 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. This table shows the presence of a positive and statistically significant relation between the participation in GVC and the extent of M&A from the user sector to the supplier sector.

Table 3 – Supplier's 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The coefficient of 3.93 reported in column 1, that is statistically significant at the 10% level, indicates that for a one standard deviation variation in the GVC participation index (0.03%), M&A flows from the user sector increase of about 0.12%. For instance, 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%. These results are consistent with the evidence provided by Martínez-Galán and Fontoura (2019) at the aggregate level, and show that a higher GVC sector participation is a channel to increase foreign M&A. 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 that a one standard deviation increase in the GVC participation index implies an increase in M&A flows from the user sector in the supplier sector of about 0.15%. When we include the complete set of fixed effects to account for all possible determinants of M&A (column 3) we obtain a lower impact of GVC participation estimated through LSDV, even though it is still positive and statistically significant. The coefficient of 1.46 implies that a one standard deviation increase in the GVC participation index produces an increase of M&A of about 0.04% over the next period.

These results provide indeed support to the supplier's hypothesis. Moreover, they are robust to different specifications, since the linear model provides results that are very similar to a model that accounts for the 'zero inflation' of our dependent variable. Moreover, since including the complete set of fixed effects in the equation does not change the results in terms of sign and

significance, in what follows we adopt the PPML with the reduced set of fixed effects as our preferred estimation method.[13]

Results reported in Table 3 are obtained using the entire sample period, 1995-2010. Since Figure 3 shows a strong decrease of M&A transactions after the financial crisis, 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 impact on the post-crisis M&A (column 2), the impact is three times larger than that of the pre-crisis period. In this case, an increase of GVC equal to 0.03% increases M&A by 0.29%. These results demonstrate that the financial crisis fostered the GVC participation channel as a determinant of M&A.

Since the value of M&A shows two major waves during our sample period, we have also analyzed the impact of GVC participation index, averaged over the period 2001-2004, on M&A transactions that took place in the second wave, i.e. over the period 2005-2010 (column 3 of Table 4). Also in this case, we find a positive and statistically significant impact of GVC participation on M&A.

Table 4 – Supplier's 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[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. Results are available from the authors upon request.

5.2 The user's hypothesis

The second hypothesis that we test states that the motivation to invest in a sector in the destination country relies on the participation of a given origin sector in the exports of the destination one. The results are reported in Table 5, that mimic the structure of Table 3 in terms of estimation methods and fixed effects sets.

Table 5 – User's 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Column 1 reveals a positive impact of GVC participation of the supplier sector to the user sector on M&A from the supplier to the user sector. The coefficient of 6.45, statistically significant at the 1% level, implies that the impact on M&A by users is about double that on M&A by suppliers, reported in Table 3. An increase of GVC participation of 0.03% implies an increase in M&A by about 0.19%. This result is confirmed, in terms of sign and significance, using the linear estimator. Column 2 reports indeed a coefficient of 3.29 and column 3 a coefficient equal to 0.94, obtained including all fixed effects.

Table 6 confirms that also considering different sample periods to test the user's hypothesis the previous results are confirmed.

Table 6 – User's 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

As for the supplier's hypothesis, the positive impact of GVC on M&A is independent on time periods and is stronger in the post-crisis period than in the pre-crisis period. The impact on M&A for the pre-crisis period is indeed 0.19%, comparable to that obtained on the entire period, and the impact on the post-crisis M&A is 0.26%. Finally, the impact on the second wave of M&A of the preceding period GVC is still positive and statistically significant, with a coefficient of 3.89.

As a whole, our results show that countries and sectors with a high involvement in GVC participation in the production process report higher levels of foreign mergers and acquisitions. The higher the value added a sector in a country provides for exports of a sector in a foreign country, the more the origin sector invests in the destination sector involved in the GVC. The same applies to the investment of the destination sector toward the sector that has contributed to its exports.

6. Sample split by country and sector characteristics

Given that our sample incudes 47 target countries that are extremely heterogeneous in terms of institutional quality, as reported in the descriptive statistics, an additional hypothesis that is under scrutiny is to what extent these country characteristics are likely to affect the relationship between GVC and M&A activities. Indeed, one may argue that in an institutional environment more supportive of market transactions the effect of GVC participation on foreign investment is higher because firms in the investing sector face fewer impediments to access foreign markets, and therefore lower expenses.

