Participation in Global Value Chains and M&A flows

Andrea Ciani[a]   Wildmer Daniel Gregori[b]

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Abstract

This study investigates to which extent firms operating in sectors more integrated into Global Value Chains (GVC) are more likely to be involved in cross-border Mergers and Acquisitions (M&A) flows. We focus on firms acquired in the EU27 during the period 2008-2020. Results show that cross-border investments are indeed associated with sectoral GVC participation, in particular the dependence on intermediate products supplied by other countries (i.e. backward GVC participation) of the target country-sector is positively correlated with M&A flows. This evidence is confirmed when the acquired firm operates in manufacturing or high-tech sectors, and when the investor originates from OECD countries. In addition, we find that companies from non-OECD countries supplying inputs to other countries (i.e. forward GVC participation) are more likely to pursue a cross-border acquisition.

Keywords: Global Value Chains, Mergers and Acquisitions, Gravity model, EU firms.

JEL codes: F21, F23, G34.

[a] European Commission - Joint Research Centre, Via Fermi 2749, Ispra, Italy; email: andrea.ciani@ec.europea.eu.
[b] European Commission - Joint Research Centre, Via Fermi 2749, Ispra, Italy; email: wildmer.gregori@gmail.com.

1. Introduction

Global Value Chains (GVC) changed the landscape of the international organization of production, placing the specialization of countries and firms within production chains at the central stage. The overall share of GVC trade in total world trade grew significantly during the period 1986-2008 (Antràs, 2021).[1]

To a great extent, this phenomenon is driven by large manufacturing firms which vertically fragment production into different stages located in different countries (Gereffi, 1999). According to Hilliberry (2011), the drivers of the fragmentation of production are difficult to disentangle from those of international trade. This holds true also for the expansion of foreign direct investments (FDI), which ultimately are an instrument for setting up global production chains by multinational enterprises (MNEs).

The decline in information and communication costs due to a rapid technological progress in the ICT sector, decreasing transportation costs thanks to relatively low oil-prices, together with lower political barriers to trade and capital flows are usually identified as the main factors behind the rise of GVC participation in the first decade of the 2000s (Antràs, 2003; Antràs and Chor, 2013; Alfaro et al., 2019, Fernandes et al., 2022).

Starting from the Great Recession, concerns that the phase of sustained globalization had come to a halt intensified. A general rise in protectionism, together with initiatives to "bring manufacturing back" through the reshoring of production, and to increase the share of domestic value added in exports, led to recent calls for policy interventions putting at-stake the global fragmentation of production.

An example of the extent to which national economies are interconnected within global production networks is the shortage of semiconductors recently experienced by the major industrial economies.[2] Concerns have been raised in relation to the production of chips needed by different industrial ecosystems, such as consumer electronics, space and defence, and automotive. The pandemic exacerbated the vulnerability of the chips supply chain, leading to a global shortage and increasing the appetite of investors to acquire European firms operating in this strategic value chain.

In this context, the European Union (EU) on the one hand intends to remain an open market and welcome investments from third countries, on the other hand aims at protecting internal security and economic sovereignty.[3] The European Commission (EC) has adopted a new regulation on FDI screening in October 2020, with the aim to foster the level of scrutiny on non-European investments, introducing a

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[1] According to Antràs (2021), the ratio of world trade to world GDP almost doubled in this period.
[2] https://www.gartner.com/en/articles/what-s-ahead-for-semiconductor-shortages.
[3] See the statement made by the President of the European Commission, Ursula von der Leyen, in 2020: https://ec.europa.eu/commission/presscorner/detail/en/IP_20_528.

coordination mechanism among EU member states and the EC on the grounds of security and public order. In addition, the EC has recently adopted the "Chips Act", with the objective to increase in the short-term EU resilience to future shortages by avoiding supply chain disruptions, and in the medium-term to become an industrial leader in this sector.[4]

The emerging structure of value chains will shape the developments of European production chains in the coming 20 years. As a consequence, a deeper understanding of the relationship between the involvement of industrial sectors in GVC and trends in cross-border takeovers is needed.[5] Figure 1 provides preliminary evidence of the relation between the index of aggregate GVC participation of EU member states and incoming cross-border M&As to the EU. Data show that a higher level of GVC participation is linked to a higher value of M&A inflows, especially in the recent years.

Figure 1: Value of inward cross-border M&A and GVC participation index in EU27
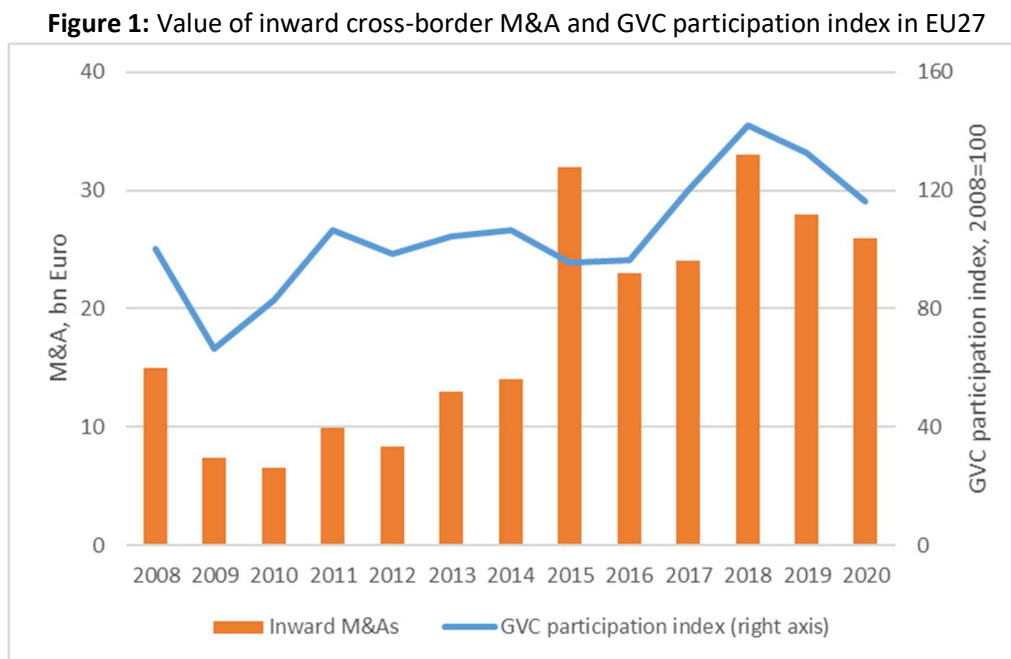
Notes: This figure shows, for the years 2008-2020, the value of EU27 inward cross-border M&As in billion Euro (orange bars, source: Zephyr), as well as the EU27 total GVC participation index using 2008 as the basis year (blue line, source: ADB MRIO).

Inspired by this preliminary evidence, we investigate the relation between GVC participation and FDI entry decision in the EU, focusing on the following questions: to what extent GVC participation of industrial sectors, in which the investing and the target company operate, fosters cross-border

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[4] See the statement made by the President of the European Commission, Ursula von der Leyen, in 2022: https://ec.europa.eu/commission/presscorner/detail/en/statement_22_866.
[5] In this study, we use the term foreign as a synonym of cross-border.

acquisitions? Is there a difference if a company operates in a sector which demands (supplies) input produced by (to) others?

To address these questions, we construct a dataset based on company-level M&A flows into the EU for the period 2008-2020, obtained from the Bureau van Djik Zephyr database, and GVC indexes derived from Inter-Country Input-Output (ICIO) tables measuring participation to global value chains at the sector-country level.[6] In particular, we employ the index measuring GVC participation in terms of the value of a country-sector output crossing more than one border (Borin and Mancini, 2015; Antràs, 2020). This index is determined by two measures of cross-border linkages at the sectoral level, i.e. backward and forward GVC participation. The former accounts for imported inputs embedded in a country's output supplied to domestic consumers, if inputs crossed more than one border before, or to foreign consumers, if inputs crossed only one border. The latter measures how much of a country's value added is sold abroad directly or indirectly via domestic chains, and then re-exported by the partner countries (Borin, Mancini, and Taglioni, 2021). To assess the effects of participating into global production chains, we consider as the main explanatory variable the index measuring GVC participation at the country-sector level for both investing and target firms. We estimate a gravity model enabling us to take into consideration a number of possible confounding factors, and adopt Pseudo Poisson Maximum Likelihood estimation to accommodate the structure of our database.

We find that cross-border investments in the EU27 are indeed associated with GVC participation. According to our estimates, a 1 percent increase in GVC participation of the investment destination country is associated with a 0.6 percent higher value of M&A flows at the sector-country level.

