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"Global Value Chain and innovation: evidence from Central and Eastern European companies"

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SUMMARY

1. Introduction

This thesis investigates the intricate relationship between global value chains (GVCs) and innovation in the context of Central and Eastern European (CEE) countries, examining the results at the firm level, in a field of research unexplored by the existing literature. In recent decades, the CEE region has experienced profound economic transformations, moving from centrally planned economies to market-oriented systems. In this dynamic landscape, the integration of CEE countries into GVCs has emerged as an important driver of economic growth and development. The central premise of this research is to reveal the multiple connections between participation in GVCs and innovation activities in CEE economies.

The main objective of this paper is to investigate whether the participation in a GVC has an impact on the probability of a firm to generate any product innovation in the manufacturing sector. The purpose under this hypothesis is to confirm the beneficial effects, that have already been assessed through analysis at industry or country level, that generates the entrance of a firm from an emerging or transitioning economy in a Global Value Chain.

The results of this analysis will also provide useful insights for the local governments for changing the existing policies and maximize the effects of GVCs participation for the local companies. For economies that are experiencing profound economic transformation, being able to capture the positive effects of GVC participation will generate a positive and long-lasting effect on the country economic performances.

This thesis is structured in three main chapters. In Chapter 2 there will be a detailed review of the theoretical framework available, focusing first on the innovation-performance nexus in the CEE countries, with a review of the existing literature on the theme. After this, a common definition of GVC will be adopted, starting from the work done by Gereffi et al. (2005), distinguishing between the five possible types of GVC governances that can be found and then looking at the relation between GVC and productivity. The chapter will then continue with a focus of the moderating factors that influence the innovation-firm performance relation and that will be useful in the review of the results of the analysis performed. The last part of this chapter will be focused on a literature review of the innovation-performance review from areas different from the CEE, to see if there is any common behavior that can be associated with the one of CEE.

In Chapter 3 the focus will move to the GVC-innovation relationship, with a similar approach of Chapter 2. First a literature review on the topic will be performed, assessing which are the

gap on the existing literature to further investigate in the analysis. Following this phase, an analysis of the different innovation patterns for the different GVC governances and sectors of interest will be performed. At the conclusion of this chapter, the hypothesis to be tested will be formalized.

In chapter 4, the dataset will be presented and there will be an explanation of how the dataset has been constructed followed by a description of the variables and of the econometric model adopted. To conclude, the results of the analysis will be discussed from different point of views (both firm and sector level).

2- Theoretical framework

2.1- The Innovation-performance nexus in Eastern and Central Europe firms

As previously delineated in the introduction, the present chapter will undertake a review of the existing literature on the relationship between innovation and economic performance looking at companies that enters in Global Value Chains[1] (GVC from now on). The primary objective of this analysis is to highlight the underexplored thematic that have yet to be sufficiently addressed. As it will be seen in this chapter, even if the relationship between innovation and firm performances has been investigated by several authors, both at sector and firm level, there is a very little portion of the literature that analyses the relationship between innovation and firm performances at firm level in Eastern Europe countries.

Eastern European countries have been taken into consideration since those can be considered transition economies, meaning that these countries are undergoing a process of transition from centrally planned to market-oriented systems, and they are being specifically examined or included in the analysis due to their unique economic characteristics and development stages. Another peculiarity of most of those countries is that until the USSR dissolution, the companies were not integrated inside GVC and couldn't fully exploit the advantages of being part of them. So, by analyzing them, it can be seen the effect of internationalization on companies that are only now entering in a competitive and borderless market.

Most of the papers analyzed have been taken by the analysis performed by Boermans et al. (2014), where the author performed a preliminary analysis of the existing literature on the relation innovation-performances in Central and Eastern Europe, reviewing and systematically analyzing many studies published on the theme. This has been done to assess which was the current material and the current relations already analyzed, but only few of those are analyzing the thematic from a firm level perspective. The paper contributes to the literature by synthesizing empirical findings from various studies on innovation and firm performance in CEE countries. It provides insights into the overall relationship between innovation and firm performance in the region and sheds light on the factors that may influence this relationship.

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[1] Later in this paper there will be a deeper discussion on GVCs' definition. For now, it can just be said that for the purpose of this paper, we will consider firms inside a GVC only the ones export, import or are two-way traders (do both the activities written before) that have an international quality certification (Del Prete et al., 2017).

The key findings of this paper are also confirmed by most of the other papers analyzed during the analysis performed by the author. The first main finding is that there is a positive and significant relationship between innovation and firm performance in Central and Eastern Europe countries. This finding suggests that firms that engage in innovation activities tend to achieve better performance outcomes compared to those that do not emphasize innovation. A second import finding is that many factors that influence the innovation-performance relation have been identified (e.g., firm size, research and development (R&D) intensity or industry characteristics). Those factors have also been found to be major drivers for GVC participation (Del Prete et al., 2018; Criscuolo et al., 2016; Amador and Cabral, 2016). It has been found that companies with a larger size or with a lower cost of labor are the most attractive for GVCs given the fact that those can sustain a big part of the production for a specific step of the process of the value chain and, consequently, bring bigger savings and advantages. Regarding the role of innovation, there are certain sectors or industries where innovation plays a more crucial role in maintaining competitiveness, while in other sectors, the absence of innovation may not lead to an immediate loss of competitive advantage. The first are known as innovation-intensive sectors, while the second can be defined as low innovation-demanding sectors[2].

Continuing in the review of the existing literature on the impact of innovation on firm performances is the one by Berulava et al. (2020), that analyses this relationship on firms from 28 transition economies using a dataset with a structure like the one that will be used in the following chapters. The first main finding of this research is that there is a positive relationship between innovation and firm performance, highlighting the fact that firms that engage in innovation activities, such as R&D investments and patenting, tend to exhibit higher sales growth, profitability, and market share compared to firms that do not emphasize innovation.

A second important takeaway is that the strategy in which a company innovates influence the effectiveness of the innovation introduced. In the paper it has been assessed that a firm that adopt a combination of product and process innovations tend to achieve better performance compared to firms that focus solely on one kind of innovation. The last important finding highlighted by Berulava is that this kind of analysis is influenced by some *moderating factors[3]* and it clearly states that the results of the analysis are influenced by heterogeneity.

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[2] This topic will be discussed more in detail in the following paragraphs of this chapter, where the reader will also find specific references to the literature analyzed.

[3] The author in the paper defines moderating factors as several contextual factors that may moderate the relationship between innovation and firm performance. It finds that factors such as firm size, export orientation, industry characteristics, and the availability of external funding can influence the strength and nature of the innovation-performance relationship.

Before proceeding on with the analysis of other papers that inspired this analysis, it will be useful to list and briefly describe the most common moderating factors that have been found during the review of the actual theoretical framework.

The most common moderating factors found during the review of the existing literature are:

- **Firm Size**: The size of a firm can influence the relationship between innovation and performance. Larger firms may have more resources and capabilities to invest in innovation and may benefit differently compared to smaller firms.

- **Ownership Structure**: The ownership structure of a firm, such as whether it is privately owned, publicly owned, or state-owned, can play a role in how innovation impacts firm performance. Different ownership structures may have varying priorities, incentives, and access to resources, which can influence the relationship between innovation and performance.

- **Access to Finance**: The availability of financial resources and access to external financing can significantly impact a firm's ability to invest in innovation and, subsequently, its performance.

- **Industry Characteristics**: The characteristics of the industry in which a firm operates can affect the relationship between innovation and firm performance. Factors such as market competition, technological intensity, and industry dynamics can interact with innovation efforts and influence performance outcomes.

- **Institutional Environment**: The broader institutional and regulatory environment in transition economies can have an impact on innovation and firm performance. Factors such as intellectual property rights protection, legal frameworks, and government policies can shape the incentives and opportunities for innovation, thereby influencing firm performance.

The topic of moderating factors has also been reported by Ramadani et al. (2019), mainly analyzing the role of firm characteristics and external factors as potential moderators of the innovation-performance relationship. This is done because by considering these contextual factors it will help in understanding the impact of innovation on firm performance in transition economies. This paper also highlights which could be different ways in which a firm can innovate and which could be some harmful behaviors for a company. A way in which the company can introduce a new product in the market, to be intended as the country in which the

company operates are several. It can be done by investing in R&D activities until an innovation[4] is discovered; buying a patent from a third company and gain the exclusivity of the production; a third way is to enter in a GVC and gain the rights of producing a certain product for the value chain that isn't produced yet in the country. This last point can be seen by two different point of views: the supporters of this last approach sustain that it reduces the efforts that the company must do to innovate, allowing them to use their resources in a most efficient way; on the other hand, those who are against affirms that this practice could disincentivize R&D investments and undermine the company's innovative capacity in the long run, making them dependent from the GVCs on the innovation side.

Also, this paper employs a firm-level dataset where there are firms from Eastern Europe and former Soviet Union countries from the Business Environment and Enterprise Performance Survey (BEEPS), so with a similar dataset[5] to the one of the analyses that will be performed in the following chapters (so expecting to have similar results). This paper also confirms the positive relationship between innovation and firms' performance in transition economies, by observing that the innovative firms have better performances compared to non-innovative firms. The study's results suggest that innovation positively influences various performance indicators, such as productivity, sales growth, and profitability.

Another important finding by Ramadani that will be deepened in the following chapters is about how much each type of innovation impacts firm performance, stating that there are certain types of innovation[6] that are more effective than others in firm performance indicators.

To be more specific, the major types of innovation taken into consideration in this paper are:

- **Technological Innovation**: Technological innovation involves the development and application of new or improved technologies, products, or processes. It typically includes research and development (R&D) activities, advancements in scientific knowledge, and the adoption of new technologies to improve products, processes, or services.

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[4] In the following pages there will be a detailed list of the type of innovation that will be considered in this paper.

[5] To be more precise, looking at the analysis performed by Ramadani et al. (2019), in their paper "*Product innovation and firm performance in transition economies: A multi-stage estimation approach*" employs firm-level data from the Business Environment and Enterprise Performance Survey (BEEPS) conducted by the European Bank for Reconstruction and Development (EBRD) whilst the dataset used in this paper employs data from the World Bank dataset. Another difference is that our analysis will be focused on data taken at regular intervals between them (and not in subsequent years) to see the effect of innovations over time. This approach has been done also to reduce the risk of endogeneity related to observations taken in subsequent years. More on this will be discussed in the following chapters.

[6] In the analysis results that product innovation is the one with the biggest impact on firm performances, especially in the manufacturing sector. Unfortunately, it has not been possible to assess the impacts of other type of innovation on the firm productivity due to lack of consistent data in the dataset used. More details on this topic will be found in the following chapters.

- **Product Innovation**: according to the OECD (2018) definition, product innovation can be defined as follows*:" a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market."*;

- **Process Innovation**: according to OECD (2018), it can be defined as "*a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use in the firm*";

- **Organizational Innovation**: defined by OECD (2009) as *"the implementation of a new organizational method in the firm's business practices, workplace organization or external relations";*

- **Marketing Innovation**: according to OECD (2009), it can be defined as *"the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing";*

- **Service Innovation**: according to Aas et al. (2003), service innovation can be defined as *"new or considerably changed service concept, client interaction channel, service delivery system or technological concept that individually, but most likely in combination, leads to one or more (re)new(ed) service functions that are new to the firm and do change the service/good offered on the market and do require structurally new technological, human or organizational capabilities of the service organization."*

Another important paper that analyzes the innovation-performance relationship in Central and Eastern Europe is the one done by Radosevic et al. (2012), where it also puts in the scope of his analysis the institutional context that, especially for former Soviet Union countries, plays an important role in facilitating innovation. The author, while confronting CEE data also with the one from other regions of Europe[7] emphasizes that the institutional context[8] plays a crucial role in shaping the innovation performance and overall economic performance of these economies. They discuss the role of intellectual property rights protection, venture capital availability, public research and development (R&D) support, and the quality of education and research institutions. Radosevic analyzed how these factors can either facilitate or hinder innovation

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[7] Being more specific the authors have taken into consideration are CEB (Central Europe and Baltics), CIS (Commonwealth of Independent States and Mongolia) and SEE (South-Eastern Europe). For a more in detail look of the composition of countries of each aggregate, please look at the paper "*Are systems of innovation in Eastern Europe efficient?*", Radosevic (2012).

[8] For institutional context Radosevic (2012) means "*the legal frameworks, regulatory systems, intellectual property rights protection, and governance structures*".

efforts and shape the overall economic performance of firms and countries. The two main takeaways from this paper are the confirmation of the positive relation between innovation and performances and the importance of designing and implementing policies that promote institutional development, strengthen intellectual property rights protection, enhance access to finance and venture capital, and foster collaboration between industry and academia.

Some common findings within the papers taken into consideration through the analysis of the theoretical framework regarding the innovation polices adopted by the institutions in Eastern Europe can be summarized as follows:

- Contextual factors are fundamental to be considered while looking at the innovations policies implemented in each single country. Since most of them where part of the former Soviet Union, their economies, as said at the start of the chapter, underwent through a significant change of their structure, transitioning from a centrally planned to a market-based one. And, through the different policies implemented by each country, we can also observe some differences in the health of each economy.

- Many Eastern European countries have recognized the importance of innovation for economic growth and have implemented policies to support innovation activities. These policies typically aim to promote research and development, foster collaboration between academia and industry, enhance access to funding and venture capital, and improve the innovation ecosystem. However, the effectiveness of these policies can vary depending on the implementation, coordination, and enforcement mechanisms in place.

- Like the point above, the quality and strength of the institutions supporting innovation can significantly impact the effectiveness of innovation policies. This includes factors such as intellectual property rights protection, efficient governance structures, transparent regulations, and supportive research and education institutions. Strengthening these institutions is crucial for creating an enabling environment for innovation.

- The level of collaboration and networking among firms, research institutions, and government entities can influence the success of innovation policies. Establishing effective mechanisms for knowledge exchange, technology transfer, and industry-academia collaboration is essential for promoting innovation. This can also be observed in more advanced economies (Spanish ceramic district in Castellon de la Plana and Italian ceramic district in Sassuolo are two renowned examples)[9];

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[9] For more details, please refer to Belussi (2015).

- Countries that provide to company a sufficient access to finance and that fosters a venture capital culture have better results overall compared to countries that doesn't; this reflects mainly in SMEs (Small and Medium Enterprises), that are the one that need more capitals to start innovation driven activities. The main takeaway that has been highlighted in most of the papers analyzed is that improving access to finance can enhance the effectiveness of innovation policies.

2.2- Global Value Chain. Definition and existing literature review

2.2.1- Introduction on Global Value Chains and main definitions

Talking more in detail about Global Value Chains, those started to be widely adopted in the 1990s (Piermantini and Rubinova, 2021), when there has been an increase in the international trades activities and global economies started to be more connected than ever. This production methodology started to be widely applied with the purpose of achieving the most efficient and cost-effective production system by MNEs. Labor-intensive operations started to be performed in low-wage countries while tasks that required high-skilled labor have been located in countries where highly skilled workers were abundant (Urata and Baek, 2020a). It has also been found that firms which enter GVCs are the one that performs better in the country (selection effect) and register the biggest productivity gains after their entrance in the GVC (learning effect) (Del Prete et al., 2017).

GVCs have a series of positive effects on companies, as for example GVCs can be a powerful channel for what concerns knowledge spillovers[10], since it gets in contact foreign and domestic firms opening channels for knowledge and know-how transfers. It has been found by several authors (Ernst and Kim 2002; Gereffi 2014; Gereffi and Fernandez-Stark 2011) that the participation in GVCs provides firms with a better opportunity for acquiring know-how, better technology and network links. It also increases the level of trust for foreign companies that decides to outsource some steps of the production process, as those companies are more willing to outsource their knowledge since they will be the consumer of that company output. (Baldwin and Lopez-Gonzalez, 2015)

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[10] Those have to peculiar characteristics:
- firms can acquire information created by others without paying for that information in a market transaction;
- the creators (or current owners) of the information have no effective recourse, under prevailing laws, if other firms utilize information so acquired.