To account for this possible moderating role, we test the user's hypothesis splitting the sample of target countries into two sub-sample, depending on the level of institutional quality indicators described above. The "low-quality" sub-sample includes countries in the first percentile of rule of law, in or below the second percentile of regulatory quality, in the first percentile of control of corruption, in or below the second percentile of property rights and in or below the second percentile of economic freedom. The "high-quality" sub-sample includes countries in the other percentiles.

Table 7 show the results obtained using the PPML estimator for the two subsamples of countries, with low-quality and high-quality institutions. Columns 1 and 2 present the results splitting the sample according to the level of rule of law. For the 13,729 observations for which the target country is in the first percentile of the distribution of rule of law, the coefficient of GVC participation on M&A is 2.14, and it is statistically significant at the 1% level (column

1). For the 52,574 observations regarding destination countries with high levels of rule of law, the coefficient is instead higher, at 7.22 (column 2), and also statistically significant at the 1% level. 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, and it is statistically significant at the 1% level in both sub-samples. Interestingly, also countries with a higher level of control of corruption show a stronger impact of GVC on M&A (columns 5 and 6). Focusing on the last specific aspects of the index of economic freedom, property rights, columns 7 and 8 show that it exerts a significant moderating effect on the impact of GVC on M&A. Indeed, a higher 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 second percentile (7.43 compared to 2.66). Finally, considering the aggregate index of economic freedom, the results reported in columns 9 and 10 also confirm the propulsive role of institutional quality for foreign investment, even though the impact is very similar for both sub-samples (6.26 and 6.17).

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

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Rule of law		Regulatory quality		Control of corruption		Property rights		Economic freedom	
	Low	High	Low	High	Low	High	Low	High	Low	High
	PPML		PPML		PPML		PPML		PPML	
GVC	2.14***	7.22***	2.23***	7.91***	1.91***	7.36***	2.66***	7.43***	6.26*	6.17***
	(0.74)	(1.54)	(0.46)	(1.57)	(0.68)	(1.55)	(0.68)	(1.60)	(3.35)	(1.49)
N	13,729	52,574	26,787	39,516	13,532	52,771	29,885	36,418	30,203	36,100
F.E.	*ij ih jz*		*ij ih jz*		*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, respectively: in the first percentile of rule of law, in or below the second percentile of regulatory quality, in the first percentile of corruption, in or below the second percentile of property rights and in or below the second percentile of economic freedom. *High* sub-sample includes countries in the other percentiles. Included (unreported) fixed effect are country pair and country-sector. Standard errors, reported in parentheses, are clustered by country pairs. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

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 additional support to the view that it is precisely in those countries that already face other types of impediments to investment activities that improving

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 countries (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 countries below and above the sample median of GVC participation. The results show that the impact of GVC participation on M&A is stronger, and statistically significant, only for the sub-sample of countries and sectors where the participation in GVC is 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 GVC of 0.03 determines an increase in the value of M&A by 0.14%, whereas the impact for sectors less involved in GVC as importers is not significant. Similar results are obtained testing the user's hypothesis (column 4).

Table 8 – Supplier's and user's 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. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

7. Conclusions

Global value chains (GVC) are well known to be a main driver of the patterns of international trade. In this paper we have estimated a gravity equation model of sector M&A on a dataset of 12 sectors, for 22 investor countries and 47 target countries, between 1995 and 2010.

Our results provide robust evidence that participating in GVC increases the value of both supplier and user sectors inward FDI. This complements the vast empirical literature on the determinants of FDI and provides additional evidence consistent with the hypothesis that GVC alter the optimal organizational structure of firms' cross-border activities.

References

Alfaro, L., Antràs, P., Chor, D., Conconi, P. (2017), Internalizing Global Value Chains: A Firm-Level Analysis, *Journal of Political Economy*, forthcoming.

Amendolagine, V., Presbitero, A. F., Rabellotti, R., Sanfilippo, M. (2019). Local sourcing in developing countries: The role of foreign direct investments and global value chains. *World Development*, *113*, 73-88.

Anderson, J. E., Van Wincoop, E. (2003), Gravity with gravitas: a solution to the border puzzle, *American Economic Review* 93, 170-192.

Antràs, P. (2003), Firms, Contracts, and Trade Structure, *Quarterly Journal of Economics* 118, 1375-1418.