Backward GVC participation of the sector-country hosting the target firm plays a significant role. Results show that a 1 percent increase in backward participation of the target country-sector is associated with a 2.78 percent increase in the value of M&A flows. This evidence is confirmed when focusing on acquired firms in manufacturing sectors, and in high-tech sectors. Our estimates also show that participation of the target economy-sector matters only when investors originate from OECD countries, while GVC participation of the country-sector from which the acquiring company originates is positively

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[6] While FDI includes both M&A and greenfield investments, in this study we focus on M&A flows, considering that they are the most relevant form of investment adopted by multinational enterprises when engaging in FDI (e.g., see the World Investment Report released annually by the United Nation's Conference on Trade and Development, last issue: https://unctad.org/webflyer/world-investment-report-2021). In addition, the discussion about GVC is especially relevant when a target firm is already present in the market, therefore providing insights of its integration in global production chains.

associated with acquisitions pursued by non-OECD investors. For this group of economies we observe that forward participation of the acquiring sector is positively and significantly associated with M&A flows.

This work is linked to different strands of the literature. The first relates to recent empirical research focusing on the linkages between GVC and FDI. Martinez-Galan and Fontoura (2019) show that between 2002 and 2011, for 28 EU countries and other 14 major economies, a higher GVC index is linked to a higher bilateral FDI inward stock. This result supports the view that inward FDI are sustained by the key role played by MNEs in GVC participation, and the related cross-border trade of intermediate goods present among their networks of affiliates, including contractual partners. In the same vein, Carril-Caccia and Pavlova (2020) study the effects of both GVC participation and trade openness on the yearly number of inward M&As during the period 2001-2015 for a sample of major economies, showing that trade does not drive M&As, while countries' GVC participation positively affects their ability to attract foreign investments. In addition, Cipollina, Pietrovito and Pozzolo (2021) confirm the positive relation between GVC participation and average M&A values for specific sectors in the period 1995-2010, but generally with limited economic impact. Inverting the direction of the link, Adarov and Stehrer (2021) investigate the impact of FDI on GVC over the period 2000-2015 on a sample of European countries, showing that inward FDIs boost backward GVC participation, while outward FDIs enhance forward GVC linkages, particularly in high-tech manufacturing sectors. Fernandes et al. (2022), also show that foreign direct investments, among other factors like political stability and domestic industrial capacity, are crucial in shaping countries' GVC participation.

Our study contributes to this line of research from different angles. Following the recent debate on the reorganization of value chains (Antràs, 2021), we are interested in further investigating the extent to which GVC participation fosters foreign investment attractiveness of European firms, therefore focusing on the effects of GVC on FDI. To construct the GVC participation index, we exploit a recently developed a country-sector level database, not yet employed in the literature to explore the impact on FDI in a gravity framework, namely the ADB MRIO database.[7] Previous works employed country-level GVC participation indices (e.g. Martinez-Galan and Fontoura, 2019; Carril-Caccia and Pavlova, 2020) rather than sector-level information, therefore these studies did not employ sectoral variation in the variables of interest as detailed in our research. Indeed, differences among sectors, e.g. high-tech and low-tech activities, play an important role for cross-border investments and provide a novelty compared to previous evidence. In addition, recent studies employing sectoral level information (Cipollina, Pietrovito and Pozzolo, 2021)

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[7] This database follows the WIOD approach extending it to more countries and recent years. For further details on the database, see section 3.

pose the attention on bilateral participation. In our case, we employ data on bilateral M&A flows in a specific sector of the target economy, yet we employ GVC participation indices at the sector-country level for both the investor and the target country-sector. By not focusing on bilateral GVC participation, we are able to capture FDI decisions which are guided by GVC integration of the target economy with other economies, independently from bilateral GVC integration between the target and the acquirer economy.

Furthermore, previous studies focused on a smaller selection of countries and employed data from the first decade of the 2000s which was characterized by an increasing trend in GVC participation. We provide a more comprehensive view addressing the role of forward and backward GVC participation for both destination and origin countries in fostering M&A flows, focusing on the recent years where M&A activities gain momentum (as suggested by Figure 1) in a period characterized by the return of economic protectionism and trade wars. Our focus on European countries provides a unique case study, considering that this is a geographical region particularly appealing for cross-border acquisitions given its own participation and its openness to trade with the other major economic areas. Moreover, EU member states are subject to a similar institutional scenario and are converging towards the common FDI screening framework.

We also contribute to a growing literature which relies on gravity models to study FDI. In addition to the aforementioned works (i.e. Carril-Caccia and Pavlova, 2020; Cipollina, Pietrovito and Pozzolo, 2021), thanks to the theoretical background provided at the beginning of the current century by Markusen and Maskus (2002) and Bergstrand and Egger (2007), the use of gravity models to study FDI, and not only trade flows, gained interest in the recent years (Carrere, 2006, Bénassy-Quéré, Coupet and Mayer, 2007; De Sousa and Lochard, 2011; De Sousa, Mayer and Zignago, 2012; Heid and Larch, 2016; Gregori and Nardo, 2021). We contribute to this stream of literature providing new evidence based on the role of GVC participation, relying on granular data.

Finally, the present study contributes to the broader literature on FDI determinants. This literature examines a wide range of push and pull factors without reaching unanimous conclusions on the main drivers of foreign investments (Blonigen, 2005). For instance, Blonigen and Piger (2014) identify a group of variables as main drivers, such as cultural distance, the difference in labour endowments, and the presence of trade agreements. They find little supporting evidence for factors such as multilateral trade costs, host country's business costs, infrastructure or political institutions. Di Giovanni (2005) suggests that institutional quality of the receiving economy together with positive domestic financial conditions can stimulate cross-border M&As. The link between trade agreements, currency unions, and cross-border investments is also an open question. Eicher, Helfman and Lenkoski (2012) find a positive link only under

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specific conditions, while potential market opportunities in the host country are identified as a decisive pull factor. Economou (2019), focusing on Greece, Italy, Portugal and Spain, confirms the relevance of market size and gross capital formation to attract FDI, while unit labour cost in the receiving economy has a negative impact on cross-border investments. Our study adds to this literature stressing the role of GVC participation and its components for determining bilateral M&A flows, from the perspective of the destination and the origin country, disentangling potential asymmetric affects at the sectoral level.

This paper unfolds as follows. Section 2 focuses on the role of GVC participation in the context of FDI, while section 3 presents our dataset and the empirical methodology. Section 4 discusses the results, while a series of robustness checks are reported in section 5. Section 6 concludes.

2. GVC in the context of FDI

The organization of production through a global network of suppliers and customers is closely linked to the dynamics of FDI across countries. Indeed, companies can decide to serve a foreign market by shipping products to their customers via the trade channel (i.e. arm length) or by relying on a physical presence in that market. The latter can be established thanks to FDI in the form of new production facilities (i.e. Greenfield FDI) or through the acquisition of (or by merging with) companies already operating in that market (i.e. M&A). The investment can be pursued with the aim of founding or gaining control over an entity producing goods or services that are substitutes to those produced by the investor (i.e. horizontal FDI). A motive for choosing this strategy is the presence of specific advantages linked to physical or human capital which the investor has no incentive to transfer via arm's length trade or that might be appropriated by others (Dunning, 1988). Investing horizontally might be beneficial also when transportation costs are prohibitive or when economic sanctions such as export controls or anti-dumping duties prevent the investor from serving the destination market using the trade channel (Helpman, Melitz and Yeaple, 2004; Kleinert and Toubal, 2010).[8]

Alternatively, FDI might be pursued with the aim of gaining control over production stages which are placed upstream or downstream in the production chain to which the acquirer belongs (i.e. vertical FDI).[9] The investing company, in this case, perceives the target company as complementary or ancillary to its main activities. In this respect, vertical FDI is more likely to take place in the form of M&A of target

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[8] High import tariffs in the target economy can also be a factor explaining horizontal FDI (Kowalski et al., 2015).
[9] Sectors placed upstream supply the inputs employed by the investor while sectors placed downstream demand the products of the investor.

companies since Greenfield investment would generally require an internal know-how in the production of the good or service at stake (Davies, Desborders and Ray, 2018).[10] The investor may target companies upstream in the production chain to control the markets of its inputs or invest in companies operating in the subsequent stages of the supply chain (i.e. downstream) to gain market shares, pursuing the possibility to realize scale economies (Markusen, 1984).

The participation to GVC of an industrial sector indicates how connected this sector is with other industrial sectors in third countries thanks to international trade. A higher GVC participation of the target country should therefore stimulate foreign companies to invest in order to benefit from the trade linkages already available in the target economy. The new business venture may indeed take advantage of the network of suppliers already available in the destination economy and from the network of foreign customers that can potentially be served from the newly established, acquired or merged company. On the contrary, investors operating in sectors-countries already highly integrated into global value chains might have lower incentives to invest in foreign companies. Indeed, companies operating in sectors already strongly involved in global production chains might be less likely to pursue their internationalization strategies through either vertical or horizontal FDI.

Total participation into GVC is determined by backward and forward participation of each industrial sectors. In simple words, an increase in the index measuring forward participation indicates that an industrial sector is getting more integrated into GVC as a supplier to other industrial sectors in other countries. On the contrary a higher value for backward participation informs regarding a higher dependence of a sector's output on goods and services provided by others.