For a better definition of knowledge and technology spillover, please refer to Grossman and Helpman (1992).

Before entering in the details with the definition of GVC, it is worth to firstly define what a value-added chain is and how does this differ with a GVC. Subsequently, there will be a description of the three variables that play a role in determining how the GVC are governed and the five models identified by Gereffi et al. (2005) related to the governance of GVCs.

Starting from the concepts of value-added chain, this can be defined as "*the process by which technology is combined with material and labor inputs, and then processed inputs are assembled, marketed, and distributed. A single firm may consist of only one link in this process, or it may be extensively vertically integrated.*" (Kogut,1985). This definition differs from the one of GVC because it does not explicitly imply that the process is spread in different countries, that's instead the key peculiarity of GVCs.

According to the existent literature (Marin-Odio, 2014; Benkovskis et al., 2014), the three broad stages of the value chain are upstream (with activities such as R&D, design and management), downstream (packaging, sales and aftersales) and middle stream (assembly of products). The first two stages are the one where most of the value can be added, while instead the latter is the one that has relatively low value addition. Countries can benefit more if the companies can move upwards in the value chain and perform activities that are closer to the upstream end of the value chain, where there is the maximum of the added value.

Starting from the definition of value-chain, it can be understood that value chains are characterized by three different factors: *fragmentation*, *coordination* and *strength of the network*.

From a business and strategic point of view, fragmentation is intended as "*the physical separation of different parts of the production process*" (Arndt et al., 2001). Going further, Gereffi (2005) pointed out that fragmentations allow for the formation of cross-borders production networks, also between different firms, exploiting the resources and the competitive advantages that each country can offer. This can be seen also by looking at the increased number of international transactions that regards for intermediate goods and components (Yeats, 2001).

Strictly related with the concept of fragmentation there is the one of coordination, because the more the production process is fragmented across different places or countries, the higher is the level of coordination required to manage the overall process. Coordination is also influenced by the type of product that is required by the receiver company. For example, a standard product will require a lower level of coordination because those can be produced for stocks and supplied when needed; in addition to this, given the fact that is not a product customized on the needs of a specific client, it can be sold to different customers avoiding the lock-in relation with a specific client.

The level of coordination required ends up also influencing the type of investment done by the company. According to Gereffi, the higher it is the level of customization of the product or of the service, the more likely it is for the supplier to involve transaction-specific investments, that can raise raises the risk of opportunism.

The opportunism factor influences the way in which a network works and opportunism can be controlled by specific social norms that are embedded in a specific area or network. Trying to synthetize the extensive literature regarding the network functioning in GVCs[11], it has been found that some key factors as reputation and mutual dependence lower the risk of opportunistic behaviors and increase the possibility to make more complex inter-firm relations and have more interdependences amongst the actors in the network. More complex inter-firm relations will also generate some economies of specializations because it will push the firms on focusing on a specific core competence and outsource other activities with a lower added value. This will generate an increase in the performances of each company involved in the GVC. It has also been found that companies that adopts this strategy tends to perform better than companies that are better integrated or that are incoherently diversified (Prahalad and Hamel, 1990).

2.2.2- Different types of GVC Governance

After this necessary introduction on the GVCs, now it will be discussed the different types of governance in the GVC, as theorized by Gereffi (2005). This distinction tries to highlight the importance of new global buyers as key drivers for the formation of fragmented production,
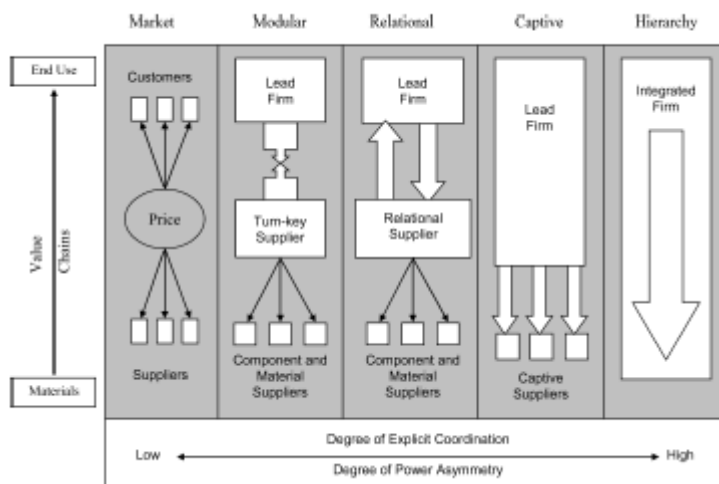

Fig. 1: Types of Global Value Chain. (Source: Gereffi, Humphrey, & Sturgeon (2005), p. 89.

[11] Please refer to Jarillo, 1988; Lorenz, 1988; Powell,1990; Thorelli, 1986 for more details regarding this topic.

network distribution and globally dispersed GVCs, together with the importance of coordination across firm boundaries to keep everything together.

In Fig.1 are represented the five types of GVC theorized by Gereffi. Before going into the details of each of these five types, it is needed to specify the factors that defines each of these types.

The first factor to consider is the complexity of the information and the knowledge transfer that is required to perform a particular transaction, more specifically about process and product specification.

The second factor is the level of knowledge codification and how this is efficiently transmitted and without any transaction-specific investment between the firms.

The third and last factor is the level of capabilities of the suppliers (both actual and potential) in relation to the requirement of the transaction.

Keeping this in mind, now there will be a more detailed explanation of each of the five types of GVCs (from left to right of Fig.1):

- **Markets**: In this type of GVC the product specifications are relatively simple, transactions are easily codified and there is no need of any transaction-related investment from the customer. Given the nature of the product and the lower complexity of the information exchanged in the transactions, transactions can be governed without great effort on the explicit coordination;

- **Modular Value Chains**: This type of GVC arises when the ability to codify specifications extends to complex products. It is usually used when product architecture is modular and technical standards can simplify interactions by reducing the variability of components. Linkages based on codified knowledge can provide access to low-cost inputs, speed and flexibility to the transaction. Anyway, given the fact that the codified knowledge exchanged in this transaction is not so high, the cost of switching partner stays low;

- **Relational Value Chain**: This GVC type usually happens when product specifications cannot be codified, transactions are complex, and supplier capabilities are high. This is because a mutual dependence arises because tacit knowledge needs to be exchanged between buyers and seller. This dependence can be handled in two ways: it could be regulated through reputation and spatial proximity or through a mechanism that imposes costs on the part that breaks the contract (Williamson, 1983). The cost of switching partner in this type of relation is high because the exchange of complex tacit knowledge usually requires a high level of explicit coordination;

- **Captive Value Chains**: This usually happens when the ability to codify – in the form of detailed instructions – and the complexity of product specifications are both high but supplier capabilities are low, then value chain governance will tend toward the captive type. Captive suppliers usually perform a narrow range of tasks that are low value added and are dependent on the lead firm for what concerns the design or the technology upgrades. Usually, the opportunism risk is controlled by the lead firm using its dominance on the smaller firm but providing to the company resources and market access, that makes for the smaller firm the exit from this relation not a viable option;
- **Hierarchy**: This last GVC type happens when product specifications cannot be codified, products are complex, and highly competent suppliers cannot be found, then lead firms will be forced to develop and manufacture products in-house.

Table 1 sums up all the five hierarchy types with the key determinants explained at the start of the paragraph, also adding a specific column that shows the degree of explicit coordination and power asymmetry in these relations.

Governance type	Complexity of transaction	Ability to codify transactions	Capabilities in the supply-base	Degree of explicit coordination and power asymmetry
Market	Low	High	High	Low
Modular	High	High	High	
Relational	High	Low	High	
Captive	High	High	Low	
Hierarchy	High	Low	Low	High

Table 1: Key determinants of global value chain governance. Source: Gereffi,, Humphrey, Sturgeon, (2005), p. 87.

What is important to note is how the power relations works in the different GVCs methods. For example, in captive value chains, the lead firm exert power directly on the suppliers, like in hierarchy structures and it shows that there is power asymmetry towards the lead firm and that explicit coordination is needed to make this system work. Conversely, in relational value chains the power relation is equal amongst the different parts because they all contribute with specific key competences. Lastly, in modular value chains and in markets structure, the power

asymmetries are weak since it is relatively easy for all the parts involved to switch customers and suppliers.

It is also worth to specify that once one of this governance types are agreed between the parts, it is not set on stone but it can happen that through time, the relationship changes and it could happen to switch from one governance type to another[12].

2.2.3- GVC effects on Productivity

Another of the key point of attention of this paper is the one regarding how the participation in GVC can affect the productivity of the companies in it. Looking at the work done by Piermantini and Rubinova (2021), it has been found that, regardless the fact if the company in the GVC is part of an emerging or developed economy, the participation to a GVC boost innovation on average by 5%.

Some of the reasons for this result could be that inputs used in the production could come from foreign affiliates and could have better quality or features than the one originally used, improving the TFP[13] of the company even if this company has not received a direct technology transfer[14]. It is important to note that an increase in the TFP does not directly implicates that the countries that imports these intermediate goods acquires the knowledge needed to produce them. This is important to underline in order to look at the long-term effects of the participation of one company in a GVC. This is related to the concept of technology lending (Baldwin, 2014), where less developed countries have an opportunity for rapid industrial development, by hosting the outsourcing of a specific task and the required technology, that can be stopped if the offshoring company decides to move this task to another country. Piermantini has not found any evidence that knowledge spillovers are related to a mere import of inputs, meaning that in innovation knowledge spillovers are driven by strong interactions like the ones present in GVCs.

One of the main findings of his study is that, in less developed countries, industries with the lower R&D intensity are the one that relies more on external financing for their innovation decisions and strategies. It has also been found that R&D spillovers channeled through GVCs are a third more powerful than a domestic investment for what concerns generating innovation.

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[12] Gereffi (2005) in his paper described some real cases in which there has been a change in the governance structure of the GVC. If the reader is interested in a more detailed explanation, please refer to Gereffi, Galvin and Morkel (2001), Bonacich et al. (1994) and Dolan and Humphrey (2000, 2004).

[13] Total Factor Productivity. This can be defined as "*the portion of output not explained by the amount of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production.*" Comin (2010).

[14] For a more in-depth reading, please check Newman et al. (2015).

Another important finding of this paper, confirmed also by Keller (2002) and Bottazzi and Peri (2003), is that knowledge spillovers are less effective the bigger is the distance between the two companies. It has also been found that, for non-codified knowledge, linguistic barriers may be an obstacle to knowledge diffusion.

The last main key takeaway of this paper is that knowledge spillover depends on the strengths of the GVC linkages and not only by the trade linkages by themselves.

Looking at the paper of Reddy et al. (2021), they found two ways in which a company can take part in GVCs: the first is through backward integration, so by using foreign inputs in its export basket, while the second is through forward integration, by exporting its products as intermediate inputs to other countries for production purposes[15].

It has also been found that innovation is one of the key drivers for entering in GVCs because it reduces costs for the company and increase the product differentiation, providing then more opportunities to penetrate in the international markets by looking more attractive from the GVC point of view (Guan and Ma 2003; Tavassoli 2018). Being more specific, according to Reddy et al. paper, innovative firms are approximately 5-6% more likely to participate in GVCs. Similar findings emerged regarding the age and the size of the firms, showing that larger and older firms have more probabilities of participating in GVCs.

According to Faberger et al. (2018), GVC participation can be seen as a way in which knowledge transfer takes place in an organized and interactive manner, in addition to the trade aspect that is at the base of this phenomena. This paper also found that spillovers, knowledge or economically related, are small and not so significant for developing countries, suggesting improving the human capital level before entering in making part of a GVC if the purpose of the company/country is to have positive effects from this participation. This is supporting the findings on the existing literature that suggest a linkage between social capabilities and economic development of one country (Faberger and Shrolec, 2017).

This paper also tried to analyze how the different type of innovation can influence the probability of a firm to participate in a GVC, making a distinction between radical[16] and incremental[17] innovation. Firstly, it has been found that the probability of a firm in entering in the GVC increases when it starts to innovate, confirming the findings in the existing literature. Secondly, the authors found that the probability of an innovative firm joining GVC increases

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[15] For a more in-depth reading, please check Koopman et al. (2010) and Montalbano et al. (2018).

[16] According to the definition given by Zhou et al. (2020), "*Radical innovation advances the innovation structure substantially and has the potential of altering the market structure, catering to novel consumer needs, and pushing the technological frontier of the industry*".

[17] According to the definition given by Zhou et al. (2005), incremental innovation can be defined as "*minor changes in technology, simple product improvements, or line extensions that minimally improve the existing performance*".

when they move from incremental to radical innovations, underlining that climbing up the innovation ladder increases the probabilities of GVC participation.

Another important aspect to take into consideration while looking at the GVC development and at all the positive effects that it has is the one related to the quality of the human capital of each country, the capability that this has of absorbing external knowledge that comes from FDI investments. It the existing literature it has been found that a high-quality national education system is required to attract foreign companies and create networks globally recognized (Wagner and Leydesdorff, 2005).

Looking at the work done by Urata and Baek (2021), that investigated the effects of GVC participation on companies from Indonesia, Viet Nam and the Philippines, have found that companies that do not participate in GVCs have the lowest TFP levels, implying the presence of some fixed costs[18] for GVC participation. Among companies that enters in GVC, the author found that the one with the largest increase in their TFP level are the one that both import and export[19], followed by companies that only export.

Some of the findings from Urata and Baek, that confirms what already written by several authors, are that a firm can improve its productivity by importing intermediate goods and exporting output directly, and no positive and significant effects will emerge otherwise. This is because a firm can improve its productivity only when it is deeply involved in the GVC process through both backward and forward linkages. Another significant finding is that firms the firm productivity doesn't experience an increase when the export is indirect or it is involved only in importing intermediate goods, without exporting any product.

2.3-The impact of innovation on firm performance: the moderating factors

Another important aspect highlighted by the literature and already mentioned before is the one regarding moderating factors. Contextual factors are several and they can have different impacts on the innovation-firm performance relation. In this paragraph there will be a brief analysis of the results of each of them in the existing literature, to provide to the reader a solid background before proceeding forward with the description of the dataset and the findings of this research.

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[18] This finding has also been described by Melitz (2003), where it has been found that the firm needs to be productive enough to sustain some fixed costs associated with exporting, such as setting up a distribution system or changing some machineries or processes in its production system to adapt to the new market.
[19] According to Keller (2004), this can be explained because firms that participate in GVC can obtain cheaper intermediate goods, reducing then the costs and increasing the TFP.

2.3.1- Impact of the firm size variable on the innovation-performance relation

The effect of firm size on innovation decisions and strategies is one of the most studied and analyzed by the research community and, for what regards innovation strategies, there are two ways of thinking about which, between SMEs (Small and Medium Enterprises) or MNEs (Multi-National Enterprises) are better in fostering innovation and benefits more in adopting innovations.

From the perspective of the SMEs, those are often more agile and flexible compared to large MNEs, allowing them to quickly adapt to changing market conditions and seize opportunities for innovation. They can make decisions swiftly, implement changes more rapidly, and experiment with new ideas.

Another advantage of the SMEs is that they can focus on specific niche markets or specialized areas, allowing them to develop deep expertise and satisfy the unique customer needs. This specialization can lead to breakthrough innovations and differentiation strategies that may be more challenging for larger MNEs. For MNEs is not worth to focus on niche markets because are not enough profitable for them, considering that to target them there should be a change in the product or the process where the costs will be higher than the possible profits.

The last, but not for this less important, SMEs often have a strong entrepreneurial culture, fostering creativity, risk-taking, and a willingness to challenge established norms. This culture can stimulate innovation and encourage employees to generate and implement novel ideas. This is not usually the case of MNEs, where there is the risk of falling into the path-dependency[20] phenomenon and being less willing to change since what has been done by them until that moment worked.