Antràs, P., Chor, D. (2013). Organizing the global value chain, *Econometrica* 81, 2127-2204.

Antràs, P., Helpman, E. (2004), Global sourcing, *Journal of Political Economy* 112, 552-580.

Baldwin, R., & Lopez-Gonzalez, J. (2015). Supply-chain trade: A portrait of global patterns and several testable hypotheses. *The World Economy* 38(11), 1682-1721.

Brakman, S., Garretsen, H., Van Marrewjk, C. (2005), Cross-border mergers and acquisitions: On revealed comparative advantage and merger waves, CESifo Working Paper 1602.

Bris, A., Koskinen, Y., Nilsson, M. (2006), The Real Effects of the Euro: Evidence from Corporate Investments, *Review of Finance* 10, 1-37.

Buelens, C., Tirpák, M. (2017), Reading the footprints: How foreign investors shape countries' participation in global value chains, *Comparative Economic Studies* 59, 561-584.

Coase, R. H. (1937), The nature of the firm, *Economica* 4, 386-405.

Daude, C., Fratzscher, M. (2008), The pecking order of cross-border investment, *Journal of International Economics* 74, 94-119.

Di Giovanni, J. (2005), What drives capital flows? The case of cross-border M&A activity and financial deepening, *Journal of International Economics* 65, 127-149.

Dunning, J.H. (1977), The Determinants of International Production, *Oxford Economic Paper*s 25, 289-330.

Dunning, J.H. (1981), International Production and the Multinational Enterprise, London, Unwin Hyman.

Eaton, J., Tamura, A. (1994), Bilateralism and regionalism in Japanese and US trade and direct foreign investment patterns. *Journal of the Japanese and International Economies* 8, 478-510.

Erel, I., Liao, R. C., Weisbach, M. S. (2012), Determinants of cross-border mergers and acquisitions, *The Journal of Finance* 67, 1045-1082.

Fally, T. (2015). Structural gravity and fixed effects. *Journal of International Economics*, 97(1), 76-85.

Giroud, A., & Mirza, H. (2015). Refining of FDI motivations by integrating global value chains' considerations. *The Multinational Business Review*, *23*(1), 67-76.

Grossman, S. J., Hart, O. D. (1986), The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration, *Journal of Political Economy* 94, 691-719.

Head, K., Ries, J. (2008), FDI as an Outcome of the Market for Corporate Control: Theory and Evidence, *Journal of International Economics* 74, 2-20.

Markusen, J. R. (1984), Multinationals, Multi-plant Economies, and the Gains from Trade, *Journal of International Economics* 16, 205-226.

Martínez-Galán, E., & Fontoura, M. P. (2019). Global value chains and inward foreign direct investment in the 2000s. *The World Economy* 42(1), 175-196.

McKinsey (2019), Globalization in transition: the future of trade and value chains. January 2019, McKinsey&Company, Accessible at: https://www.mckinsey.com/featured-insights/innovation-and-growth/globalization-in-transition-the-future-of-trade-and-value-chains

Rossi, S., Volpin, P. F. (2004), Cross-country determinants of mergers and acquisitions, *Journal of Financial Economics* 74, 277-304.

Ruhl, K. J. (2015), How well is US intrafirm trade measured?, *American Economic Review* 105, 524-29.

Silva, J. S., & Tenreyro, S. (2011). Further simulation evidence on the performance of the Poisson pseudo-maximum likelihood estimator. *Economics Letters*, 112(2), 220-222.

UNCTAD. (2013). Global value chains and development, United Nations, New York and Geneva.

Xing, Y. (2011), How the iPhone widens the US trade deficit with China, VoxEU.org, 10 April.

Yotov, Y. V., Piermartini, R., Monteiro, J.-A., and Larch, M. (2016). An Advanced Guide to Trade Policy Analysis: The Structural Gravity Model. UNCTAD and WTO, Geneva.

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	Argentina
Belgium	Australia
Brazil	Austria
Canada	Belgium
China	Brazil
Denmark	Bulgaria
Finland	Canada
France	Chile
Germany	China
Hong Kong	Colombia
Ireland	Czech Republic
Italy	Denmark
Japan	Finland
Mexico	France
Netherlands	Germany
Norway	Hong Kong
Singapore	Hungary
Spain	India
Sweden	Indonesia
Switzerland	Ireland
United Kingdom	Israel
United States of America	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