A priori, the relationship between these two components of GVC participation and FDI is not straightforward. A higher backward participation indicates that a sector is placed relatively downward in the production chain and therefore controls the last stages of production. This is usually the case for the most advanced economies which are dependent on imports from the rest of the world and are responsible for those stages of production where a higher technological or human capital content is added. This might attract the attention of foreign investors which want to gain control over those stages of the production chain that guarantee a higher share of value added. In this case, a higher backward participation of the destination economy might be positively associated with FDI, while the opposite holds, reverting the reasoning, for a higher backward participation in the economy from which the investor originates. Alternatively, backward participation of the target economy may deter foreign investment when it is not

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[10] Helpman (1984), Markusen and Venables (1998), Yeaple (2003), among many others, suggests that factors like market size, trade costs, and relative factor endowments, determine trends in horizontal and vertical FDI.

the result of a higher technological know-how in the target sector, but it is the outcome of a higher dependency on cross-border inputs due to the lack of alternative suppliers in the domestic economy.

A higher forward participation characterises those sectors which are suppliers of inputs and intermediates. Sectors-countries supplying inputs might be less likely to be the target of foreign investments as they occupy those stages of the value chain which are characterized by lower increments in value added. In this case, a higher forward participation of the destination economy might be negatively associated with FDI, while the opposite holds for a higher forward participation in the origin economy. These implications are overturned when a higher forward participation is the result of the strategic relevance of a specific sector-country in global value chains. Such relevance in the value chain, which may derive from a comparative advantage in specific production factors, could instead attract large inflows of foreign investments. Given these implications, the relationship between the different measures of value chain participation and inward FDI is ultimately an empirical question, which remains to be addressed.

The following figures describe trends in GVC participation experienced by EU economies. Figure 2 reports the evolution over time for the index representing GVC participation of European member states between 2007 and 2019. To better understand the related dynamics, we focus separately on manufacturing and service sectors, as the inherent characteristics of companies operating in these categories could lead to different patterns in GVC participation. The graph on the left hand side, reporting data on manufacturing sectors, confirms that EU countries increased their participation into GVC by 30 percent from 2016 onwards. This increase has been fuelled mostly by a rise in backward participation, which reported a remarkable increase from 2016 onwards.

Data on value chain participation for service sectors, displayed in the right hand side, shows a similar pattern with the only difference being a larger increase in backward participation, starting from 2009 onwards.

Figure 2: GVC participation, aggregate EU27, manufacturing and services (2007=100).

Manufacturing
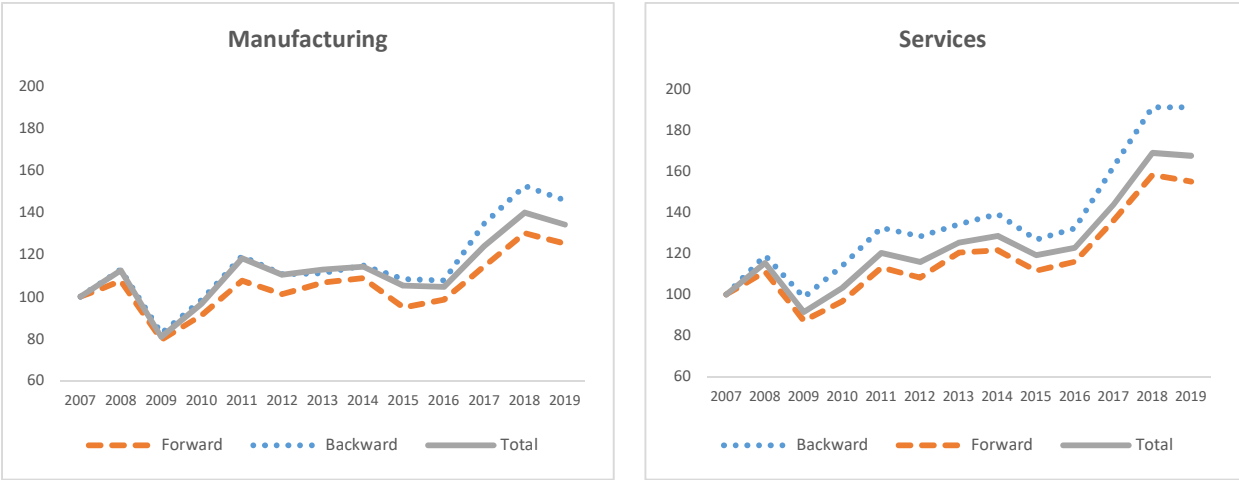
Services

Notes: This figure displays, for the period 2007-2019, backward (blue line), forward (orange line), and total (grey line) GVC participation index for manufacturing and service sectors. The value observed in 2007 in chosen as the basis (Source: ADB MRIO).

Backward and forward participation of manufacturing and service sectors across different EU countries are reported in Figure 3 and 4, respectively. Data on the former category confirms that all EU countries are more backward than forward integrated in 2019, supporting the argument on the relative downward position of EU manufacturing companies in their respective production chains. Indeed, EU manufacturing sectors strongly rely on cross-border intermediates and raw materials to assemble their output. This is particularly evident for the three largest manufacturing countries in the Union: Germany, France, and Italy. The opposite holds, especially for larger economies, when looking at service sectors (Figure 4). In this case, the majority of EU countries is actually more forward than backward integrated, thus showing a relative specialization in the stages of production placed upward in the chain.

Figure 3: Forward and backward GVC output integration in EU27, manufacturing sectors, 2019.
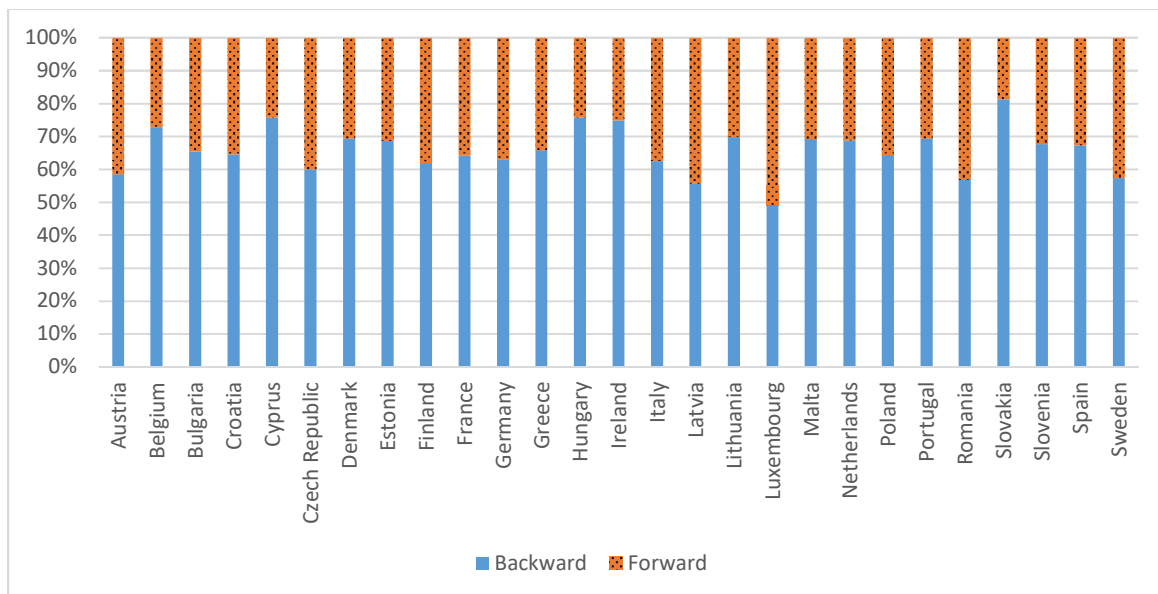
Notes: This figure displays, for year 2019, backward (blue) and forward (orange) GVC participation of manufacturing sectors across EU member states (Source: ADB MRIO).

Figure 4: Forward and backward GVC output integration in EU27, service sectors, 2019.
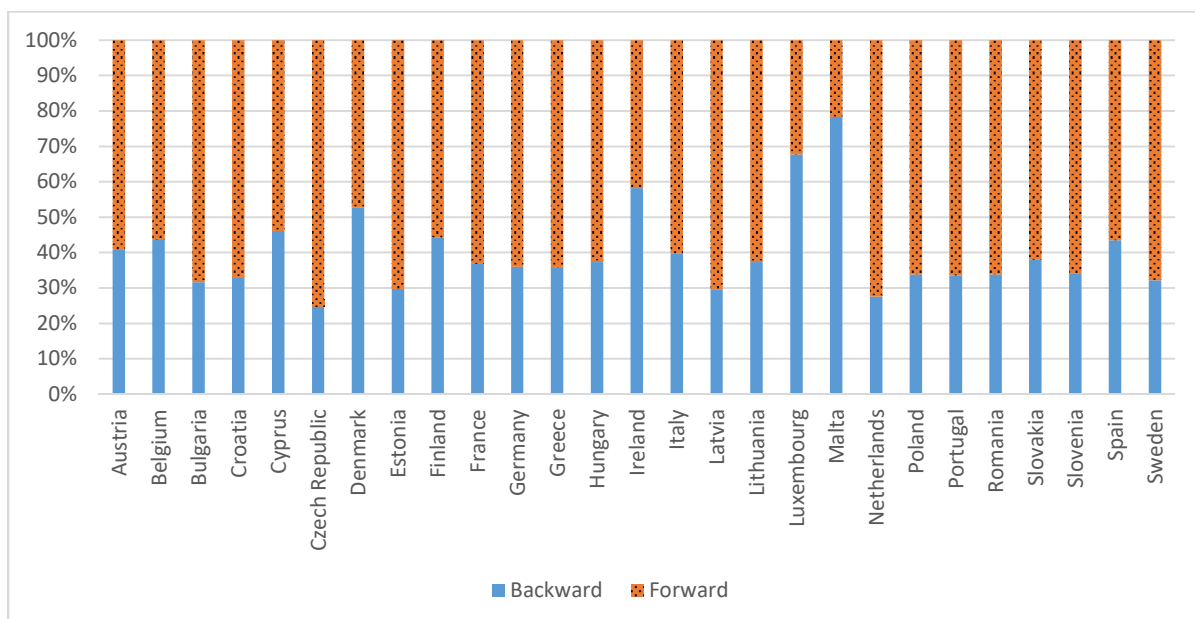
Notes: This figure displays, for year 2019, backward (blue) and forward (orange) GVC participation of service sectors across EU member states (Source: ADB MRIO).