Looking to the MNEs advantages in fostering and promoting innovations, the first advantage that they have compared to SMEs is that MNEs often have greater financial resources, research and development (R&D) capabilities, and access to global knowledge networks. They can invest heavily in innovation activities, conduct large-scale R&D projects, and leverage their global presence to access diverse markets and technologies. For SMEs this is not possible, at least at the initial step of their growing path, due to the lack of financial resources and difficult to borrow it in the financial market.

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[20] Path dependency explains the continued use of a product or practice based on historical preference or use. A company may persist in the use of a product or practice even if newer, more efficient alternatives are available. Path dependency occurs because it is often easier or more cost-effective to continue along an already set path than to create an entirely new one.

Another aspect to keep into consideration is that MNEs can facilitate knowledge spillovers and technology transfer by operating across multiple countries and collaborating with local partners. Their global networks and connections enable the dissemination of innovative practices and ideas across borders, potentially benefitting both their subsidiaries and local firms.

A last important point to highlight in favor of the MNEs is that they can leverage their size and scale to take advantage of economies of scale and scope in innovation. They can allocate significant resources to R&D, develop a broad range of products or services, and implement innovation strategies that span multiple markets or industries.

Nevertheless, one important point to highlight is that collaboration between MNEs and SMEs can be mutually beneficial. MNEs can partner with SMEs to access their agility and specialized knowledge, while SMEs can benefit from the resources, market reach, and expertise of MNEs. Even if not taken into consideration by the analysis performed in this paper, collaboration within SMEs and MNEs, also through some spin-offs or collaborations, needs to be considered by the institutions and norms that supports this practice should be implemented to enhance the productivity of the firms in specific sectors, especially the innovation-intensive one.

2.3.2- Impact of the ownership structure on the innovation- firm performance relation

The next moderating factor that will be deepened in this paper is the ownership structure. This factor has been analyzed in several papers, including this one, and the usual distinction that is utilized is the one between family-owned companies, state-owned, foreign-owned and institutionally owned one.

Starting from the family-owned companies, the common findings among the existing literature is that family-owned firms, where a single family or a small group of families holds a significant stake, often have distinctive characteristics that can influence innovation and are usually more presented in emerging economies compared to more developed one. Family-owned firms may have a long-term vision and strong commitment to preserving the family legacy, which can provide a conducive environment for sustained investment in innovation. However, they may also face challenges related to succession planning, conservatism, and the potential influence of family dynamics, which could impact their innovation efforts.

The next category to be discussed is the State-Owned Enterprises (or SOEs), that can be defined as companies in which the state has a significant influence or most of the ownership of the company. State-owned enterprises may face different incentives and objectives compared to privately owned firms. While state ownership can provide resources and support for long-term investment in innovation, it may also introduce bureaucracy and political considerations that

can hinder innovation efforts. It is fundamental for the state to avoid as much as possible political interferences and keep the company decision as much market oriented as possible. Especially in some emerging economies, where the state has a significant ownership stake in companies, state ownership can influence innovation strategies.

A third category of ownership structure that has been taken into consideration during the analysis is the foreign owned one. This can be generally defined as a company that is owned and controlled by individuals, organizations, or companies from another country. Some of the most important benefits to highlight are that foreign direct investment (FDI) and foreign ownership can bring new technologies, management practices, and knowledge to emerging market firms. Looking at emerging markets, research suggest that foreign-owned firms in emerging markets tend to exhibit higher levels of innovation compared to domestically owned firms. Foreign ownership often brings access to global networks, R&D capabilities, and market knowledge, fostering innovation.

The last category that needs to be kept into consideration while discussing and analyzing the ownership structure is the institutional ownership. Institutional ownership refers to the ownership of shares or equity in a company by institutional investors, such as mutual funds, pension funds, insurance companies, and other large financial institutions. These entities pool funds from individual or institutional investors and invest them in various financial instruments, including stocks of publicly traded companies. One of the advantages from a company perspective to be owned by an institutional investor is that often it has significant financial resources and expertise in managing investments, which can influence the strategic decisions and governance of the companies in which they invest. One of the drawbacks to keep into consideration while looking at institutional investors is that those tends to prefer short-term returns instead of a long-term one, ending by damaging the profitability of the company in the long term.

As a reference point to the concepts discussed in this paragraph, there will be a brief description and analysis of the findings of the work done by Chen et al. (2014). The authors investigate how different types of ownership, including state ownership and foreign ownership, influence a firm's innovation activities and outcomes in the Chinese market. The key findings of the paper suggest that ownership structure has a significant effect on a firm's innovation behavior. It is important to underline that the specificities from a legal point might have influenced the paper's findings. Nevertheless, apart for the legal specificities of the Chinese market, all the other characteristics are the same of the emerging economies that will be analyzed in the paper, so the results can be useful for our analysis.

State-owned firms tend to have lower innovation levels compared to privately owned firms. This can be attributed to factors such as bureaucratic constraints, limited autonomy, and a focus on political objectives rather than innovation. On the other hand, foreign-owned firms, particularly those with multinational corporations as investors, tend to exhibit higher levels of innovation. Foreign ownership brings access to global knowledge, technology, and best practices, which can drive innovation in emerging market firms.

The paper also explores the role of institutional ownership, highlighting that institutional investors can exert both positive and negative influences on a firm's innovation. While institutional investors provide financial resources and monitoring mechanisms, they may also prioritize short-term financial performance over long-term innovation investments.
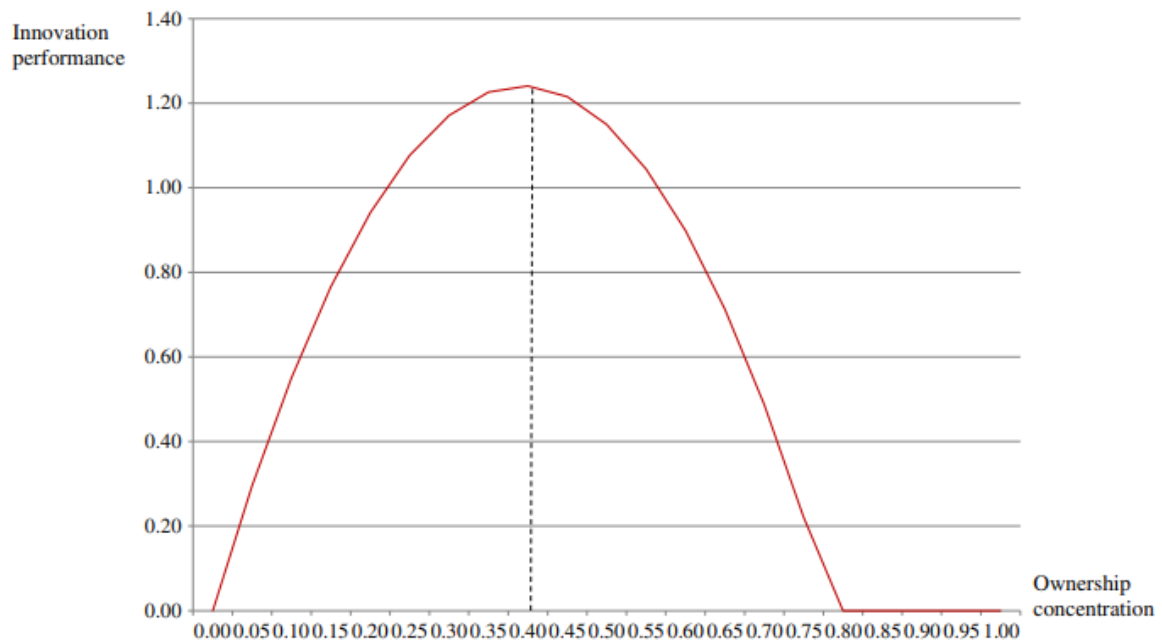
Fig. 2: Effects of ownership concentration on innovation performance. Source: Chen et al. (2014), p. 16.

Looking at Fig.2, the authors have found that the optimal ownership composition for this specific market is a mix of state and private ownership for what foreign investors. This is since without a state participation in the company it results more difficult to obtain funds by the banks and then to finance R&D innovation the company will need to recur to more expensive financing methods. A company can't even be only state-owned because it will not have the know-how and the experience that a private company has and that is needed to have good innovation performance. The optimal mix between private and state ownership, according to Chen analysis, resulted to be close to 40% of state-owned and the rest private-owned; this will

ease the access to financing for the company and give the possibility to exploit the knowledge and the technology that the private-foreign investors will bring.

2.3.3- Access to finance impact on the innovation-firm performance relation

The impact of access to finance on the innovation and firm performances it has been analyzed from several perspective in the existing literature and it influences both SMEs than MNEs. The effects that this moderating factor has on the two firms' categories are different and they will be briefly explained in this paragraph. Joining a GVC can facilitate the access to investment, by both an inflow of capitals from the other companies that are part of the GVC or by the fact that making part of a GVC can results in a decreased level of perceived risk for an investor. Starting from the SMEs, the access to financial resources is a common challenge mainly due to their size, limited collateral, and perceived higher risks. This constraint can also restrict their ability to invest in (R&D), acquire new technologies, or engage in innovative activities. A second point to highlight for this type of company can be described as "innovation financing gap", where their internal funds and traditional financing sources, such as bank loans, are insufficient to support their innovation projects. This gap can inhibit their capacity to innovate and compete in the market.

The third and last point to highlight is that, alternatively to banks, SMEs often turn to alternative financing options, such as venture capital (VC), angel investors, crowdfunding, and government grants or subsidies, to bridge the financing gap for innovation. These sources can provide the necessary capital and expertise to support SME innovation. About this point, it is worth to cite the work done by Lee et al. (2014), that investigates the relationship between access to finance and innovation starting from the financial crisis of 2008, since when conditions for accessing to finance became stricter and different from the pre-crisis period. The paper highlighted how venture capitals can bring support to companies not only under a financial aspect, but also brings expertise and networks. It has been seen that VC-backed firms tend to have access to a broader range of resources, including managerial and technical expertise, which can enhance their innovation capabilities. The authors found also that the positive impact of access to finance on innovation is particularly pronounced for firms operating in industries with higher technological uncertainty and higher information asymmetry. These industries are typically characterized by greater risk and require significant financial resources to support innovation efforts[21].

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[21] This point has also been highlighted by Efthyvoulou et al. (2016), where a large sample of firms from 11 countries have been analyzed, and it has been identified that high-tech manufacturing and knowledge-intensive

Looking at the impacts that access to finance can have on MNEs, the first point to highlight is that, especially large and established firms, generally have better access to global capital markets. They can raise funds through public offerings, corporate bonds, or other financial instruments. This allows them to secure substantial financial resources for their innovation initiatives. A second common finding looking at the existing literature is that MNEs can leverage their financial strength and global networks to establish strategic partnerships and alliances with other firms, research institutions, or startups. These collaborations provide access to additional funding sources, shared R&D costs, and knowledge exchange to drive innovation. What has been found to be some common point in which access to finance can impact companies, both SMEs and MNEs, are:

- **R&D investment**: Sufficient financing enables firms to allocate resources to research activities, develop new products or processes, and enhance their technological capabilities.

- **Technological acquisition**: Access to finance facilitates the acquisition of external technologies through licensing, purchasing patents, or engaging in strategic alliances, allowing firms to accelerate their innovation efforts.

- **Human capital investment**: Adequate funding supports the recruitment and retention of skilled employees, fostering a culture of innovation and promoting knowledge-intensive activities within the organization.

- **Market expansion**: Financing can fuel market entry strategies, international expansion, and the commercialization of innovative products or services, enhancing the firm's competitive position.

2.3.4- The impact of industry-specific characteristics on the innovation-firm performance relation

Talking about the fourth moderating factor, industry-specific characteristics, as already mentioned previously in this chapter, needs to be taken into consideration because it could influence in a significant way the results of this analysis. For example, different industries have distinct structural characteristics that can influence firm performance. Factors such as market concentration, the number of competitors, barriers to entry, and product differentiation can impact the competitive dynamics and profitability within an industry. Industries with a lower

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service sectors are particularly sensitive to financial constraints. These sectors tend to have higher levels of R&D expenditure and innovation activities, making them more reliant on external funding sources.

number of competitors may face a lower degree of competition and can lead to have lower innovation investments but the firm will still have good profitability figures.

Another factor to consider is the technological intensity level of the sector in which the firm is operating. Technological-intensive industries often require higher levels of R&D investment, and firms operating in these industries may face unique challenges and opportunities related to innovation and competitiveness.

A third important element that varies within each industry is the regulatory environment, that ends up to impact on the innovation intensity and the profitability metrics involved in the analysis. This is because industries subject to stringent regulations or government interventions may experience different market dynamics and constraints that affect firm profitability, market share, and investment decisions. As it has been seen by Chen et al. (2014) before analyzing the Chinese market, innovative industries in the Chinese market are basically forced to change their ownership structure also including a state participation in their equity, otherwise they will struggle to operate in the country.

A fourth moderating factor that can impact and influence firm performances and innovation strategies is related to the life cycle[22] of the industry. The performance of firms can vary depending on the stage of the industry life cycle. Early-stage industries may offer greater growth opportunities but also involve higher risks, making then more likely for a firm to invest in R&D to develop a better product and gain market share. Instead, mature industries may be characterized by more stable and predictable performance patterns, making less likely for a company to invest, given that this investment will less likely produce an increase in the performances.

The last important aspect to consider while talking about industry-specific characteristic is the industry demand structure and its characteristics, such as price elasticity, customer preferences, and market growth, can influence firm performance. Industries with highly volatile demand or rapidly changing customer preferences may require firms to be more adaptable and innovative to maintain a competitive edge. Taking price elasticity as example, in industries with elastic demand, where consumers are highly responsive to price changes, firms may face intense price competition and have limited pricing power. This can put pressure on profit margins and require firms to focus on cost efficiency and operational effectiveness to maintain competitiveness. One of the positive effects of a company joining a GVC is that, for products that have a seasonal demand, they can expand their market by selling its products to other markets across the world

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[22] It can be defined as "*The evolution of an industry or business through four stages based on the business characteristics commonly displayed in each phase. The four phases of an industry life cycle are the introduction, growth, maturity, and decline stages.*"

by exploiting the distribution channels of the other companies inside the GVC or, in case of a semi-component, secure a possible buyer for the whole year.

Also, market growth can influence significantly firm performances and decisions on how much or frequently invest in R&D and innovate. Industries with high market growth rates often present greater opportunities for revenue expansion, market share gains, and profitability. Firms operating in high-growth industries may need to invest more in R&D to develop new products, expand their customer base, and capture a larger share of the growing market.

2.3.5- The impact of institutional environment variable on the innovation-firm performance relation

The last moderating factor that it is important to consider while looking at the relation between innovation and firm performance is the institutional environment of the country in which a firm operates. An institutional environment that fosters innovations will influence positively this relation while an environment that sets a lot of constraints about, for example, FDIs and does not protect property rights will result in making less effective innovation and firm performances.

One of the main paper worth to cite is the one written by Rodriguez-Pose et al. (2015), that investigates how the quality of the government influence the innovative performances in Europe and provides useful insights on how a good institutional environment can foster innovation.

As proxy to measure the quality of the government, the authors are using the QoG[23] index (Quality of government index) created by Charron et al. (2014).

The authors proceed to divide in two macro-categories, *Core* and *Periphery[24]*, the regions involved in the analysis because those have significant differences in their economic, social,

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[23] This index is composed of four main pillars: control of corruption, rule of law, government effectiveness and government accountability. In case the reader wants to better understand this index and how it is composed, please look at the work done by Charron et al. (2014).

[24] According to authors definition, a peripheric region is the one that "*eligible for Objective 1 or 'convergence' support in the European regional policy during the period 2000–2006.*". For *core* region instead is meant every region that is not peripherical.

and institutional conditions.
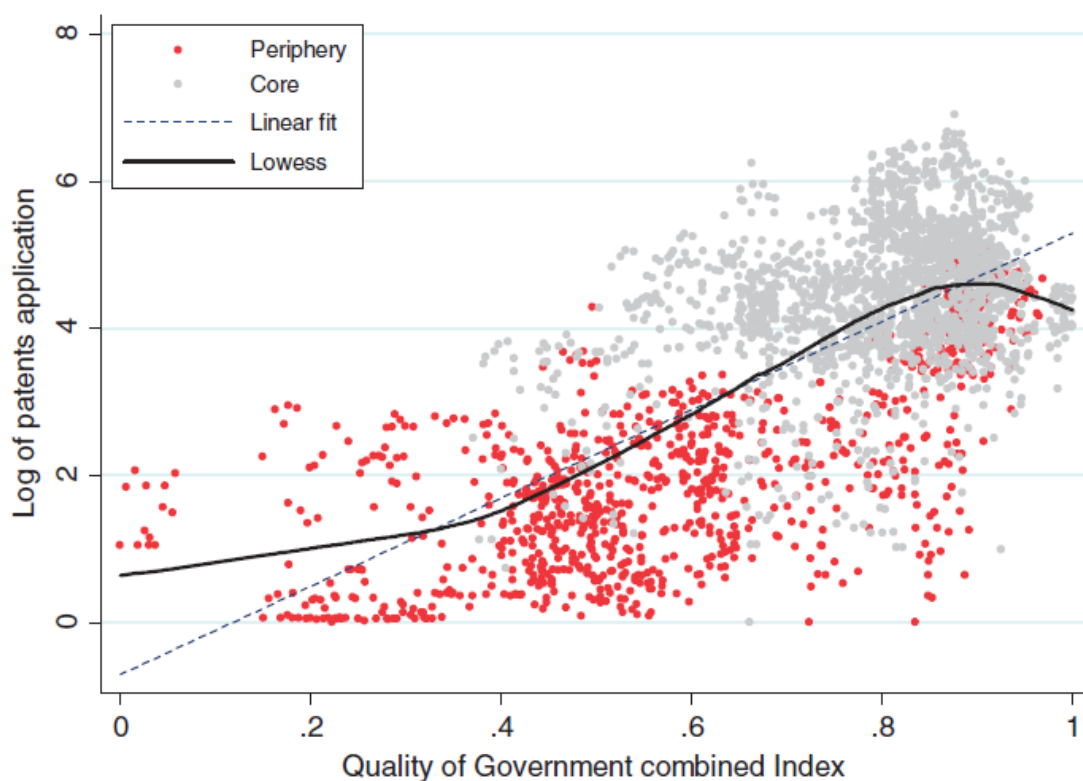
Fig. 3: Patents application and quality of government by region EU NUTS 28-region. (Rodriguez-Pose e Di Cataldo (2015). Quality of government and innovative performance in the regions of Europe).

Following this distinction among the regions, in the Fig.3 can be clearly seen that peripheric regions tends to produce less patents compared to the core regions, because those scores lower results in the QoG index. The key takeaway from this paper is that regions with better quality of government tends to create a better innovation environment for companies than regions with a lower QoG score. This can be related to the fact that environments with a better control of corruption and government effectiveness (as in the case of core regions) incentives companies in performing innovation activities. This then will lead to better economic performances as already confirmed by the work of other authors already discussed in this chapter.

Continuing the analysis on the institutional environment effects, most of the papers analyzed agree on the fact that a good institutional environment is positively associated with innovation activities, firm performance and it can attract FDI[25] . Factors such as the rule of law, regulatory

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[25] Foreign Direct Investments. According to OECD, those can be defined as follows. "*Foreign direct investment (FDI) is a category of cross-border investment in which an investor resident in one economy establishes a lasting interest in and a significant degree of influence over an enterprise resident in another economy. Ownership of 10 percent or more of the voting power in an enterprise in one economy by an investor in another economy is evidence of such a relationship. FDI is a key element in international economic integration because*

quality, property rights protection, and control of corruption are often identified as key institutional determinants. A good institutional environment also fosters a supportive ecosystem for innovation, providing firms with the necessary legal frameworks, protection of intellectual property rights, and efficient contract enforcement. This enables firms to invest in R&D activities, collaborate with other entities, and access funding for innovation both from banks and foreign investors (those could be both VC or joint ventures, with the latest that are attracted by the possibility of entering in a new market, exploiting the possibility of favorable market conditions and lower risks of knowledge steals). In some cases, for some SMEs, can be the first step for increasing their competitiveness and productivity compared to other local firms and aim to join a Global Value Chain thanks to the already solidified relation with international companies.

Another positive effect of a good institutional environment is related to spillover effects, because a good institutional environment not only benefits individual firms but also promotes knowledge spillovers and innovation diffusion within an industry or region. This leads to a positive external effect, where the overall innovation ecosystem and the competitiveness of the industry or region are strengthened. To correctly understand the results of some analysis of firm performances and innovation behaviors from companies in one country, it is also needed most of the times to analyze the country policies; there could be the case in which some bad results are explained by weak protection policies. It has been confirmed by the literature that good institutions create an even "playing field", reduce transaction costs, and enhance business confidence, which contribute to improved firm outcomes. Supporting this statement there is the work done by Lupu et al. (2022), where while analyzing the relationship between IPR[26] protection and economic growth within the member states of the European Union, have found a positive relation between the strength of IPR regimes and the economic growth of a specific country. In addition to this, it has been found that a country with stronger IPR protection laws is more likely to attract FDI, especially in technology-intensive sectors, compared to countries with weaker IPR policies. This explains why GVC are mainly focused on countries with good IPR rules (and not only in countries where the labor costs are lower[27]). The analysis also highlighted the fact that technology transfer is most likely to happen in countries with strong

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it creates stable and long-lasting links between economies. FDI is an important channel for the transfer of technology between countries, promotes international trade through access to foreign markets, and can be an important vehicle for economic development."

[26] Intellectual Property Rights; those are defined by the World Trade Organization as follows: "*Intellectual property rights are the rights given to persons over the creations of their minds. They usually give the creator an exclusive right over the use of his/her creation for a certain period.*"

[27] Nevertheless, the labour cost is another key determinant to keep into consideration while analysing the geography and the distribution of GVC around the world.

IPR policies. This highlights the fact that a good institutional environment fosters a supportive ecosystem for innovation, providing firms with the necessary legal frameworks, protection of intellectual property rights, and efficient contract enforcement. In addition to this point, it could happen that part of the innovations that a firm brings into the new company is based on tacit knowledge, which can be transferred only by closely working with one of already skilled employs. Having better IPR rules will create a better and more relaxed environment where to work, ideal for transferring knowledge between employees without the risk of fraudulent behaviors. This enables firms to invest in R&D activities, collaborate with other entities, and access funding for innovation. This last point has been analyzed by Stojcic et al. (2020), where the authors highlighted during his work the role of institutions in promoting firm innovativeness in the context of Central and Eastern Europe (CEE) using a large-scale survey on nine emergent CEE countries that was aiming at collecting information about R&D activities, collaboration with other organizations, and the introduction of new products and processes. What it has been found by the author and by the work done by Radošević, S. (2017), is that the innovation in CEE economies is mainly based on the interaction of domestic producers with imported equipments and inputs and not on research-driven innovation. To change this paradigm and permit companies to not be completely dependent on imported technology it is necessary to foster an environment where innovation is generated by internal innovation efforts. To do so, the author highlights the importance of institutions, making a distinction between two categories: formal institutions and informal institutions. For what regards formal institutions, it can be said that strong intellectual property rights protection, efficient legal systems, and well-functioning financial markets are positively associated with firm innovativeness, confirming one of the common findings listed above. What has been instead found for informal institutions is that social networks and collaboration play a crucial role in fostering firm innovativeness in CEE countries. Trust and social capital within networks positively influence the exchange of knowledge and resources among firms. Summarizing in a glance the paper's finding, it highlights the need for supportive institutional frameworks that encourage innovation, promote collaboration, and protect intellectual property rights but also underlines the significance of building and leveraging social networks to facilitate knowledge sharing and learning among firms.

Similar findings have been found by Ciocoui (2011) while investigating the impact of the institutional environment, defined in this paper as the set of regulatory quality, the rule of law and the government effectiveness, on innovation activities and subsequently on the firm performances in the digital economy. The main indicators used by the authors in this case have been R&D expenditure as inputs, patents as outputs and firm performance measures. What has

been found is that institutional factors have a significant impact on firm innovation activities. Higher levels of regulatory quality, rule of law, and government effectiveness are positively associated with increased R&D expenditure and patenting activity. It has also been found that this positive relationship between institutional factors and firm performance is more pronounced in the digital economy sectors compared to other sectors outside this category.

A recent paper by Zhang et al. (2019) provides a comprehensive perspective on the moderating factor under consideration. Their study analyses Chinese and Indian companies to examine the relationship between the institutional environment and firm performance. It confirms that there is a positive relation between institutional quality and innovation performance. Stronger institutions, characterized by factors such as the rule of law, government effectiveness, and control of corruption, tend to foster the presence of companies with higher levels of innovation activity. The study also highlights the role of interaction effects between institutional factors and economic development. The positive impact of institutional quality and intellectual property rights protection on innovation performance is more pronounced in more developed economies. The main takeaway from this paper, and this chapter in general, is that policymakers can focus on improving institutional quality and implementing robust intellectual property rights regimes to support innovation-driven economic growth.

A last point that is important to cite, connected with this topic, is the one related to the NSI (National Systems of Innovation)[28], which can be defined as "*that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies, and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies.*" (Metcalfe, 1995). This definition, among all the others that has been formulated and can be found in the existing literature (Freeman, 1987; Lundvall, 1992; Nelson, 1993; Patel and Pavitt, 1994), highly stresses the fact that the flow of people, institutions and the set of rules in a specific country are fundamental for the innovation outcomes of that country. The country specific NSI will also indirectly influence the attractiveness of the country for what concerns FDI and the ability of the firms to be able to participate in GVC. It is important then for a country to be create, through a proper set of rules that strengthens IPR and fosters innovation, both through formal and informal institutions, an attractive environment for GVC to enter in the country. Among the NSI literature, it has been found that to successfully exploit the foreign

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[28] If the reader wants to deepen this topic, it is suggested to look at the work done by Freeman, 1987; Lundvall, 1992; Nelson, 1993; Patel and Pavitt, 1994 and to the literature already present.

knowledge it is crucial the development of technological capability (Kim, 1997)[29] and a good absorptive capacity[30], otherwise the effects of FDI can't be fully exploited. One example of this, found by Castellani and Zanfei (2006), is that the host country, to benefit from FDIs, must have a sufficient absorptive capacity and links with its foreign affiliate, otherwise it will not be possible for the company to gain any insight from the task.

NSI are important, especially for companies located in lower-income countries, because if the national system is weak, the company is less likely to benefit as much as countries with higher income level and a strong industrial and knowledge base from the participation in GVCs. This is because it is probably that weaker countries under a NSI and income point of view will perform tasks with a lower value added and will be in a GVC dominated by foreign multinationals (Gereffi and Fernandez-Stark, 2011). Another important issue to underline while discussing about NSI is that, if there isn't a system that guarantees a good exchange of information between national firms, there is a risk that a company joining the GVC will not interact anymore with local companies and undermines the possibilities of building regional or national clusters (Ponte and Evert, 2009).

It has been found that country's technological capabilities are directly related with its ability to absorb technology and reproduce it elsewhere (Morrison, 2008), shaping and improving the production structure of an industry and changing its position in a GVC (by moving both upstream and downstream, based on the capabilities acquired).

2.3.6- Conclusions on the impact of moderating factors in the innovation-firm performance relation

Starting from the two most closely related moderating factor, firm size and access to finance, the papers analyzed and the findings shows us that those have a significant impact on the innovation behavior of the firm because usually a company that does not have problems in accessing to finance can decide to innovate more easily. It is worth noting that firms classified as "large" may exhibit a certain degree of hesitancy in pursuing innovative paths, particularly in non-technology-intensive markets or when they already hold a dominant position within their sector. This reluctance can be attributed to the lack of strong incentives for innovation.

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[29] It has been defined by Kim (1997) as "*Technological capability has been described as the firm's ability to design and develop new process, product and upgrade knowledge and skills about the physical environment in unique way and transforming the knowledge into instructions and designs for efficient creation of desired performance.*"
[30] It has been defined by Cohen and Levinthal (1990) as "*a firm's ability "to recognize the value of new, external information, assimilate it, and apply it to commercial ends.*"

Conversely, small firms entering new markets may face financial constraints and may not have sufficient internal resources to finance innovative projects. In such cases, these firms often turn to alternative financing methods, such as venture capital, which not only provide the necessary funds but also offer managerial support to address any potential weaknesses in the company's management capabilities.

It is also worth to highlight that the innovation decisions of the company are also influenced by some not measurable factors, such as the propensity to innovate of the owners or the culture and vision of the company, that cannot be directly measured by any variable or performance indicator but plays a fundamental role in company's decisions. What can instead be captured by some of the moderating factors discussed in this chapter is the role that the ownership structure can play on the innovation behavior of a company. Private-owned and institutional-owned companies, looking at the existing literature and at the considerations performed previously in this chapter, seems to be more likely to innovate compared to state-owned and family-owned companies. This is mainly for two reasons: firstly, state-owned companies in some cases don't have as main goal the one of obtaining the most profits as possible, that in most of the cases is related with an innovative path that aims at making the company leader in the sector with new and qualitative products, but to provide long-term stability to the company and generate as much positive externalities[31] as possible for the whole community in which the company operates; secondly, family-owned owners are less willing to innovate because they try to avoid risky, even if profitable, decisions to prefer business stability to be sure to leave the family business to the next generation. It has been observed, particularly starting from the third generation of owners, that a significant issue arises in relation to the effective transfer of knowledge and the subsequent negative impact of poor business decisions made by the owners, resulting in a decline in business profitability. Instead, private-owned and institutional-owned companies are more propense to innovative than the other two types of companies cited before because it has been highlighted by different studies that owners tend to innovate more to increase company's profitability.

Looking at the last moderating factor taken into consideration in this analysis, several studies have shown that strong IPR policies are directly correlated to positive firm performances. This means that while analyzing the results of our analysis later, it will be important to look also to the level of each country IPR protection policies to see if this have been influenced positively or, in case of weak IPR policies, if the results could have been even better.

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[31] A positive externality exists if the production and consumption of a good or service benefits a third party not directly involved in the market transaction. Private markets will underproduce in the presence of such positive externalities because the costs of production for the firm are overstated and the profits are understated.

2.4- Studies on the innovation-performance relation from outside the CEE area

In this last paragraph of the chapter, there will be an analysis of the main studies taken into consideration by the author regarding the innovation-firm performance relation around the world, with an initial focus on the threshold effect of R&D. For several reasons, results from countries outside the CEE region cannot be fully taken into consideration for comparison purposes, due to specific characteristics of each single region, with the results of our analysis, but that can still contribute to the theoretical background of this paper.

2.4.1- Threshold Effects of R&D Intensity on firm performances

What is recurrent in most of the studies analyzed is that R&D intensity and investments have a significant impact on firm performances only after a certain threshold is passed, otherwise the impact on performances will be weak or insignificant. To be more specific, the threshold effect, in the context of R&D innovation, refers to the phenomenon where the impact of R&D activities on firm performance or outcomes becomes more pronounced above a certain threshold level. It suggests that there is a minimum level of investment or engagement in R&D that firms need to reach to reap significant benefits or see a noticeable impact on their performance. However, once the threshold is surpassed, the positive effects of R&D investment become more evident and substantial. The threshold effect implies that there is a critical point at which R&D efforts start to yield substantial returns, and firms below this threshold may not fully realize the potential benefits of their R&D activities.