Table 1 reports the ranking of the ten industrial sectors which reported the highest growth rates of GVC participation across EU countries. In particular, we compute the median value of GVC participation for each industrial sector-country and then obtain the growth rate of this median value between 2007 and 2019. According to our data, the transport sector, followed by the renting of machines and equipment, has been the industrial sector recording the highest increase of GVC participation during the period under investigation. Machinery and manufacturing, together with service sectors like air transport and retail trade, are also in the top-10 of sectors reporting remarkable increases in GVC participation across all EU countries.

Table 1: Top-10 sectors with highest growth over the period 2007-2019
Median GVC Participation across EU27 MS

Rank	Sector Name	ADB Sector Code
1	Transport equipment	15
2	Renting of Machine and Equipment and other business activities	30
3	Other supporting and auxiliary transport activities; activities of travel agencies	26
4	Air transport	25
5	Food, beverages, and tobacco	3
6	Hotels and restaurants	22
7	Health and social work	33
8	Machinery, n.e.c.	13
9	Manufacturing, n.e.c.; recycling	16
10	Retail trade, except of motor vehicles and motorcycles; repair of household goods	21

Notes: This table shows the list of the ten industrial sectors which recorded the highest growth in median GVC participation across EU27 member states in the period 2007-2019. Total GVC participation is the index employed in this table (Source: ADB MRIO).

3. Data and Econometric model

3.1. Dataset

To build the database employed in this empirical study, we rely on several sources. Data on M&A is obtained from the Bureau van Djik Zephyr database, a Moody's Analytics product. Zephyr, widely used in the literature (see, among others, Clò, Fiorio and Florio, 2017; Del Bo, Ferraris and Florio, 2017), includes M&A, portfolio investments and joint ventures deals worldwide since 1997, and information is collected from a wide range of sources, such as company websites, financial journals, reports, and press releases of companies. Our dependent variable represents the yearly flows of cross-border M&A (thousand Euro) between two countries at the sectoral level. It is created considering only completed cross-border deals where the target company is based in the EU27 during the period 2008-2020, excluding rumoured or uncompleted deals to increase the reliability of information included in our dataset. For each deal, we

retain data on the country of the investing and target companies, as well as the year in which the deal takes place, the sector of the target company and the nominal deal value.[11]

In order to determine from which country the investment comes from, we rely on information on the global ultimate owner (GUO) of the investing company.[12] Thanks to this approach, we are better able to consider the country in which the investment decision has been taken, in light of the complex structure of multinational firms and the common use of special purpose vehicles (Alviarez, Cravino and Levchenko, 2017; Gregori et al., 2019). In case information on the GUO is not available, since the investing firm is an independent company, we employ information on the country where the acquirer is based.

The main explanatory variable of interest is the sectoral GVC participation index, constructed using the ADB MRIO database available from the World Integrated Trade Solution website of the World Bank, and computed following Borin, Mancini and Taglioni (2021).[13] The GVC index refers to the participation of 32 industrial sectors for 63 countries worldwide during the period 2007-2019, and it is determined by backward and forward GVC participation.[14]

The GVC participation index measures the value of output at the country-sector level crossing more than one border. The first of its components, pure backward participation is obtained summing the total value of imported inputs bought by the sector directly from abroad or indirectly through domestic chains, and embedded in final goods and services production sold to domestic consumers – if inputs crossed more than one border before – or to cross-border consumers – if inputs crossed only one border.[15] Forward

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[11] We include in our sample any type of acquisition including minority, portfolio, and full acquisitions. We assign values for deals involving more acquirers and targets dividing the total deal value by the number of investors and/or targets. We prefer to use nominal and not real values for a number of reasons. Firstly, inflation adjustments are based on subjective elements (baskets or proxies representing the true unknown deflator), and secondly there is no clear empirical evidence that agents base their decisions on real instead of observed market values (Werner, 2013). We also employ time fixed effects in our empirical specifications.

[12] GUO's information is taken from Orbis, a Bureau van Djik product which employ the same firms' identifiers used by Zephyr. A GUO owns directly or indirectly at least 50.01 percent of direct investor's shares.

[13] All EU27 member states, together with the OECD economies, and a large group of Asian countries are included in the database. Alternative databases like Eurostat's Figaro cover EU economies, the United Kingdom, and the United States at a detailed level of 64 industries. Data on other partner economies is also available from this database up to 2019 based on projections for 21 industries.

For further details on the database, see Timmer et al. (2015) and the following webpage: https://mrio.adbx.online/.

[14] Arto, Dietzenbacher and Rueda-Cantuche (2019) also propose a framework that enables to decompose the factor content of bilateral trade measured at the border and account for the role of the different countries and industries participating in the global vale chain. Dietzenbacher and Romero (2007) employ I-O tables to assess intercountry linkages between industries, focusing on GVC propagation length.

[15] The output is assigned to the last sector receiving inputs.

related output instead accounts for the value-added produced by a given sector and sold directly abroad by the same sector or indirectly through domestic chains and then exported by the partner country.[16]

Measuring GVC participation using output allows us to address two issues usually encountered when relying on trade values to measure GVC participation. First, indices based on output are able to capture the contribution to value chains by some industrial sectors which contribute to global production chains but do not directly export their products or services. For example, this is the case of some service sectors which contribute to the formation of output which is then exported by manufacturing sectors. Second, by considering the output supplied globally by sectors involved in international trade and not focusing on their total exports, these indices give the possibility to consider the magnitude of the output supplied to the foreign market relative to size of the sector in the economy under investigation, thus enabling the researcher to quantify more precisely the exposure of a country-sector to external shocks than when relying on trade values (Borin, Mancini and Taglioni, 2021).

All GVC participation indices are measured in current US dollars. In order to take into account the relative size of sectors within countries, in our empirical specification, we scale the three indices for the total output produced by each sector in a given country-year.[17]

Our dataset includes other control variables usually employed in gravity models, namely distance and GDP of the origin and destination countries, obtained from the CEPII database.[18] Specifically, country-pair distances are calculated as the distance between the most populated cities in a given pair,[19] while the main source for data on GDP is the World Bank's Development Indicators (WDI).[20]

We also include a set of time invariant variables available from the CEPII database. Contiguity, common language, and colonial links are dummies equal to one if the two countries are contiguous, share common official or primary language, are or were in a colonial relationship post 1945 respectively, zero otherwise. Common legal origin is a dummy constructed on the basis of the two studies of La Porta et al. (1999) and La Porta, Lopez-de-Silanes and Shleifer (2008), and it is equal to one when the two countries have the same historical origin of their legal system post-transition, where post-transition refers to countries that switched from a socialist legal origin to a different legal structures after gaining

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[16] The output is assigned to the first sector producing domestically in the chain.

[17] Forward and backward GVC participation may be biased for small and large economies. This weighting procedure partially addresses this concern, moreover we employ fixed effects for the acquirer and the target economy and control for variables representing the size of the economies in all of our empirical specifications.

[18] The database is available here: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8.

[19] For further details, see: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=6.

[20] See: https://datacatalog.worldbank.org/search/dataset/0037712.

independence from the Soviet Union. Finally, thanks to World Trade Organisation (WTO)'s data, regional trade agreement is a dummy equal to one if the country-pair currently has a regional agreement in place.[21]

All time-varying covariates refer to the period 2007-2019. The dependent variable is aggregated at the NACE rev.2 2-digit level by country and year, in order to have a dimension consistent with the GVC indicators. Tab. 2 shows the main summary statistics for our variables of interest, while Table 3 displays cross-correlation between the main variables employed in our specifications.