Supporting the discussion on this topic there is the paper of Aristizabal-Ramirez et al. (2015), which analyses the threshold effect in the relationship between innovation and firm performances on a sample of 147 countries' firms. The findings support the threshold theory, suggesting the presence of a threshold level of innovation. Below this critical level, the impact of innovation on firm performance is relatively weak or even negligible. However, once the threshold is reached, there is a substantial positive effect of innovation on performance. Another important aspect highlighted by the author in the paper is that firm size and industry characteristics, two of the moderating factors already discussed, can influence the threshold. It has been found that the threshold level varies across different sectors, reflecting the varying nature of innovation requirements and competitive dynamics within industries. For example, some industries may have higher barriers to innovation adoption, making it more challenging

for firms to realize the benefits of innovation. In contrast, industries characterized by rapid technological advancements or intense competition may exhibit more pronounced threshold effects, as firms need to achieve a certain level of innovation capability to remain competitive. Moreover, the threshold tends to be relatively higher for smaller firms compared to larger ones, indicating that smaller firms may need to invest more in innovation to achieve significant performance gains. Larger firms may have more resources, capabilities, and market presence, allowing them to leverage innovation more effectively and experience a stronger impact on performance. Smaller firms, on the other hand, may face resource constraints and other challenges that limit the magnitude of the impact of innovation on their performance.

Firm size and industry-specific characteristics are only two of the aspects highlighted by the literature that can exercise a significant influence on the threshold effect; the other variables that are worth to discuss are the productivity level of a company and the firm age.

Starting from what has been already analyzed regarding how the firm age can have an impact on innovation and firm performances, Czarnitzki et al. (2011), taking into consideration the German industry, and more specifically SMEs, find a positive relationship between firm age and innovation performance. Older firms in the industry tend to invest more in R&D and generate more patents compared to younger firms. This result suggests that older firms may have accumulated knowledge and experience, enabling them to engage in more innovative activities. There are several reasons why older firms may exhibit higher levels of innovation, as for example accumulated knowledge, since older firms have had more time to accumulate knowledge about their industry, technologies, and customer preferences. This accumulated knowledge, if properly used, can be translated into a competitive advantage in identifying and pursuing innovative opportunities. Older firms often have also well-established networks of partners, suppliers, customers and banks. These networks can provide access to valuable resources, information, and collaborative opportunities that facilitate innovation. Most importantly on this point, it has been founded that older firms, thanks to their established bank contacts, use their relationships with banks to gain the necessary trust to have external findings. This is not possible for newly established companies because they have not built such relationships yet (Petersen and Rajan, 1995; Martinelli, 1997; Berger and Udell, 2002).

It has also been found that younger firms may face financing constraints to R&D investments as they don't have enough internal resources to financing them or not enough bank collaterals to obtain a loan.

The authors also underline that older firms have a longer history of managing innovation projects and may have developed effective internal processes and structures to support innovation.

On top of this, it has also been highlighted that there is a positive relationship between firm age and firm size, more specifically the positive relationship between firm size and innovation is more pronounced for older firms. This could mean that larger firms benefit more from their size advantage in terms of innovation activities as they become more experienced and established in the industry. Firm size has also been found by the authors to have positive effects on innovation performances, since larger firms Germany tend to invest more in R&D and generate a higher number of patents. This suggests that larger firms have greater resources and capabilities to engage in innovative activities compared to smaller firms. This can also be related to the fact that older and larger firms are more likely to be part of a bigger group of companies, as for example a GVC, and this can allow them to have access to the group capital, through loans most of the times, and then have an easier access to external fundings.

Another important topic to threat is the one regarding the optimal level of R&D intensity[32] that a company should input to have the maximum return in term of firm performances. Looking at the existing literature, there is a work done by Cai et al. (2019) that analyses this relation on Chinese firms, more specifically whether there are threshold effects in this relationship, meaning that the impact of R&D intensity on firm performance varies above a certain threshold. The main finding is that there is evidence of a non-linear relationship between R&D intensity and firm performance. Specifically, there is an inverted U-shaped relationship, suggesting the presence of a threshold effect.

Below a certain threshold level of R&D intensity, the positive impact of R&D on firm performance is limited or insignificant. However, once the threshold is reached, further increases in R&D intensity led to a more pronounced positive effect on firm performance.

The authors also have identified the threshold level of R&D intensity at which firm performance is maximized. This optimal R&D intensity represents the point where the positive effects of R&D on firm performance are most significant. Firms that operate at or close to this optimal R&D intensity tend to achieve higher levels of performance.

2.4.2- Analysis of the innovation-firm performances from other regions

Before ending this chapter and proceeding with a more in detail analysis of the dataset utilized for this paper, it is worth considering which is the existing literature on this topic based on other

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[32] For the rest of the paper for R&D intensity it will be taken the definition given by Cai et al. (2019) in the paper "Threshold Effects of R&D Intensity on Firm Performance: Evidence from Chinese Firms" that defined R&D intensity as "*the ratio of R&D expenditure to sales revenue*".

regions analysis and see if there is any regional difference on the effects that innovation has on firm performances, and which are the most important moderating factors.

Focusing first on the North American region, it has been confirmed that firms that engage in innovation activities tend to outperform companies that don't innovate. Being more specific, firms that engage in product innovation experience higher sales growth and market share gains. Similarly, firms that invest in process innovation achieve cost savings and improved efficiency. Looking at the work done by Burrus et al. (2018), that examined the innovation-firm performances relation in the US context, it has been found that the factors that have been found to majorly shape this relation are managerial practices, organizational capabilities, market competition and collaboration with external partners, mainly looking at product and process innovation. The other main findings are that firms that engage in product innovation experience higher sales growth and market share gains. Similarly, firms that invest in process innovation achieve cost savings and improved efficiency.

Starting deepening from the latter the factors that shape the innovation-firm performances relation, collaborating with external partners, such as universities, research institutions, suppliers, or customers, can provide firms with access to specialized knowledge, expertise, and resources. Such collaborations can foster innovation by combining diverse perspectives and capabilities, leading to improved firm performance. This could also lead to the formation of distinct clusters characterized by strong interconnections between universities and companies, like the renowned example of Silicon Valley. This clusters have been proven to be very attractive for GVCs, because GVCs will try to incorporate one of the clusters' companies to have access to the knowledge and all the benefits of the cluster. The physical proximity of leading universities, research institutions, and technology companies in Silicon Valley fosters collaboration, knowledge sharing, and the exchange of ideas. This proximity facilitates face-to-face interactions, networking, and the formation of strategic partnerships.

Talking about the effects of market competition on North American companies, it has been found that competitive market conditions incentivize firms to invest in innovation to differentiate themselves, gain market share, or respond to changing customer demands. Competition can force firms to continuously improve their products, processes, and services, leading to enhanced firm performance. If the market is also technologically intensive, then innovation becomes essential for the company to continue in its innovation path to survive. If a firm is based in a cluster, it can favor of knowledge spillovers. It has been proved that innovation can generate positive externalities through knowledge spillovers. When firms engage in innovative activities, they generate new knowledge and insights that can benefit other

firms in the industry or economy. This diffusion of knowledge can lead to productivity improvements across the board, as firms learn from and build upon each other's innovations.

Another aspect that is worth to cite is the impact that managerial practices have on innovation decision and firm performances because it has been analyzed in several papers that effective management practices, such as strong leadership, strategic planning, and efficient decision-making, can help facilitate the successful implementation and commercialization of innovative ideas. Good management practices can ensure that innovation efforts are properly organized, supported, and integrated into the overall business strategy.

The last point that has been found to be relevant in the innovation-firm performance relation for what concerns North American companies is the level of organizational capabilities that a company has in adopting new technologies. Being more specific, the presence of certain organizational capabilities, such as a culture of continuous learning, flexible structures, and effective communication channels, can enable firms to adapt to new technologies, processes, and market conditions. These capabilities can enhance the firm's ability to effectively leverage innovation and translate it into improved performance outcomes.

Before proceeding further with the analysis of other countries findings, it is worth to briefly explain the mechanisms through which innovation contributes to improved productivity, always starting from the work of Burrus. Together with the knowledge spillover cited in this chapter, the adoption of new technologies plays an important role; this is because innovation often involves the adoption or development of new technologies, which can have significant productivity implications. It has been proved by the author that technological advances, such as the use of advanced machinery, automation, or digital tools, can boost productivity by enabling firms to perform tasks more quickly, accurately, or with less effort. Another well-known advantage in adopting innovation is that innovation can provide firms with a competitive edge in the marketplace. By continuously introducing new products, processes, or business models, firms can differentiate themselves from competitors and capture a larger market share. This competitive advantage can lead to increased sales and market power, contributing to improved firm performance.

The two most important mechanisms that improves productivity are process and product innovation. Starting from the process innovation, the authors found that innovations in production processes, technology, or organizational practices can lead to improvements in efficiency, cost reduction, and quality enhancement. By adopting more efficient processes or technologies, firms can produce more output with the same level of inputs, leading to increased productivity. Talking instead about the product innovation, the authors found that the introduction of new or improved products, services, or features can enhance customer

satisfaction and generate higher demand. Product innovation can lead to increased sales, market share, and profitability, contributing to overall firm performance.

It is important to note that these mechanisms are not mutually exclusive, and multiple mechanisms can interact and reinforce each other. For example, process innovation can enable firms to produce new or improved products more efficiently, while product innovation can drive the adoption of new processes or technologies. Together, these mechanisms contribute to the overall positive relationship between innovation and firm productivity observed in the paper.

Looking at some studies that focuses more on Canada, Creed et al. (2019) performed a study on Canadian manufacturing firms focusing on the relationship between firm performances and innovation from a sustainability perspective looking at productivity and profitability metrics to assess the innovation impact.

What has been found is that there are certain types of innovations that are more likely to generate a higher revenue growth effect, such as product and process innovation, compared to other innovation method, like organizational and marketing innovation. It has been highlighted that product and process perspective has also a major impact in improving the firm sustainability and in the reducing the impact that the company has on the environment. It has also highlighted the importance of considering contextual factors while looking to the results because those could explain the reasons for a poor performance of companies in a certain sector or country.

Looking at the existing literature of LAC region, it is important, before discussing the findings of some of the already existent works, to briefly describe the structure of the characteristics of this market to better understand the peculiarity of some of the results.

Firstly, the LAC region is characterized by a significant presence of small and medium-sized enterprises. SMEs play a crucial role in the region's economy, contributing to employment generation and economic development. Strictly related to this point, firms often have a strong focus on serving domestic markets. Due to various factors, including market size and proximity, firms in the region may prioritize catering to local consumer needs and preferences. It has been found that in many cases it is more convenient for firms to not try to penetrate in a new market because those won't be able to sustain the related costs.
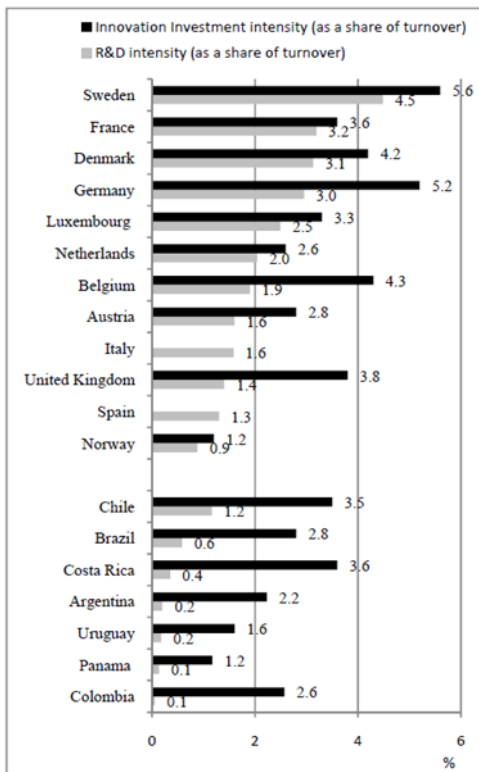
Fig. 4: Investment in R&D and Investment in Innovation Activities. Crespi et al. (2012), p. 30.

For similar reasons, MNEs tend to not invest heavily in R&D in these countries given the fact that there won't be a significant economic return (due to the size of the markets) (Raffo et al., 2008). More generically, it can be seen in Fig.4 the different in innovation investment intensity and R&D intensity (both as share of turnover) for OECD and LAC countries, with a significant gap between the two set of countries, meaning that innovation rates and investments are significantly different and could explain the region productivity gap. So, contrary to what one might expect, domestic companies result more propense to innovate compared to MNEs. This means that a company from this region that enters in a GVC will experience no significant increases in its innovation effort compared to the period before its entrance in the GVC. Looking at the works done by Crespi (2012), Anlló and Suárez, (2009) Navarro et al., (2010), it has been found that in many LAC economies, firms' innovation is mainly incremental with no impacts on international markets and it is obtained by imitating technologies from more advanced countries.

Secondly, the informal sector is prevalent in the LAC region, with a significant number of businesses operating outside formal regulations and lacking formal legal recognition. Informality can present challenges in terms of access to credit, markets, and productivity

improvement. In this framework, it is not easy to attract FDIs due to the weak IPR regulations and consequently it is more difficult to start a sustainable innovation path.

The last important point to consider while looking at strategies and innovation decisions taken by LAC firms is the economic volatility present in the region. The LAC region can experience economic volatility due to factors such as fluctuations in commodity prices, political instability, and external shocks. Firms in the region may need to navigate these challenges and adapt to changing economic conditions. Taking Argentina for this last point, starting from 2001 the country experienced nine defaults[33], and this make very difficult for companies to survive into this environment due to high price instability and inflationary phenomena.

Proceeding further, by analyzing the work done by Crespi et al. (2010), which examined the relation between firm performances and innovation in 6 countries of the LAC region[34] (and comparing them with some representative OECD countries) by looking at how the different types of innovation, such as product and process innovations, influenced the firm performances, found that older firms are less willing to innovate compared to younger firms. This is against the trend found by Czarnitzki (2012), that found that older firms tend to innovate more. This could be due to factors such as established routines, resistance to change, and a lack of agility in adapting to new technologies and market dynamics. Younger firms, on the other hand, tend to be more open to innovation and have a higher propensity to introduce new products or processes. It has been found that many young firms are increasingly recognizing the importance of innovation for competitiveness and are investing in research, development, and technological advancements.

What instead has been confirmed to be the same across the regions is the positive relation that exists between innovation and firm performances, Also for LAC companies it has been found that by engaging in innovative activities, particularly product innovation, they experience higher productivity levels, employment growth, and sales growth. The study also highlights, in a restricted number of cases, the positive link between innovation and firms' ability to penetrate international markets, as indicated by higher export intensities.

Also, in LAC some firm-characteristics impacts the innovation decisions and, consequently, company performances. Excluding firm age, that has already been discussed in this paragraph, also firm size impacts this relation in the same way that has been highlighted for CEE companies. The paper suggests that larger firms in the LAC region are more likely to engage in innovation activities compared to smaller firms. This is attributed to the relatively higher

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[33] Default can be defined as "*the failure to make required interest or principal repayments on a debt, whether that debt is a loan or a security. Individuals, businesses, and even countries can default on their debt obligations.*"

[34] Argentina, Chile, Colombia, Costa Rica, Panama, and Uruguay.

resource availability and capabilities of larger firms, which enable them to better spread the R&D fixed costs on all its outputs (Cohen and Levinthal, 1989) and to leverage economies of scope related to R&D production.

The last firm characteristic that the paper emphasizes is the significant role of access to finance as a determinant of firms' innovation capabilities in the LAC region. Limited access to external funding sources, such as bank loans or venture capital, can pose constraints on firms' ability to invest in R&D, acquire new technologies, or engage in innovation activities. Improved access to finance is therefore seen as a crucial factor in fostering innovation among firms in the region. It is worth underline that these firm-level characteristics interact with the innovation strategies and outcomes of firms in the LAC region, shaping their overall innovation performance.

The last area to analyze due to its distinct firm composition, characterized by a significant predominance of small and medium-sized enterprises (SMEs) is Italy. In this region, SMEs represent more than 99% of the total companies operating within its boundaries. This unique characteristic that differentiates the country economic behavior compared to the one of the other countries within the same region. Nevertheless, Italy is one of the few cases around the world where SMEs can attract GVC companies due to their know-how and skilled labor force.

Looking at the existing literature about innovation on this country, it has been confirmed by the work done by Antonioli et al. (2011)[35] that, similarly to other countries, firms that actively pursue innovation in Italy have been shown to experience higher revenue growth and gain larger market shares compared to non-innovative firms. Innovation can help firms capture new market opportunities and attract more customers.

Another important finding that needs to be specified is that innovation has been found to positively impact the export performance of Italian firms. Innovative products and services can increase the attractiveness of firms in foreign markets and contribute to higher export volumes. What differentiates Italy from most of the countries in the world and must be highlighted is the *Made in Italy* concept, where the products produced are renowned for their quality, craftsmanship, and sophistication. The *Made in Italy* concept embodies long-standing Italian traditions and heritage. Many Italian products are deeply rooted in regional and cultural traditions, which adds to their appeal and uniqueness. What is interesting to note is that Italy's export sector is characterized by a significant presence of small and medium-sized enterprises. These businesses often specialize in niche markets, bringing diversity and customization to the

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[35] The study utilizes a quantitative research approach and employs econometric techniques to analyze data collected from a sample of manufacturing firms in Italy. The authors gathered data on innovation activities, such as R&D investments, patents, or adoption of new technologies, as well as firm-level performance indicators, such as sales growth, market share, or financial performance.

Made in Italy concept. But also, important to note is that these SMEs, even if specialized in niche markets and handmade processes, they invest in innovation to stay competitive and increase the quality of the products exported. Another important confirm of the findings highlighted precedingly in this chapter is that firms that actively pursue innovation in Italy have been shown to experience higher revenue growth and gain larger market shares compared to non-innovative firms. This confirm also in a country dominated by SMEs, innovation is key to distinguish from the competitors.

2.4.3- Conclusions of the effects of innovation on firm performances from other regions

Going towards the conclusion of this first chapter paragraph, it has been seen that most of the findings from the different regions are consistent with the one analyzed for CEE region. Most importantly, it has been confirmed that product and process innovation are the one with the strongest impact on firm performances. This suggest that adopting innovation through one of these two methods is the most effective way for firms to increase performances and revenues. Another important point to remark from this chapter is that firm age has an impact on the innovation behavior of the company, since it has been found in several papers that the older a firm is, the more it is likely that this firm invest in R&D activities. The only region in which this has not been confirmed is the LAC, where an opposite result has been found and probably this is related to some external factors typical of the region.

Access to finance has been addressed as one of the key determinants for what concerns investment decisions and it is fundamental for the policymaker to set up an environment that permits to companies to easily access to external fundings, otherwise companies will be less propense to invest if they need to use exclusively internal fundings.

Strictly related to investment decisions is the one of the optimal quantities of innovation to implement in the company, that it has been discussed together with the threshold effect. Firstly, it has been found by several authors that there are cases in which investments in innovation are effective only above a certain threshold, depending on factors such as firm size and industry-specific characteristics for example.

Secondly, another key takeaway is that company should not over-invest because then the costs will be superior to the benefits that the company will get in return. It has been seen above that usually the relation investment-R&D return has an inverted U-shape meaning that is not true the statement that the more money it is invested in R&D activities, the better this is for the company under a performance point of view.

Last important concept to underline is related to Italy, where given its specific industry composition it was important to see if also in this country the same concepts that have been found on other countries could be applied also to a country dominated to SMEs companies. Overall, looking at the work of other authors, the main takeaways have been confirmed meaning that innovation has positive effects independently from the firm size and the industry sector.

3. The role of GVC on innovation

3.1- Introduction

After having discussed in the previous chapter the existing literature about the GVCs and effect that innovation have on firms, taking into consideration also all the moderating factors that are usually considered in the existing literature, on this chapter there will be a transition towards the hypothesis to analyse and the literature used to gain knowledge on this topic. Firstly, there will be a section that will briefly discuss the existing literature on this topic, with a deep dive on the innovation behavior that the companies could have based on the different GVC structures that are part of. Secondly, a case study on Vietnamese companies regarding the relation within Innovation and GVC participation will be discussed. Lastly, the hypothesis that will be tested in the following chapter will be introduced.

3.2- Literature introduction and hypothesis formulation

3.2.1- Literature introduction. Gap analysis on what has been already tested.

In this section of the chapter there will be a brief introduction to the academic literature already available on the thematic that will be tested in this paper, the correlation between firm innovation and GVC participation and the effect that this has on the company probability of introducing a product innovation, to identify the existing gaps to be tested.

There is an extensive literature that proves the relation between innovation and GVC participation at industry or country level, but not many researches concerning this relation at firm level are available, so a gap in the existing literature is present.

General findings that can be found in most of the papers taken into consideration for this study are that there is a positive association between GVC participation and innovation since firms that are involved in GVCs have access to new technologies and production techniques that can stimulate innovation.

It has also been found that GVC participation can foster innovation through technology transfer. Being part of the same GVC or organization can increase the level of trust among companies and result in technology upgrading and upskilling for those firms. It is also possible that firms in GVC can learn from their partners and suppliers, leading to technology spillovers and adoption of best practices that can improve efficiency.

Another finding that has been found is that GVC effects on company innovation behaviors are different depending on if the company is a SMEs or a MNEs; this since the first firm category experiences a significant increase in its innovation capabilities compared to the second one. This is because SMEs, when they get in contact with global markets and new technologies, can easily change its business model and be more agile compared to MNEs, being able in this way to better exploit all the positive effects that are related to GVC participation. Related to this point, it has also been found that for SMEs is more difficult to be part of a GVC because of their small-scale production (Urata and Baek, 2020b), and are also more constrained in terms of availability of various resources, including human and financial resources. Wignaraja (2013) found various evidences that supports the fact that SMEs are in a disadvantaged situation compared to MNEs for what concerns probability and capacity to be part of a GVC[36]. Wignaraja also pointed out that receipt from the export sales tends to lag for a relatively long period compared to domestic sales and for this reason exporters need trade finance to pay for variable costs including costs of intermediate goods and labor. For this reason, larger companies are advantaged compared to smaller ones because they can easily access to finance sources such as loans or mortgages since they can provide more collaterals. Based on these findings, it must be taken into consideration for the analysis of the results that will be shown later, that innovative firms could not be able to participate in GVC because of a co-participation of firm size and financial constraints.

A last common finding that has been partially anticipated in the previous chapter is that GVC effects on innovation behavior are different depending on if the company is participating in an upstream or low-stream stage of the GVC[37]. Companies that operate in the upstream stages of the GVCs usually tends to focus on process innovation, whilst companies in downstream stages of the GVC are more likely to focus on product innovation (Marin-Odio, 2014). This is also related to the different types of activities done in these two stages, with the upstream one that is more focused on design or organizational activities (where a process innovation is more likely to happen) while the downstream one is more related to low-added value activities.

Harvie et al. (2010) found that innovation is the key determinant, among high productivity, foreign ownership, favorable financial access, and positive and challenging managerial/entrepreneurial attitudes for companies to join GVCs. This highlights the fact that

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[36] This study reflects two of the moderating factors discussed in the first chapter: financial constraints and firm size. To better understand this topic, please refers to what already discussed in those paragraphs and to the papers cited.
[37] To have a better understanding of which are the activities included in the upstream or downstream stage definition, please refer to Marin-Odio (2014)

only the most innovative firms are the one that have a higher probability to enter in a GVC. It has been proved also the opposite relation, as found by Brancati et al. (2015), where participating in a GVC can lead to a higher probability to introduce an innovation[38] . This relation is then difficult to disentangle and by looking at firm level data it will be possible to have a different perspective on this theme. What has been found by Urata and Baek (2020b) is that, among all the innovative firms that are entering in the GVC, one of the main characteristics that they have in common is that innovative firms have usually at least more than 5 years of experience, signifying that companies that enters in GVC needs to have a solid base and those are not start-up. A solid base must be intended as an accumulated business experience and a solid financial situation that helps them to afford sunk costs related to the GVC entrance. This also means that GVCs are targeting companies that are already established in a market and that can help them in entering in new markets or consolidate even more their position in certain countries. On this point, in their analysis Urata and Baek found also that business experience is not so important for increasing the level of GVC participation, underlying the fact that the economic component has the biggest impact. In addition to this, they have found that GVCs are targeting the most productive firms that are the one that are also introducing one or more innovations in the period of interest.

Looking at another study from Pietrobelli and Rabellotti (2011), innovations strategies of the firm are implicitly dependent from firms' innovation capabilities and the context in which companies operate are highly interrelated, specifically looking at GVCs and the geographically bounded innovation systems. This could explain GVCs decisions of locating part of their activities in certain countries not because of innovative companies by themselves, but also because of the national innovation system that can favor their activities.
Another aspect to consider while looking at firms' innovation capabilities and the results that our analysis will generate, a new stream of literature found that the separation of different stages of activities in GVC (more specifically the upstream and downstream activities discussed before), is detrimental for the firms' innovation capabilities and for firms' product innovation in specific industries. (Zirpoli and Becker, 2011; Ketoviki and Ali- Yrkko, 2009; Buciuni and Finotto, 2016). They sustain that proximity within firms that are performing different stages in the GVC will increase the overall innovation and technological level of all the companies. Co-location of R&D and manufacturing activities is a necessary factor,

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[38] According to what found by Brancati ed al. (2015), it has been found that by participating to a GVC the company will be 4,1% more likely to introduce an innovation compared to a company that doesn't make part of a GVC.

according to this stream of literature, for innovation development. Geographical proximity of upstream and downstream activities facilitates the exchange of knowledge between actors, which increases the probabilities of improving new products or generating incremental innovations (Pisano and Shih, 2012).

Looking at the second and most predominant stream of literature, it has been found that, looking at successful cases of many MNEs (e.g., Apple), fragmentation and disentanglement of the key features such as production and R&D are the key features of successful GVCs (Dedrick et al., 2010; Farrell, 2005). Looking at the arguments that supports this theory, the authors sustain and proves that this is valid for sectors in which production is not the biggest and most important activity of the value chain, because in this case companies can just exploit countries with a low cost of labor and allocate all the remaining resources in R&D and high-added value stages. Unluckily it's not possible with the dataset available to test this two hypothesis looking at firm level data because we are not able to identify accurately which companies are inside the same GVC and in which stage of the production those are involved, nevertheless highlighting this point could be useful for future studies.

3.2.2- Innovation patterns based on different GVCs structures and sectors.

Another interesting paper that investigates the variety of innovation strategies in GVCs, focusing on how different types of GVCs governances can impact companies' innovation behaviors and the effectiveness in which companies inside the value chain can absorb the knowledge from other companies in the GVC, is the one of Buciuni and Pisano (2021). This paper utilizes two main theories to identify, in the GVCs governance models proposed by Gereffi (2005), four innovation patterns related to four specific GVC structures. These two main theories are the Transaction Cost Economics[39] (Williamson, 1975) and the Modularity-Maturity[40] framework (Pisano and Shih, 2012). While the first one is easily understandable and it has been used as a base for the definition of the five types of GVCs governance done by Gereffi (2005), where, among the other variables in Gereffi's model, depending on the costs involved in the buyer-supplier transactions one type of governance is preferrable to the others, the second theory analyzes the relationship between the production innovation strategy and the firms' dispersion of value chain stages. According to this theory, by dispersing the GVCs activities across countries, lead firms can exploit more the advantages of the globalization of the production, including lower production costs and the penetration in new final markets

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[39] From now the author will refer to it as TCE.
[40] From now on the author will refer to it as MM.

(Kano et al., 2020). By doing this, anyway local companies that enters in the GVC will have difficulties in exploit benefits related to their participation in GVCs if activities are not properly codified and properly communicated. If the activities performed in some stages of the GVC have a big component of implicit knowledge required to perform them and the lead firm or the firms that are performing the following and proceeding stages are not physically close to them, the local company will have a lower probability to gain some new knowledge or experience positive effects from the GVC participation. Talking more in detail regarding the MM theory, the modularity dimension tries to explain in which situation upstream and downstream activities can operate independently from each other, while the maturity dimension focuses more on the maturity of the technology used in the process. The less mature a technology is, the better it is to focus the GVC in a smaller area and not spread it around the globe, because the lead firm is more likely to not be able to codify the knowledge needed to perform some steps of the project or to use the technology that is provided to the other companies involved in the GVCs. For companies that are entering in a GVC, independently from their initial level of innovation or innovation capabilities, it's important to take into consideration this point to exploit at their best.

Looking at the TCE theory, starting from Gereffi's GVC theory and its three key factors[41], two of them (degree of codification and complexity of the transaction) are taken from the TCE theory that investigates the relationship buyer-supplier, that it usually happens between a buyer from a developed country and a supplier from a developing one. This theory will be used in this paragraph to understand which are the most efficient dynamics to transmit innovation through the various step of the GVC looking also at the type of technology involved in the process.

3.2.3- Innovation behaviors in the *Captive Innovation* model: findings from the pharmaceutical sector

In the work of Bucioni and Pisano, as can be seen in Fig. 5, using the two theories just explained, are shown four different types of ways in which innovation is generated depending on the two variables of the quadrant: leads firm control over operations and Geographic concentration of Value Chain Stages.

Starting from the *Captive Innovation*, it is characterized by a high level of control on operation from the lead firm and from the dispersion around the globe of different stages of

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[41] More specifically: degree of the *codification* of the transaction, *complexity* of the transaction and the *capabilities of the supply base.*

the production. In this structure, that can be associated to the *captive* governance model from Gereffi's model, the lead firm will coordinate innovation through explicit coordination mechanisms, in which also a hierarchical governance can be found.
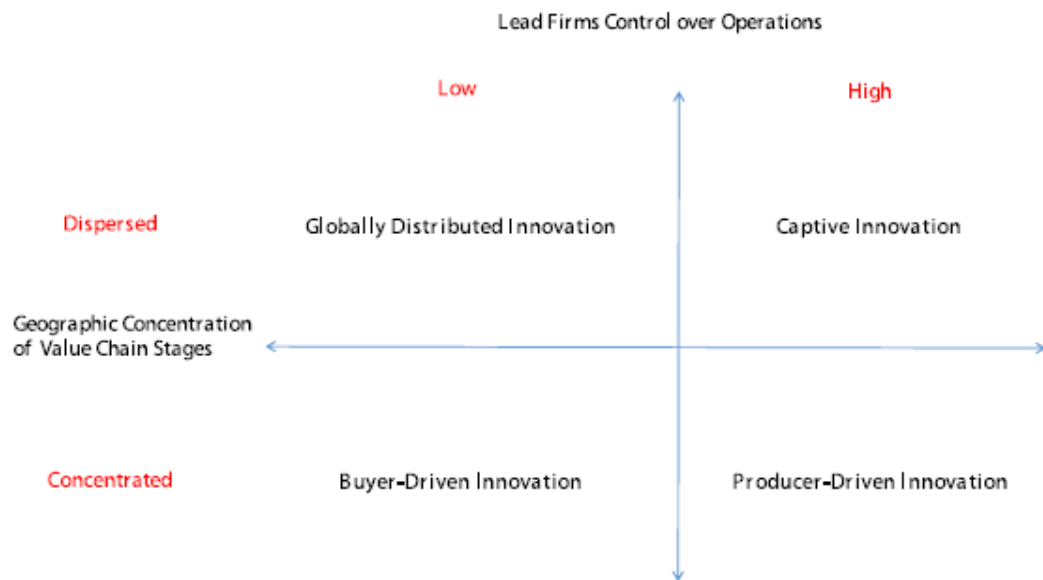
Fig. 5: "Variety of innovation in GVC", Buciuni and Pisano (2021); p. 5.