Table 2: Descriptive statistics

Variables	Source	Obs.	Mean	SD	Min.	Max.
Dependent variable						
M&A (billion Euro)	Zephyr	13,647	0.17	0.99	0.00	61.90
Main control variables						
GVC - origin	ADB MRIO	13,647	0.20	0.18	0.00	0.95
GVC - destination	ADB MRIO	13,647	0.25	0.20	0.00	0.90
GVC forward - origin	ADB MRIO	13,647	0.04	0.04	0.00	0.50
GVC forward - destination	ADB MRIO	13,647	0.05	0.04	0.00	0.53
GVC backward - origin	ADB MRIO	13,647	0.04	0.06	0.00	0.57
GVC backward - destination	ADB MRIO	13,647	0.06	0.07	0.00	0.57
Bilateral indicators						
Distance (in log)	CEPII	13,647	7.36	1.24	4.09	9.81
GDP of the origin country (in log)	CEPII	13,647	21.30	1.60	15.83	23.79
GDP of the destination country (in log)	CEPII	13,647	20.75	1.04	15.92	22.10
Contiguity	CEPII	13,647	0.23	0.42	0.00	1.00
Common language	CEPII	13,647	0.17	0.38	0.00	1.00
Colonial links	CEPII	13,647	0.00	0.04	0.00	1.00
Common legal origins	CEPII	13,647	0.30	0.46	0.00	1.00
Regional trade agreements	CEPII	13,647	0.67	0.47	0.00	1.00

Notes: This table reports descriptive statistics for variables employed in the econometric specifications presented in this study. For each variable, we report the data source from which it is retrieved, the number of observations, the mean value of the variable, its standard deviation, as well as the minimum and the maximum value.

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[21] Conte, Cotterlaz and Mayer (2021) provide further details related to the construction of the CEPII Gravity Database.

Table 3: Correlation table

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) M&A	1.00									
(2) GVC - origin	-0.02	1.00								
(3) GVC - destination	0.05	0.51	1.00							
(4) GVC forward - origin	0.00	0.70	0.45	1.00						
(5) GVC forward - destination	0.04	0.37	0.67	0.51	1.00					
(6) GVC backward - origin	-0.02	0.70	0.31	0.24	0.08	1.00				
(7) GVC backward - destination	0.04	0.34	0.67	0.15	0.15	0.50	1.00			
(8) Distance	0.03	-0.32	0.02	-0.31	0.02	-0.24	0.02	1.00		
(9) GDP of the origin country	0.08	-0.50	0.07	-0.34	0.03	-0.38	0.06	0.48	1.00	
(10) GDP of the destination country	0.01	0.06	-0.25	0.01	-0.15	0.07	-0.17	-0.02	-0.03	1.00

Notes: This table reports cross-correlations between the main variables employed in the econometric specifications presented in this study. We report data for the dependent variable (M&A), the indicators of GVC participation, and the most relevant gravity variables.

3.2. Econometric model

Starting from the seminal paper of Tinbergen (1962) and the theoretical foundations provided by Anderson and Van Wincoop (2003),[22] gravity models gained popularity in the trade literature to study the determinants of bilateral trade flows. In addition, also the literature related to FDI has widely implemented gravity models to perform empirical studies (see, among others, Eaton and Tomura, 1994; Di Giovanni, 2005; Bénassy-Quéré, Coupet and Mayer, 2007; Hijzen, Görg and Manchin, 2008; De Sousa and Lochard, 2011; Carril-Caccia, Garmendia-Lazcano and Minondo, 2021). Given our setting, we are interested in explaining the amount of bilateral M&As, at the country-sector level, using as the main explanatory variable the level of global value chain participation of the investor, proxied by GVC participation represented by three different indices, namely the total, forward and backward participation. Therefore, we implement a gravity model designed as follows:

$$M\&A_{ijk,t} = \exp[\beta_0 + \beta_1 GVC_{ik,t-1}^{\alpha} + \beta_2 GVC_{jk,t-1}^{\alpha} + \beta_3 \ln(Distance_{ij}) + \beta_4 \ln(GDP_{i,t-1})$$
$$+ \beta_5 \ln(GDP_{j,t-1}) + \sigma\, Bilateral_{ij} + \gamma_i + \omega_j + \varphi_{\tilde{k}} + \delta_t + \varepsilon_{ij,t}] \tag{1}$$

where the term $M\&A_{ijk,t}$ represents the flow of cross-border M&As (thousand Euro), from country i to country j, in sector k, at time t. The sector k is defined using the NACE 2-digit classification.[23] Our explanatory variables of interest are $GVC_{ik,t-1}^{\alpha}$, and $GVC_{jk,t-1}^{\alpha}$, where the former is the Global Value Chain (GVC) indicator of the investor's country i in sector k at time $t-1$, and the latter is the GVC indicator of the target's country j at time $t-1$. The term α is an indicator which varies according to the three types of GVC participation indexes taken into consideration, i.e. total, forward and backward. All indices are scaled by output at the sector-country level. Equation (1) represents our baseline model, composed by three specifications, one for each type of GVC participation.

In addition to the GVC indices, we include the standard gravity variables in logarithm form, specifically a variable measuring bilateral $Distance$ between each country pair, and GDP of both origin and the destination countries. The model is augmented including the vector $Bilateral_{ij}$, composed by country-pair's time-invariant characteristics, namely contiguity, common language, colonial links, common legal origin and common regional trade agreement (Head, Mayer and Ries, 2010; Head and Mayer, 2014), as further detailed in the next section.

Explanatory variables are lagged by one year to partially reduce potential endogeneity issues stemming from reverse causality. In addition, we include fixed effects for investor (γ_i), and target countries (ω_j), and industrial sectors at the NACE-1 digit classification ($\varphi_{\bar{k}}$) to take into account persistent factors varying at the sector or at the country level affecting M&A flows. We also include year fixed effects (δ_t) in order to capture global shocks and trends affecting the dynamics of FDI across sectors and countries. Standard errors are two-way clustered by country-pair and time to consider potential heteroscedasticity. Considering that our dependent variable often assumes a value equal to zero (whenever, for each sector, a country-pair does not have M&A flows), the gravity estimates obtained from log-linearized ordinary least squares (OLS) would be biased by the presence of a high frequency of zeros in the dependent variable, as taking logs clears the sample from null observations (Helpman, Melitz and Rubinstein, 2008). Thus, the model is estimated using Poisson Pseudo Maximum Likelihood (PPML), in line with Silva and Tenreyro (2006) and Head and Mayer (2014). PPML estimators provide an additional advantage, thanks to their robustness to heteroscedasticity in log-linear gravity equations, for instance in the case of correlation between the scale of the residual and countries' GDP (Nordås and Rouzet, 2017).

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[23] For further details on the NACE classification, see:
https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF.

4. Results

4.1. Baseline

The baseline gravity model (1) is estimated in two steps. Firstly, we show results obtained when considering only core gravity controls together with the GVC participation indexes, namely distance among countries and GDP of both origin and destination countries, as reported in Table 4, specification (1). We then estimate the baseline model adding further country-pair control variables, to control for geographical contiguity, the presence of a common language among the two countries, colonial relationship, common legal framework, and the dummy equal to one when a country pair is involved in a regional trade agreement, as reported in Table 4, specification (2).

Baseline results show that our variables of interests, total GVC participation of origin and EU27 destination countries, have contrasting effects on cross-border M&A flows.[24] Indeed, estimates show that sectoral GVC participation of the origin country is negatively associated with M&A investments in EU countries, while GVC participation of the EU27 destination country is positively associated with M&A flows. Member states whose industrial sectors are more integrated in global value chains receive a higher amount of cross-border investments, while origin countries more integrated in global production networks tend to invest less in EU countries. According to estimates reported in column (2), the coefficient of the GVC participation of the destination country shows that, all other factors being constant, a 1 percent increase in GVC participation of the destination country is associated with a 0.6 percent increase in the value of M&A flows at the sector-country level.[25] On the contrary, sectoral participation in global production chains of the investor's origin country is negatively and significantly correlated with FDI: a 1 percent increase in GVC participation of the origin country is associated with a 1.30 percent reduction in M&A flows towards EU member states. Companies operating in countries-sectors which are highly integrated in value chains are less likely to invest in European companies.

We now consider the two components of GVC participation, forward and backward. We first assess the role of GVC forward participation of the origin and the destination country in affecting bilateral M&A, as shown in specification (3). Estimates show that sectoral forward participation of the origin and the destination country is not significantly associated with M&A. In specification (4), we estimate the model

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[24] We discuss specifications obtained relying on alternative sets of fixed effects in the section devoted to robustness checks.

[25] To compute the M&A flow's variation for specification (2) in Table 2 related to the GVC of the destination country, we solve the following equation: $M\&A_{ijk,t} = [\exp(\Delta GVC_{jk,t-1}^{Total} * \widehat{\beta_2})] * 100$. In our case, $\Delta GVC_{jk,t-1}^{Total}$ is equal to 1 percent.

focusing on GVC backward participation, which accounts for the dependence of each country's output on goods and services supplied by other countries. Results show that a 1 percent increase in backward participation of the target country-sector is associated with a 2.78 percent increase in the value of M&A deals, while investments from more backward-integrated origin countries tend to be lower. Backward participation in GVCs of the destination market is then positively associated with FDI and supports the positive and significant coefficient of total GVC participation obtained in column (2) of Table 4.