An example of the structure of the GVC can be found hereunder in Fig. 6, where it is depicted the Captive Innovation model in the pharmaceutical sector, where GVCs are usually designed in this way given the sunk costs that those must sustain and the high level of specialization and skills required.
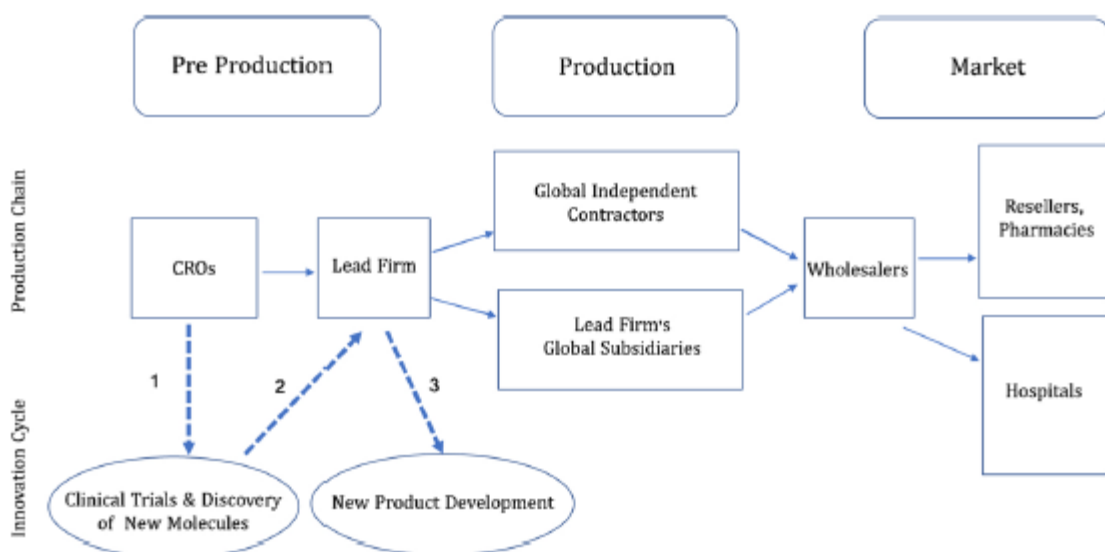
Fig. 6: "GVC Structure and Innovation Cycle in the *Captive Innovation* Model"; Buciuni and Pisano (2021); p. 8.

Lead firms disperse production to take advantage of foreign companies to access to the final market and cheaper labor forces. But, as already said, there is a high level of control and centralization in the innovation cycle given the fact that the foreign companies don't have the required level of skill needed to meet the high-quality standard and law requirements imposed from national and international authorities. It can also be seen from Fig.6 that the innovation and the production cycles are split in two silos, with the first that is managed by the lead firm and some of its global subsidiaries, while the second is managed by external suppliers. This split of the GVCs activities in two silos is possible thanks to the lead firm ability to codify the information and transmit them to all the external suppliers. Looking at the studies done by Buciuni and Pisano in this paper about the innovation dynamics in this sector, it has been found that innovation it's not embedded in the process, making possible the separation within R&D and production activities. Innovations from companies that are performing downstream activities of the GVC can happen but are rare and mainly incremental, not resulting in influencing the behavior and the strategy of the lead firm. For companies that are entering in the GVC in this innovation model it will be difficult to have any significant improvement in their innovation capabilities, except if lead firm starts to assign them more value-added tasks, where a higher level of knowledge, technology and skill is required, or if it allows the new joiner to also perform part of the other activities in the GVC.

3.2.4- Innovation behaviors in the *Globally Distributed Innovation* model: findings from the racing bicycle sector

Looking again at Fig.5 and keeping the variable on the geographic concentration the same, dispersed, and moving from a high control of the lead firm over operations to a low one, it can be found a *Globally Distributed Innovation* method, where usually the suppliers have higher capabilities compared to the precedent model and there isn't an high complexity in the transaction, allowing lead firm to adopt a loose form of coordination among all the companies in the GVC.
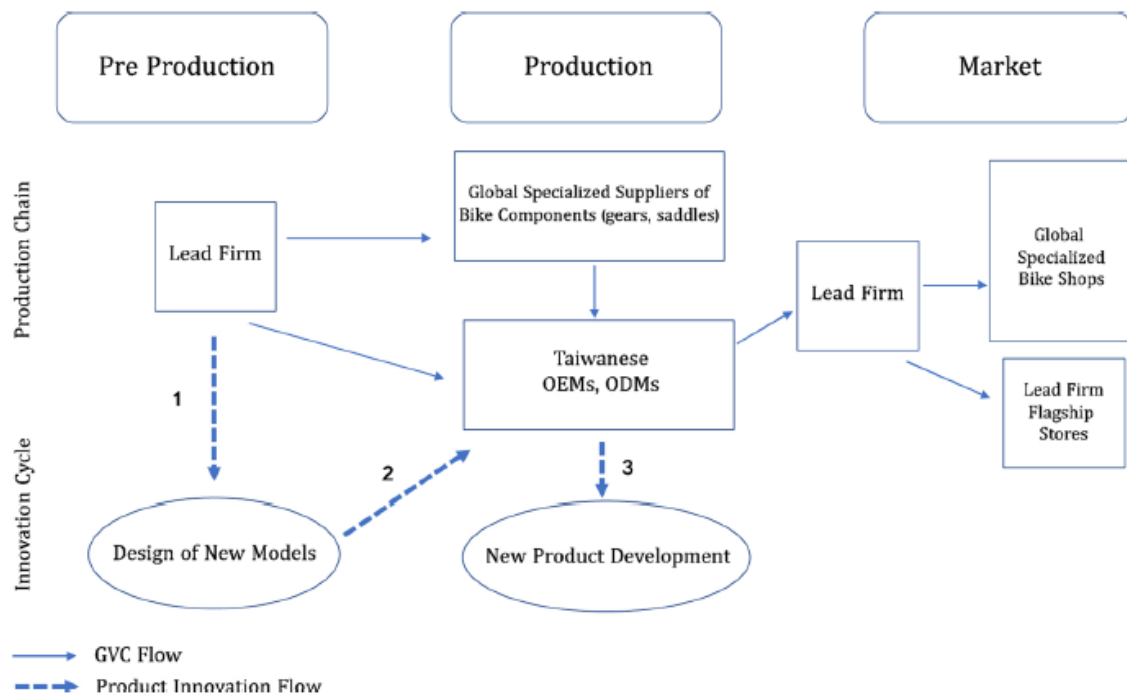
Fig. 7: "GVC structure and Innovation Cycle in the *Globally Distributed Innovation model*"; Buciuni and Pisano (2021); p. 8.

As can be seen in Fig.7, there isn't a clear division in silos between the innovation and the production cycles, meaning that all the R&D activities are not focused anymore on the lead company but could be done also from the external suppliers. Depending on the nature of innovation, innovation capabilities can shift from the lead firm to the supplier, especially in "process embedded" innovation.

Taking as case study for this model of innovation the racing bicycle industry, it has been found that the lead firms in the sector nowadays have little involvement in the global operations given the high suppliers' capabilities that allowed for a higher modularity of the production. This GVC has as lead firms big westerns companies (e.g., Pinarello and Cannondale) and external companies located in Asia that independently operates as OEMs[42], ODMs[43] or even OBMs[44]. The outsourcing of some stages of the productions started with the introduction of the carbon fiber frames in the production process, that required labor-intensive activities that were not sustainable to perform in western countries and have been outsourced in Asia. At the start there was a high level of control from the lead firms on the suppliers, but the latter rapidly increased their capabilities and become more competent and independent over time, reaching a point in which for western companies was more convenient to just

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[42] Original Equipment Manufacturers.
[43] Original Design Manufacturers.
[44] Original Brand Manufacturers.

define the specifications for the new frames and let the external suppliers design and develop the new frames. Even if Asian companies are now the center of all the production process, thanks to their "learning by supplying" process (Alcacer and Oxley, 2014), they will not be able to become lead firms of the GVC because they don't possess the design skills and brand reputation required. This innovation model shows that, for companies that enters in a geographically dispersed GVC where the lead firm has loose control over them, there is room for innovation improvements and, in the best-case scenario, it can result in leading a specific sector of the value chain. Usually, western companies select companies from developing countries that have higher innovation levels compared to other companies in that country, because they can provide better quality products. Nevertheless, it is fundamental for western companies to clearly communicate the requirements and assist closely these external suppliers at the start of the relation to ensure that the knowledge, technological and skill transfer is correctly done. Under these conditions, companies that are entering in this GVC method can increase their innovation capabilities. If the innovations are process-embedded, it can be expected that the value moves from the lead firm to the external suppliers of the GVC, transferring the knowledge with the same ratio and supporting the upgrading trajectories of the suppliers.

3.2.5- Innovation behaviors in the *Producer-Driven Innovation* model: findings from the design furniture sector

Looking at the third model on Fig.5, now there will be a focus on situations where there is a high control over operations from the lead firm and there is a geographic concentration of the GVC stages. This situation is called *Producer-Driven Innovation* model. In this model, upstream and downstream activities are concentrated in the same geographical region, and this is probably done because these stages are difficult to separate to each other due to their low modularity[45]. Looking at Gereffi's governance types, usually these models can be found in relational or captive GVCs, where coordination from an explicit form of governance is required. This is because activities are hard to codify and continuous and strict relationship between all the companies in the GVCs is required. In this case innovation is embedded in the production stages and not in the process related stages of the GVC, highlighting a big difference from the first two models.

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[45] This is usually the case for small-batched productions that are difficult to codify and craft-based. For more information, please refer to Buciuni, Corò and Micelli, 2013)

Fig. 8: "GVC Structure and Innovation Cycle in the *Producer-Driven Innovation* model"; Buciuni and Pisano (2021); p. 9.

Fig.8 represents the Producer-Driven innovation model looking at the design furniture GVC, where, differently from the first two innovation models, while the pre-production and the market stage are threated separately, in the production phase there is a clusterization of the activities, where most of the value is created and most of the lead firms' investment are concentrated. A high-level of control over the external suppliers is needed because in these kinds of sectors the market requires custom-made design, justifying the decision of locating the main production stages in the same geographical location. In this type of sectors, it also happens that, given the requirement of producing customized products, it is convenient for the lead firm to locate the design activities closer to the production site, being able in this way to transmit the requirements and the product specifications correctly. It is also important for the lead firm to have external suppliers operating in the key markets for what concerns the *market* stage of the GVC, to better capture the new trends and inputs from the market and transmit them to firms working for the design and production stages.

For firms entering in GVCs structured in this way, it is fundamental to be part of the production area because most of the value is created there and the knowledge transfers between the companies part of the cluster are more effective. If they can be part of the cluster, these companies will most likely experience an increase in their innovation activities and will experience all the positive effects of being part of a GVC.

3.2.6- Innovation behaviors in the *Buyer-Driven Innovation* model: findings from the sparkling wine sector

The last model to be taken into consideration from Fig.5 is the *Buyer-Driven innovation* model, characterized by a low control of the lead firms over operations and a geographically concentrated GVC structure. Looking at Gereffi's governance types, usually this model can be reflected in "market" or "modular" types of governance, depending also on the number of suppliers present. Usually, this structure is used when the production is dependent from the availability of specific local natural resources and the lead firm usually play the role of connecting the different suppliers.
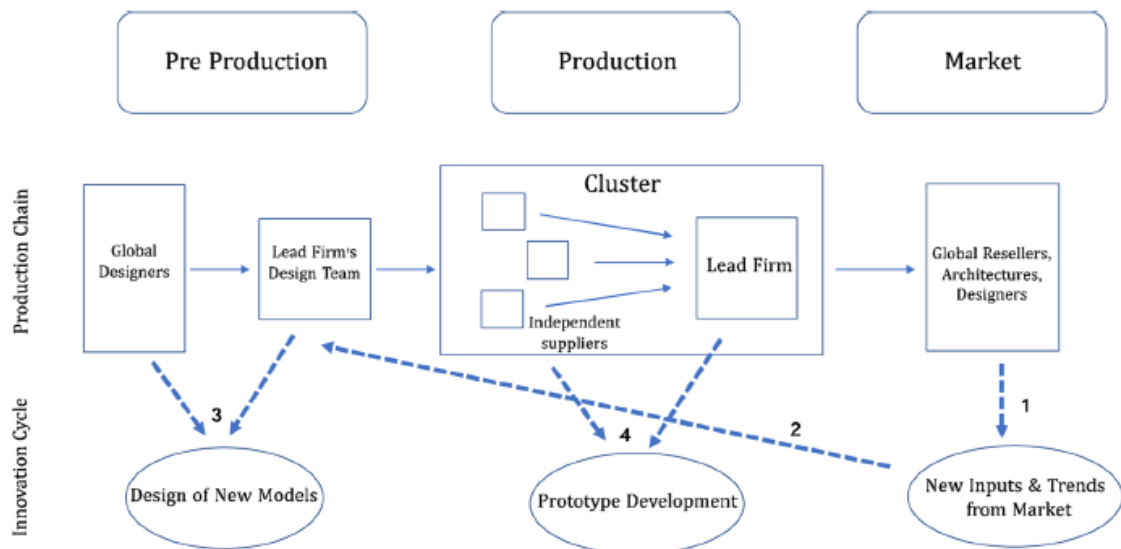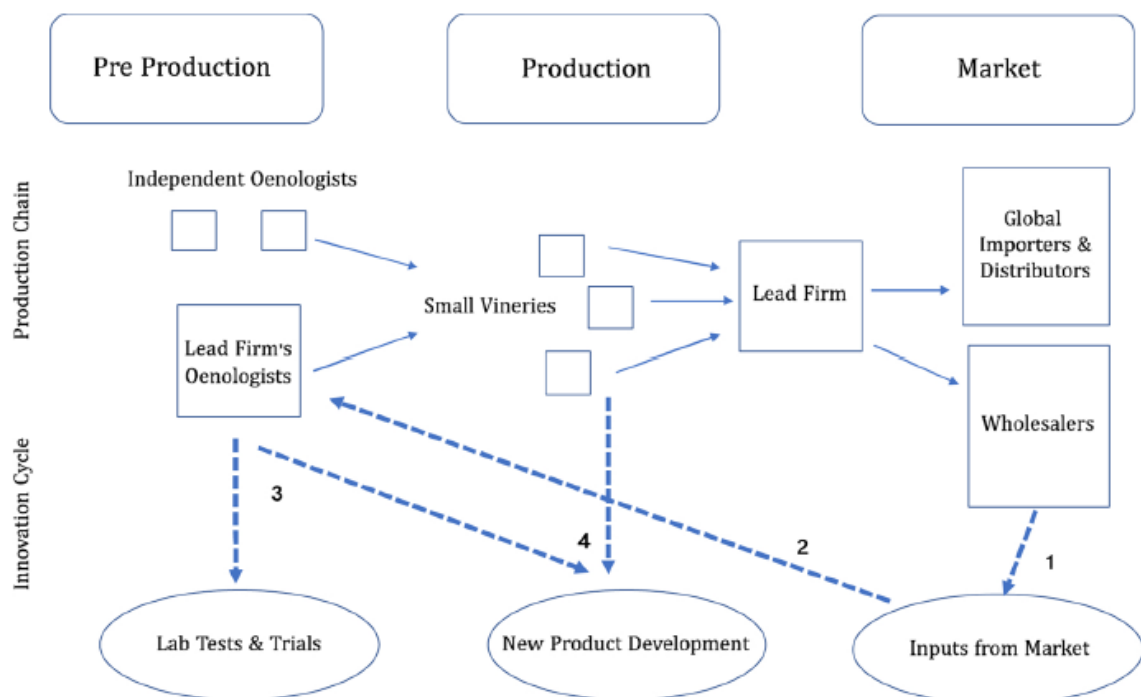

Fig.9: "GVC Structure and Innovation cycle in the *Buyer-Driven Innovation* Model";
Buciuni and Pisano (2021); p. 10.

In Fig.9 is represented the structure of the Buyer-Driven Innovation model for a GVC specialized in Prosecco, a variety of sparkling wine produced in the north of Italy. The GVC is geographically concentrated given the nature and the specificity of the final product, with a big local buyer that coordinates the activities of smaller producers and manage the selling activities in the global market. In this situation, local producers don't have the linkages and the resources to directly export their products in the global market, so a bigger company that manage this final activity is required. The innovations that are usually performed in this

model are mainly process oriented to increase the efficiency of the value chain and, in some cases, also product oriented with the goal of anticipating the customer needs. The buyers power is mainly related, in addition to their linkages with global market, also by their access to market knowledge, that make them operate as knowledge gatekeepers (Morrison et al., 2013). By looking at the type of products involving in this value chain, for foreign companies entering in the value chain the opportunities for gaining additional knowledge and innovate can only be through process efficiency due to economies of specialization and of scale.