To sum up, we find that EU firms part of an industrial sectors which strongly rely on cross-border inputs to accomplish their output, are more likely to be targets of foreign acquisitions, while companies from third countries and sectors that are less dependent on foreign inputs are more likely to invest in Europe.

Among the control variables employed in this specification, we observe that distance between the investor and the destination country does not have a statistically significant effect on M&A. GDP of the origin and destination countries are positively and significantly associated with the value of M&A deals, confirming that companies from larger economies are more prone to acquire EU27 companies, while larger economies in the EU attract more inward investments (Antràs, 2020).[26] Estimates reported in specification (2) also show that M&A is higher for country pairs sharing a common language and a legal framework. Contiguity, colonial linkages, and regional trade agreement do not seem to statistically affect M&A flows.

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[26] These specifications include any M&A deals with the target company in EU27, therefore investors may have the GUO also located in any other EU27 country.

Table 4: Cross-border M&A deals in EU27, baseline results

	(1) Deal Value	(2) Deal Value	(3) Deal Value	(4) Deal Value
GVC - origin$_{ik,t-1}$	-1.32**	-1.29**		
	(0.63)	(0.62)		
GVC - destination$_{jk,t-1}$	0.60*	0.59*		
	(0.33)	(0.32)		
GVC forward - origin$_{ik,t-1}$			2.10	
			(2.21)	
GVC forward - destination$_{jk,t-1}$			0.87	
			(2.16)	
GVC backward - origin$_{ik,t-1}$				-2.44*
				(1.25)
GVC backward - destination$_{jk,t-1}$				2.75***
				(1.05)
ln(Distance)$_{ij}$	-0.30*	0.12	0.12	0.12
	(0.16)	(0.12)	(0.12)	(0.12)
ln(GDP origin)$_{i,t-1}$	1.49**	1.41**	1.55***	1.47**
	(0.58)	(0.58)	(0.59)	(0.59)
ln(GDP destination)$_{j,t-1}$	2.51***	2.38**	2.38**	2.34**
	(0.85)	(0.98)	(0.98)	(0.97)
Contiguity$_{ij}$		-0.06	-0.06	-0.06
		(0.13)	(0.13)	(0.13)
Common language$_{ij}$		1.31***	1.31***	1.31***
		(0.31)	(0.30)	(0.30)
Colonial links$_{ij}$		-0.11	-0.15	-0.10
		(0.67)	(0.66)	(0.67)
Common legal origins$_{ij}$		0.34**	0.34**	0.34**
		(0.17)	(0.17)	(0.17)
Regional trade agreements$_{ij,t-1}$		0.14	0.19	0.16
		(0.13)	(0.13)	(0.14)
Year fixed effects	yes	yes	yes	yes
Origin fixed effects	yes	yes	yes	yes
Destination fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
Observations	737,963	737,963	737,963	737,963
Pseudo-R^2	0.413	0.405	0.412	0.414

Notes: This table shows the results from implementing the PPML model. The dependent variable is the value of bilateral M&A in thousand Euro and covers years 2008–2020. Time-varying explanatory variables are lagged by 1 year and cover the period 2007-2019. Robust standard errors, two-way clustered by

country pair and year, are shown in parenthesis. The symbols *, ** and *** indicate statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

4.2. Cross-border acquisitions in manufacturing and service sectors

M&A deals in different industrial sectors are guided by different economic motives. While, in most instances, investors on EU27 companies operating in manufacturing sectors might still take under consideration the possible trade-off between serving a destination market via exports or using an acquired company located in the destination market (i.e. horizontal FDI), this type of considerations should be less stringent for acquisitions of companies operating in service sectors. Data on GVC participation of EU countries discussed in section 2 describes the different dynamics of GVC participation experienced by service and manufacturing sectors across EU countries.

Given the differences in the motives which determine M&A in manufacturing and services, in Table 5 we separately report evidence for investments on companies operating in manufacturing and service sectors.[27] Estimates show that sectoral backward GVC participation of the destination country is positively and significantly associated with FDI in manufacturing sectors, as shown in specification (3).

EU manufacturing companies operating in sectors more dependent on cross-border output are more likely to be targets of cross-border acquisitions. The magnitude of this effect is remarkable as a 1 percent increase in backward participation in the destination market is associated with a 3.48 percent higher investment in manufacturing companies. By contrast, forward participation of the destination market is negatively and significantly associated with investments in both service and manufacturing sectors. EU companies operating in sectors whose output is then re-exported by other economies are less likely to be targeted by foreign investors. Estimates show that physical distance between the investor and the target country is positively correlated with investments on companies operating in manufacturing sectors. Investors whose GUO is based in a country more distant from the EU27 are more likely to invest in EU companies, supporting the role of distance as a factor determining FDI in manufacturing, while this is not the case for service sectors. The economic magnitude of both the investor and target economy, represented by GDP, are positively and significantly associated with the outcome variable when considering investments in manufacturing companies. Moreover, results confirm that sharing a common official language has a positive significant effect on investments in target companies operating in services.

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[27] We consider European targets operating in NACE sectors 9 to 33 as belonging to manufacturing, while companies in sectors 45 to 96 are assigned to services.

Table 5: Cross-border M&A deals in EU27, target firms in Manufacturing and Services sectors

	Manufacturing			Services		
	(1)	(2)	(3)	(4)	(5)	(6)
	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value
GVC - origin$_{ik,t-1}$	-0.42			-1.23*		
	(1.22)			(0.68)		
GVC - destination$_{jk,t-1}$	1.11			-0.23		
	(0.84)			(0.39)		
GVC forward - origin$_{ik,t-1}$		4.54			-0.89	
		(4.96)			(3.75)	
GVC forward - destination$_{jk,t-1}$		-5.72***			-6.02**	
		(1.97)			(2.66)	
GVC backward - origin$_{ik,t-1}$			0.38			-1.40
			(0.64)			(3.02)
GVC backward - destination$_{jk,t-1}$			3.43***			0.67
			(0.92)			(1.42)
ln(Distance)$_{ij}$	0.55***	0.55***	0.55***	-0.05	-0.05	-0.05
	(0.19)	(0.19)	(0.19)	(0.13)	(0.13)	(0.13)
ln(GDP origin)$_{i,t-1}$	2.26***	2.34***	2.34***	0.89	0.93	0.94
	(0.84)	(0.85)	(0.88)	(0.72)	(0.74)	(0.72)
ln(GDP destination)$_{j,t-1}$	4.64***	4.45***	4.42***	0.28	0.23	0.25
	(1.08)	(1.02)	(0.98)	(1.35)	(1.35)	(1.36)
Contiguity$_{ij}$	0.11	0.11	0.11	-0.02	-0.02	-0.02
	(0.47)	(0.46)	(0.46)	(0.14)	(0.13)	(0.13)
Common language$_{ij}$	0.81	0.80	0.80	1.50***	1.50***	1.50***
	(0.52)	(0.52)	(0.52)	(0.33)	(0.32)	(0.32)
Colonial links$_{ij}$	0.24	0.31	0.37	-0.07	-0.08	-0.07
	(2.19)	(2.18)	(2.20)	(0.76)	(0.78)	(0.76)
Common legal origins$_{ij}$	0.59**	0.58**	0.59**	0.27	0.27	0.27
	(0.27)	(0.26)	(0.26)	(0.21)	(0.20)	(0.21)
Regional trade agreements$_{ij,t-1}$	-0.73	-0.67	-0.71	0.15	0.16	0.17
	(0.49)	(0.50)	(0.48)	(0.24)	(0.24)	(0.25)
Year fixed effects	yes	yes	yes	yes	yes	yes
Origin fixed effects	yes	yes	yes	yes	yes	yes
Destination fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
Observations	185,457	185,457	185,457	368,794	368,794	368,794
Pseudo-R^2	0.455	0.457	0.463	0.432	0.433	0.431

Notes: This table shows the results from implementing the PPML model. The dependent variable is the value of bilateral M&A in thousand Euro and covers years 2008–2020. Time-varying explanatory variables are lagged by 1 year and cover the period 2007-2019. Acquisitions of targets belonging to NACE sectors 9 to 33 are labelled as acquisitions in manufacturing and considered in specifications (1) to (3), while investments in NACE sectors 45 to 96 are labelled as services, specifications (4) to (6). Robust standard errors, two-way clustered by country pair and

year, are shown in parenthesis. The symbols *, ** and *** indicate statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

4.3. Acquisitions in high-tech and low-tech sectors

One of the strongest motivations behind M&A activities is the acquisition of technologies that can guarantee to the investor a sizeable advantage towards competitors in the future. While lagging behind with respect to US companies for what concerns digitalization and disruptive innovations, EU27 companies are often leaders in sectors characterized by high technological intensity (e.g. pharmaceuticals, space and defence, electrical equipment).[28] Given this, we investigate how sectoral characteristics of the target company determine patterns in foreign investments by focusing on high-tech and on low-tech sectors.

We employ the Eurostat classification of NACE sectors according to their technological intensity and consider sectors with high and medium-high technological intensity as high-tech sectors, while sectors with a low and medium-low technological intensity are classified as low-tech.[29] The two groups include both manufacturing and services sectors, thus providing a different perspective with respect to the evidence reported in Table 5.

Specifications displayed in columns (1) to (3) of Table 6 report findings for investments in high-tech sectors, while the remaining specifications in this Table display results for low-tech sectors. Findings reported in column (3) show that backward participation in the receiving economy is positively associated with M&A in high-tech sectors. Companies operating in high-tech, backward-integrated, sectors are more likely to be targets of cross-border acquisitions. Forward participation of the target economy is instead negatively correlated with M&A, a 1 percent increase in forward participation is associated with a reduction in the value of foreign acquisitions at the sector-level equal to 3.58 percent.

Patterns for low-tech sectors are distinctively different, as we observe that all the various indicators of GVC participation for the target economy are not significantly associated with M&A flows. On the contrary, sectoral GVC participation of the origin country is negatively associated with M&A on targets in low-tech sectors, mostly due to a negative, significant, coefficient of forward participation. Companies from countries-sectors having a dominant position in the early stages of the global production chain are then less likely to invest in EU27 companies operating in low-tech sectors.

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[28] Refer to Moncada-Paterno-Castello and Grassano (2022), European Commission (2021), and Reinstaller and Unterlass (2012).
[29] The definition provided by Eurostat can be found here: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:High-tech_classification_of_manufacturing_industries.

Table 6: Cross-border M&A deals in EU27, target firms in High-Tech vs Low-Tech sectors

	High-tech			Low-tech		
	(1)	(2)	(3)	(4)	(5)	(6)
	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value
GVC - origin$_{ik,t-1}$	-1.18			-3.37***		
	(0.92)			(0.77)		
GVC - destination$_{jk,t-1}$	0.21			-0.65		
	(0.58)			(1.01)		
GVC forward - origin$_{ik,t-1}$		1.01			-9.70***	
		(3.53)			(3.77)	
GVC forward - destination$_{jk,t-1}$		-3.52*			-3.17	
		(1.85)			(3.11)	
GVC backward - origin$_{ik,t-1}$			-3.71*			-2.15
			(2.08)			(1.71)
GVC backward - destination$_{jk,t-1}$			1.48*			0.63
			(0.82)			(1.41)
ln(Distance)$_{ij}$	0.24*	0.24*	0.24*	0.06	0.06	0.05
	(0.14)	(0.13)	(0.13)	(0.22)	(0.22)	(0.22)
ln(GDP origin)$_{i,t-1}$	1.03	1.16*	1.06	2.47**	2.62***	2.70***
	(0.66)	(0.69)	(0.69)	(1.01)	(0.99)	(1.00)
ln(GDP destination)$_{j,t-1}$	3.07***	3.03***	3.02***	-0.37	-0.33	-0.33
	(1.05)	(1.08)	(1.03)	(1.19)	(1.18)	(1.19)
Contiguity$_{ij}$	-0.05	-0.05	-0.05	0.05	0.05	0.04
	(0.27)	(0.27)	(0.27)	(0.35)	(0.35)	(0.36)
Common language$_{ij}$	1.53***	1.53***	1.53***	0.78*	0.78*	0.78*
	(0.39)	(0.39)	(0.39)	(0.41)	(0.41)	(0.41)
Colonial links$_{ij}$	1.31	1.33	1.32	-5.32***	-5.32***	-5.32***
	(1.73)	(1.74)	(1.73)	(0.80)	(0.79)	(0.83)
Common legal origins$_{ij}$	0.37***	0.38**	0.38***	0.53	0.53	0.53
	(0.14)	(0.15)	(0.14)	(0.44)	(0.44)	(0.44)
Regional trade agreements$_{ij,t-1}$	-0.40	-0.36	-0.40	0.33	0.35	0.41
	(0.29)	(0.29)	(0.30)	(0.39)	(0.38)	(0.38)
Year fixed effects	yes	yes	yes	yes	yes	yes
Origin fixed effects	yes	yes	yes	yes	yes	yes
Destination fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
Observations	305,230	305,230	305,230	230,964	230,964	230,964
Pseudo-R^2	0.477	0.477	0.477	0.364	0.361	0.356

Notes: This table shows the results from implementing the PPML model. The dependent variable is the value of bilateral M&A in thousand Euro and covers years 2008–2020. Time-varying explanatory variables are lagged by 1 year and cover the period 2007-2019. Acquisitions are assigned to high-tech or low-tech activities following the Eurostat classification of NACE sectors according to the technological intensity of the target firm. Robust standard

errors, two-way clustered by country pair and year, are shown in parenthesis. The symbols *, ** and *** indicate statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

4.4. Acquisitions from OECD and non-OECD based investors

We now turn the attention to another feature which could characterize patterns of cross-border investments on European companies, the investor's origin country, differentiating between OECD and non-OECD investor countries.[30]

Findings displayed in Table 7 show that sectoral GVC participation of the origin country has an opposite effect for OECD and non-OECD investors. Indeed, GVC participation is negatively associated with M&A in EU27 countries for acquisitions from OECD countries, while non-OECD investors that are more integrated into global value chains tend to invest more in EU27 companies. A 1 percent increase in GVC participation in the non-OECD origin country is associated with a 2.35 percent increase in the value of cross-border M&A. This is mostly due to forward participation, which is positively associated with the value of M&A deals for non-OECD investors. This effect is not present for OECD investors, these origin countries actually report a negative sign of the coefficient for backward participation: OECD companies which operate in more backward-integrated sectors tend to invest less in EU member states.

Importantly, we find that participation in global production chains of the target sector-country has an effect on cross-border M&A only when the investor is from an OECD country. We observe that a 1 percent increase in GVC participation of the target sector is associated with a 0.68 percent increase in foreign investment. EU27 investment destinations which are more backward-integrated attract more investments from OECD countries.

As other control variables included in these specifications report the expected sign, it is worth mentioning that distance enters with a negative and statistically significant coefficient in those regressions employing data on investments from non-OECD countries. This suggests that physical distance deters M&A deals in EU countries only when the investor is based in a country which is not part of the OECD.

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[30] During the period under investigation, the following countries were members of the OECD: Austria, Australia, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

Table 7: Cross-border M&A deals in EU27, investors from OECD vs non-OECD countries

	OECD investors			Non-OECD investors		
	(1)	(2)	(3)	(4)	(5)	(6)
	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value
GVC - origin$_{ik,t-1}$	-1.64**			2.33***		
	(0.70)			(0.65)		
GVC - destination$_{jk,t-1}$	0.68**			-0.41		
	(0.34)			(1.26)		
GVC forward - origin$_{ik,t-1}$		1.41			6.88**	
		(2.66)			(3.17)	
GVC forward - destination$_{jk,t-1}$		-0.46			5.18	
		(1.57)			(3.15)	
GVC backward - origin$_{ik,t-1}$			-2.58**			-0.40
			(1.31)			(2.44)
GVC backward - destination$_{jk,t-1}$			2.85***			1.78
			(1.08)			(2.00)
ln(Distance)$_{ij}$	0.12	0.12	0.12	-2.68***	-2.68***	-2.68***
	(0.12)	(0.12)	(0.12)	(0.92)	(0.89)	(0.93)
ln(GDP origin)$_{i,t-1}$	1.67**	1.84**	1.75**	2.85***	2.56***	2.72***
	(0.72)	(0.73)	(0.73)	(0.95)	(0.88)	(0.95)
ln(GDP destination)$_{j,t-1}$	2.25**	2.25**	2.21**	4.63***	4.73***	4.63***
	(1.04)	(1.04)	(1.03)	(1.57)	(1.60)	(1.58)
Contiguity$_{ij}$	-0.06	-0.06	-0.07	-1.32	-1.21	-1.33
	(0.14)	(0.14)	(0.13)	(1.02)	(0.97)	(1.00)
Common language$_{ij}$	1.28***	1.28***	1.28***	2.34***	2.43***	2.33***
	(0.32)	(0.32)	(0.31)	(0.55)	(0.63)	(0.50)
Colonial links$_{ij}$	0.81	0.81	0.81	-0.81	-1.54*	-0.83
	(0.87)	(0.88)	(0.86)	(0.92)	(0.81)	(0.89)
Common legal origins$_{ij}$	0.36*	0.36*	0.37*	0.19	0.10	0.21
	(0.19)	(0.19)	(0.19)	(0.25)	(0.23)	(0.27)
Regional trade agreements$_{ij,t-1}$	0.17	0.25*	0.21	0.36	0.30	0.44
	(0.13)	(0.14)	(0.13)	(0.49)	(0.48)	(0.49)
Year fixed effects	yes	yes	yes	yes	yes	yes
Origin fixed effects	yes	yes	yes	yes	yes	yes
Destination fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
Observations	544,358	544,358	544,358	118,380	118,380	118,380
Pseudo-R^2	0.411	0.409	0.411	0.281	0.293	0.277

Notes: This table shows the results from implementing the PPML model. The dependent variable is the value of bilateral M&A in thousand Euro and covers years 2008–2020. Time-varying explanatory variables are lagged by 1 year and cover the period 2007-2019. Investors are identified either as OECD or non-OECD using information on their Global Ultimate Owner. Robust standard errors, two-way clustered by country pair and year, are shown in

parenthesis. The symbols *, ** and *** indicate statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

5. Robustness checks

In this section, we implement a series of checks to validate the robustness of our baseline results. As reported in Table 8, we start by testing the baseline results reported in Table 4, specification (2), focusing on OECD investors but excluding acquirers based in EU27 countries, to focus on non-European OECD investors, and our main results are confirmed (specification 1).[31]

We then add further explanatory variables, namely "Rule of law" for both origin and destination countries (specification 2). This indicator is constructed by the World Bank and considers the extent to which institutional factors are linked to an environment where the basis for economic and social interactions is formed by fair and predictable rules.[32] It is estimated yearly at the country level and includes perceptions on the incidence of crime, the effectiveness and predictability of the judiciary system, and the enforceability of contracts, ranging from approximately –2.5 to 2.5 (see Kaufmann, Kraay and Mastruzzi, 2011). While "Rule of law" is not statistically significant in our specifications, findings for the GVC indices, our variables of interest, are confirmed.

In addition, specification (3) controls for the logarithm of population in both the origin and the destination country, to take into account population dynamics: the main result holds.

We then verify whether findings are driven by investors located in specific locations for fiscal purposes. It could be the case that a company has the centre of its economic activities in a country but its GUO is located in a tax haven to strategically lower the overall tax burden. We take advantage of the classification made by Gravelle (2013), excluding from our estimation those investors with a GUO located in tax havens, and results are confirmed (specification 4).[33]

We also test that our results are not driven by the great recession in year 2008. Therefore, in specification (5) we run the baseline model excluding cross-border M&As taking place between 2007 and 2009. Considering that explanatory variables are lagged by 1 year, the time span covered by the

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[31] We define an investor as non-European when its Global Ultimate Owner of the investing firm is located outside EU27.

[32] The World Government Indicators database can be found here: http://info.worldbank.org/governance/WGI.

[33] This classification has been extensively implemented in the literature (see, among others, Fatica and Gregori, 2020). Gravelle's tax havens combines the following sources: (i) Hines and Rice (1994), more oriented to business issues; (ii) Tax Justice Network, "Identifying Tax Havens and Offshore Finance Centres: http://www.taxjustice.net/cms/upload/pdf/Identifying_Tax_Havens_Jul_07.pdf; (iii) OECD (2000). See: Gravelle (2013) for further details.

explanatory variables is now 2010-2019, while the dependent variable spans between 2011 and 2020. Our findings are confirmed also in this specification, and coefficients for the variables representing GVC participation remain remarkably stable.

We further assess our evidence introducing different sets of fixed effects, such as year interacted with both origin and destination countries fixed effects (specification 6), and country-pair fixed effects (specification 7). The introduction of this additional, more restrictive, set of fixed effects implies that only country-pair and sectoral time-varying parameters can be identified in the first case, while time-varying bilateral covariates and sectoral time-varying parameters can be identified in the second case, due to collinearity with fixed effects of the other covariates. In addition, the number of observations reduces, as the created zero-inflated matrix has many investor-destination countries without investment in a specific year, and therefore cannot contribute to the Likelihood function. Nevertheless, our main results continue to hold in both specifications.[34]

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[34] As suggested by Head and Mayer (2014), we also test our results using alternative estimators, namely OLS and Gamma Pseudo Maximum likelihood estimator, and results are confirmed. In addition, we test our results for the exclusion of small countries (i.e. with less than 500,00 inhabitants), as well as Cyprus and Malta, and results continue to hold. Tables reporting these specifications are available upon request.

Table 8: Robustness checks on the baseline specification

Type of check:	OECD investors excluding EU27	Rule of law	Population	Excluding tax havens	Excluding the financial crisis	Year*Countries fixed effects	Country-pair fixed effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value	Deal Value
GVC - origin$_{ik,t-1}$	-2.74***	-1.31**	-1.30**	-1.32**	-1.13*	-1.35**	-1.26**
	(0.73)	(0.63)	(0.62)	(0.62)	(0.68)	(0.64)	(0.59)
GVC - destination$_{jk,t-1}$	0.79**	0.60*	0.61*	0.59*	0.62**	0.73**	0.56*
	(0.39)	(0.34)	(0.34)	(0.32)	(0.30)	(0.35)	(0.30)
ln(Distance)$_{ij}$	0.32	0.12	0.12	0.12	0.19**	0.12	
	(0.21)	(0.11)	(0.12)	(0.12)	(0.10)	(0.12)	
ln(GDP - origin)$_{i,t-1}$	1.61**	1.53***	1.20**	1.40**	1.16*		1.41**
	(0.68)	(0.58)	(0.51)	(0.58)	(0.71)		(0.58)
ln(GDP - destination)$_{j,t-1}$	2.19*	2.32**	3.49***	2.38**	1.95		2.38**
	(1.24)	(0.92)	(0.87)	(0.99)	(1.20)		(1.06)
Contiguity$_{ij}$	-0.32	-0.06	-0.06	-0.06	-0.11	0.04	
	(0.42)	(0.15)	(0.13)	(0.13)	(0.17)	(0.14)	
Common language$_{ij}$	1.06***	1.30***	1.29***	1.32***	1.40***	1.16***	
	(0.32)	(0.31)	(0.32)	(0.31)	(0.35)	(0.34)	
Colonial links$_{ij}$	0.97	-0.09	-0.10	-0.62	-0.07	-0.31	
	(1.35)	(0.71)	(0.68)	(0.73)	(0.61)	(0.86)	
Common legal origins$_{ij}$	-0.24	0.34**	0.33**	0.33**	0.28	0.34*	
	(0.35)	(0.17)	(0.16)	(0.17)	(0.18)	(0.18)	
Regional trade agreements$_{ij,t-1}$	0.00	0.24*	0.12	0.14	0.10		0.13
	(0.14)	(0.13)	(0.13)	(0.14)	(0.10)		(0.16)
Rule of law - origin$_{i,t-1}$		-1.28					
		(0.84)					
Rule of law - destination$_{j,t-1}$		-0.87					
		(0.71)					
ln(Population - origin)$_{i,t-1}$			3.29				
			(2.53)				
ln(Population - destination)$_{j,t-1}$			-6.46**				
			(2.89)				
Year fixed effects	yes	yes	yes	yes	yes	yes	yes
Origin fixed effects	yes	yes	yes	yes	yes	yes	yes
Destination fixed effects	yes	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes	yes
Origin * Year fixed effects	no	no	no	no	no	yes	no
Destination * Year fixed effects	no	no	no	no	no	yes	no
Counry-pair fixed effects	no	no	no	no	no	no	yes
Observations	184,680	737,963	737,963	704,919	510,734	479,905	403,376
Pseudo-R^2	0.437	0.414	0.414	0.411	0.412	0.425	0.382

Notes: This table shows the results from implementing the PPML model on different specifications of the baseline model. The dependent variable is the value of bilateral M&A in thousand Euro and covers years 2008–2020. Time-varying explanatory variables are lagged by 1 year and cover the period 2007-2019. Robust standard errors, two-way clustered by country pair and year, are shown in parenthesis. The symbols *, ** and *** indicate statistical significance at the 10 percent, 5 percent and 1 percent levels, respectively.

6. Conclusions

GVC have changed the landscape of the international organization of production, placing the specialization of countries and firms within the production chains at the central stage, as highlighted by recent shortages of goods due to bottlenecks in strategic value chains. Starting from the Great Recession, concerns that the phase of sustained globalization had come to a halt started to intensify. A general rise in protectionism, together with initiatives to "bring manufacturing back" through the reshoring of production, and to increase the share of domestic value added in exports, were all recent policy interventions putting at-stake the global fragmentation of production.

In this context, our study investigates the relation between GVC participation and inward M&A flows in the EU27, focusing on the following questions: to what extent GVC participation of both investing and target companies fosters cross-border acquisitions? Is there a difference in the role of forward and backward GVC participation at the sectoral level? To address these questions, we constructed a dataset based on M&A inflows in the EU27 and implement a gravity model. To investigate the role of GVC, we consider as the main variable of interest a GVC index at the country-sector level for both the investor and target countries separately, in the attempt to better assess the role of each economy and sector.

Results show that investors take into consideration sectoral GVC participation when acquiring European companies, in particular backward participation of the target sector-country is positively associated with M&A flows. This evidence is confirmed when focusing on acquired firms operating in manufacturing sectors or high-tech activities, and when investors are located in OECD countries. Therefore, there is evidence that EU firms relying on cross-border inputs and intermediates to produce their output are more likely to be acquired.

The availability of more granular information on GVC participation, possibly based on company-level data, in the future might bring additional evidence. Such data, together with information provided by bilateral indexes on GVC participation, can give the possibility to investigate further the role of bilateral supply-chain linkages for firm-level M&A decisions. Another question worth investigating is how the recently proposed policy interventions plans, designed to guarantee the supply of specific goods to the European Union, will influence the reorganization of value chains and M&A dynamics in the years to come.

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