3.2.6- Innovation and GVCs: indications from Viet Nam

Looking from an emerging and developing country perspective, Dang and Dang (2020) analyzed the effect that the GVC participation can have on Vietnamese companies, mainly small and medium firms, focusing on the effect that GVC participation can have on innovation. This can be helpful for this paper to understand which are the main challenges that companies in developing countries have to overcome and which are the results that we must expect in our analysis. This will also help us in setting the right expectations and understand which kind of relations have not been tested or deepened enough yet. Viet Nam can also be used for comparison with other countries in CEE since around 96%[46] of Vietnamese companies are SMEs, similarly to some countries in our scope of analysis. Moreover, similarly to some of the countries from CEE after the disaggregation of URSS, Viet Nam experienced a significant increase in its economy through foreign investments and increased its innovation performances, even if most of the innovation from this country can be seen as incremental and not as disruptive.

The first results to point out is that SMEs in developing countries can obtain management and technology skills when they get involved in global value chains developed by foreign firms[47]. This results in higher productivity and in a higher probability for the company to innovate, given the higher quality of the management and in its capacity to better manage company resources, in addition to the technological improvements given by the utilization of imported products.

A second point that needs to be highlighted from studies on the dynamics that involves Vietnamese companies that are involved in GVCs is that most of their "innovation potential" depends on the degree on which MNEs transfers knowledge towards them, and whether

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[46] This data has been taken from the report done by VCCI (Vietnam Chamber of Commerce and Industry) and USAID (United States Agency for International Development) (2016).

[47] This result has also been confirmed by Gyeke-Dako et al. (2017) and MacGarvie (2006)

upstream or downstream linkages are present (OECD and UNIDO, 2019). The more open are foreign MNEs in the GVC towards the SMEs of developing countries, the more likely it is for them to successfully absorb the knowledge and transform it in new innovations and product improvements.

An interesting side effect that can push local companies to innovate is related to the fact that foreign companies from more advanced countries that are part of GVCs, opening a new establishment in a developing economy, tends to attract the most skilled worker, forcing the local companies to replace lost workers using more modern technology (Sinani and Meyer, 2004). In case local companies decide to not adopt more modern technologies but to simply replace the lost workers with unskilled one, in the medium-long term this decision will lead to the closure of the company because it won't be able to sustain the competitive environment generated by the arrive of the foreign company. It has also been found by Aitken and Harrison (1999) that presence of GVCs in the country will tend to benefit all the companies because these will be forced to innovate and increase their level of productivity to compete with products coming from other countries. It has also been found that the less innovative local companies will exit from the market and the most skilled labors from these companies will be absorbed by the other companies.

One of the big problems that must be taken into consideration, looking at Viet Nam case, is that without a skilled enough workforce and without an institutional and policy framework that supports FDIs in the country, the innovation effects on local companies are weak and, in some cases, not significant. For example, looking at the Vietnamese case, due to the lack of an adequate formal information channel for FDIs, local potential suppliers have been not able to connect with foreign companies and exploit their competitive advantage compared to local suppliers that have been able to create linkages with foreign companies. Asya et al. (2017) found that in developing economies there could be that, due to asymmetric information and coordination failures in connecting foreign and local companies, failures in FDIs happened.

3.2.7- Hypothesis definition

In this paragraph will be presented the hypothesis that will be tested in the next chapter, together with some papers that treated similar topics and from where this analysis has taken inspiration.

The objective of this paper is to demonstrate that the participation of firms in Global Value Chains (GVCs) has a significant influence on their innovation performance. From what it has been analyzed and discussed previously (Buciuni and Pisano, 2021; Dang and Dang, 2020),

what we are expecting is also to find a positive relation within innovation and GVC participation for manufacturing companies, because these companies will directly benefit from the utilization of intermediate goods or technologies from foreign and more advanced companies. What is expected to be confirmed by the analysis in the next chapter is that manufacturing companies have stronger and more robust results than companies in the service or retail sector. This is because for these two types of company, even if they are involved in GVCs, there will not be any direct transfer of technology but it will be more focused on a transfer of knowledge. Knowledge transfer in the existing literature is usually positive related to innovation, but for this sector has been found that effects are weaker and, in some cases, not significant (Yang and Yi, 2021).

Our same hypothesis has been tested by Yang et al. (2020) on the manufacturing sector, using aggregated sector-level data, and it has been found that there is a positive and significant impact of GVCs participation on the innovation performances of the companies in manufacturing sectors. The results of the analysis from this paper are promising and it will hopefully be confirmed by the results of the empirical analysis that will be shown in the next chapter.

4- Empirical Analysis

4.1- Overview of the WBES

The dataset that is used for this paper is the one of the World Bank Enterprise survey. Before starting to analyze and describing the dataset, it's worth to give a general introduction to the reader about the purpose of the survey and the key features. The World Bank Enterprise Survey is an initiative conducted by the World Bank Group to collect data from private sector firms in various countries around the world. The primary purpose of this survey is to gather information on the business environment, including the challenges and opportunities that firms face in their respective countries. This is done to assess the health status of a national economy and to analyze the dynamics that each economy is having through the years (and this will be also one of the main scopes of analysis of this paper).

There are five key features that are important to highlight before proceeding with the dataset description. The first one is that in this survey there are data both SMEs and MNEs, providing us with heterogenous data that will reduce any risk of biased data. These firms are from the private sector, and not the public one, given that there are various and clear evidences that demonstrates that the public sector have more inefficiencies than the private one. Including also the public sector will just generate dirty data because those sectors are not involved in Global Value chains.

Secondly, this survey covers various topics related to business environment, including access to finance, regulatory compliance, innovation, workforce, and other topics. Some of these topics are moderating factors that have been discussed in the previous chapter and that will be deepened under another perspective later in this chapter. Having an enhanced granularity of the data (at firm level instead of country or region level data) for these topics is important because it can give to the analysis that will be performed on this paper a different perspective and will add new findings to the literature on this subject.

Thirdly, this survey is conducted in multiple countries around the world, allowing for comparisons between countries and perform analysis at a regional or global level. Strictly related to this point, it's worth to say that even if this survey has data for every year, not all the countries do this survey every year, causing some restrictions to our analysis[48] caused by the impossibility to compare data from two or more countries in subsequent years.

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[48] This issue and how it has been solved will be discussed later in this chapter.

Fourthly, another important feature that is noteworthy is that these data are publicly available, allowing everyone, including researchers, policymakers, businesses, and the public to access and analyze the information. This drastically reduced the data gathering process and make this dataset widely used in the existing literature by other researchers to analyze similar topics, helping the growth of the branch of studies that investigate firm level effects and dynamics in several countries and regions.

Lastly, even if it is not directly related to this paper, this survey can highlight which are the dynamics of the economy at country and sector level, offering some indications of which are the emerging markets of the economy, making firms trying to approach and enter in these sectors, or can be used by policymakers to understand the areas where improvements are needed to enhance the business environment, stimulate economic growth, and attract investment.

4.2- Construction of the dataset

The initial dataset was composed by observations from more than 50 different countries on a period that was spacing from 2002 to 2021. The first operation done was to assess which countries that had an economy that could have been defined as "emerging" had observations in the same years, to have results that were coherent in term of timing. From this first screening exercise, only 24 countries[49] remained.

After this first screening, the author started went through each country dataset to check for the coherence amongst all of them, to avoid misalignments due to differences in the survey performed through the different countries. Following this second check, other 12 countries[50] have been taken out from the analysis. The remaining 12 countries resulted to be all homogeneous regarding the type of questions that have been asked in the survey and the year in which these surveys have been performed.

The years for which the analysis of this paper will be performed are 2013 and 2019. The countries of interest are all located in the central and eastern Europe area and most of them were part of the former Soviet Union. Unfortunately, it was not possible to involve Russian

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[49] More in detail, the countries remained from this first exercise were: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Moldova, North Macedonia, Poland, Romania, Serbia, Slovak Republic, Slovenia, Tajikistan, Ukraine and Uzbekistan.

[50] These countries are Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyz Republic, North Macedonia, Tajikistan and Uzbekistan.

Federation in this analysis since this country's survey are not from the same years of all the other countries in the sample[51].

The final number of observations present in the analysis after this first round of quality check on the dataset, and that can be found hereunder in table 2, is 1438 and represents 12 different countries, with a different number of observations for each country.

Country	Freq.	Percent	Cum.
Bosnia and Herzegovina	168	11.68	11.68
Bulgaria	112	7.79	19.47
Czech Republic	91	6.33	25.80
Estonia	84	6.54	32.34
Hungary	107	7.44	39.78
Latvia	108	7.51	47.29
Lithuania	71	4.94	52.23
Moldova	106	7.37	59.60
Poland	221	15.37	74.97
Romania	117	8.14	83.10
Serbia	154	10.71	93.81
Slovenia	89	6.19	100.00
Total	1.438	100.00	

Table 2: Representation of the final observations present in the dataset, divided by country.

Poland is the country that is represented the most in the analysis, while countries such as Lithuania, Slovenia, Czech Republic and Estonia don't have a lot of observations. This could be due to the size of the economy of each country is different and to the fact that the way number of companies interviewed in each country were different[52].

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[51] For what regards Russian Federation, the surveys are from 2008, 2012 and 2019, not aligned with the period of analysis of the other countries. Including those data in the analysis, even if would have provided some useful insights of how the former Soviet Union countries are performing in the period of analysis, would have generated incorrect results.

[52] The way in which this survey was conducted could have a role in this and it's part of the limitations of this analysis. In fact, survey didn't have any mandatory question to answer so it happened that companies have data only for "objective" questions (such as the revenue of previous year or the number of employees), while many gaps have been found in the questions related to introduction of any type of innovation, generating some issues in the analysis.

4.2.1- Variable Description

Looking at table A1, that can be found in the appendix, it can be seen all the 88 variables present in the final dataset with the original codification from the original survey in the first column, the new naming convention in the second column to make easier for whoever wants to access the dataset the understanding of it and in the third column a description of what each variable mean or the question that corresponds to that in the survey.

Trying to give to the reader an overview of what all these variables are about, the main macro-categories in which these can be grouped are:

- ***General***: In this category are included all the variables that refers to the size of the company, the sector of interest and the main information regarding the ownership and if it is in possess or not of an international recognized quality certification;
- ***Trade***: this category includes all the information regarding the sales and revenues of the companies of the, plus the percentages of sales or inputs that are from the national market or a foreign one;
- ***Innovation***: All variables related to the fact that the company introduced or not any of the innovation categories already explained in the first chapter;
- ***_2013_***: These variables represent data from only the 2013 survey, that have the exact respective variable in the 2019 survey;
- ***_2019_***: Same as the category above but for 2019 data.

In addition to those variables, some additional variables have been added by the author to understand the weight of the direct export on each company. These three variables called *Direxp_10%*, *Direxp_5%* and *Direxp_1%* checks if the company observed has direct exports on the overall sales equal or higher than, respectively, 10%, 5% and 1%. This is done to assess how much of these observations can refer to companies that are part of a GVC with different thresholds of significance.

Talking more in detail about the variables that will be analyzed in this paper, to define the GVCs variables we have utilized the approach of Gopalan et al. (2022), where GVC has been defined in two different ways, one stricter than the other. The first GVC definition says that a firm can be considered a GVC if a firm is simultaneously importing and exporting. The second definition, stricter than the first, includes all the characteristics of the first definition, also requiring the firm to have a quality certification internationally recognized.

In the model of used for this analysis, the author created six different GVC variables, that are defined as follow:

- *GVC1*[53]: in this case, the firm must direct import inputs from foreign countries & directly export to a foreign country;

- *GVC1.1*: the firm must directly import inputs from foreign countries and export directly or indirectly;

- *GVC 1.2*: the firm must directly import inputs from a foreign countries and direct export at least 10% of its sales;

- *GVC2*[54]: this variable has all the characteristics of GVC1 variable, plus it is required an international certification;

- *GVC2.1*: this variable has all the characteristics of GVC1.1 variable, plus it is required an international certification;

- *GVC 2.2*: this variable has all the characteristics of GVC1.2 variable, plus it is required an international certification.

The author here decided to expand the number of variables used for representing the effects of the other variables and to produce more robust results. These six GVCs variables have also the purpose to investigate how the direct or indirect export can influence the innovation effects that GVC participation can have on the firm.

In table 3 can be seen all the variables that have been taken into consideration for the analysis, and that will be briefly explained before discussing the econometric model adopted for this analysis and the results of the analysis.

- *INNOPROD*: this is the dependent variable of the model; it refers to 2019 data [55] and it's a dummy variable that has value equal to 1 if any innovation has been introduced, while it has value equal to 0 if no innovation is introduced;

- *Emp*: this variable represents the number of employees that the company has. The companies that have been analyzed for this variable have value that spaces from 1 employee to 1420, highlighting the variety of companies that this survey takes into consideration;

- *Age*: this variable represent the age of the company and it's calculated thanks to the information on the year of foundation of the firm[56]. This survey takes into consideration companies that have been recently established, as the minimum value

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[53] This variable can be associated with the first GVC variable from the paper of Gopalan et al. (2022) previously discussed. The other two variables of this category (GVC1.1 and GVC1.2) are derivation of this first variable. The same approach has been used for the variable GVC2 of this model.

[54] This variable can be associated with the second GVC variable from the paper of Gopalan et al. (2022) previously discussed.

[55] This is the only variable that refers to 2019 data while all the other variables are representing 2013 data.

[56] Please refer to the variable *Est_year* of Table A1 present in the Appendix

of the variable equal to 2 shows, but also companies that have more than one century of activities;

- *Foreign*: this is a dummy variable used to signal if a company is owned by a local investor or if it is under foreign ownership. This dummy variable has value equal to 1 if it is owned by a foreign investor, otherwise this variable assume value 0;

- *Rd*: this variable signal if there have been R&D activities in the firm or not. It's a dummy variable that has value equal to 1 if there has been any R&d activity in the firm, otherwise it gets value equal to zero;

- *Prod*: this variable is related to the sales per employee and it's used to signal the measure the productivity level of the firm. The higher is the value of this variable, the higher is the productivity level of the firm.

variable	Obs.	mean	Std. dev.	Min	Max
INNOPROD	1,438	.3379694	.4731826	0	1
gvc1	1,438	.1335188	.3402529	0	1
gvc1_1	1,438	.1578581	.3647348	0	1
gvc1_2	1,438	.1008345	.3012142	0	1
gvc2	1,438	.0598053	.2372082	0	1
gvc2_1	1,438	.0709318	.2568003	0	1
gvc2_2	1,438	.0514604	.2210117	0	1
emp	1,438	43.97844	107.549	1	1420
age	1,438	22.61405	12.5789	2	129
foreign	1,438	.0841446	.2777012	0	1
rd	1,438	.1411683	.3483162	0	1
prod	1,438	.5333319	17.70613	5.00e-08	666.6733

Table 3: Summary of the econometric model variables

Before proceeding further with the explanation of the econometric model adopted and the results of the analysis, it's worth spending some time to explain the controls done to assess that there is not multicollinearity[57] in the dataset and risk to have meaningless results in our analysis. As can be seen in Table 4, the results of the correlation test within the variables are

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[57] In a multiple linear regression model, there are several independent variables that are used to explain the variation in the dependent variable. When these variables are correlated with each other, it can be challenging to isolate the individual effect of each independent variable on the dependent variable.

not high enough to highlight a risk of correlation within the variables of the dataset, so it can be said that in the model utilized for this analysis there is no risk of multicollinearity within the variables.

	gvc1	gvc1_1	gvc1_2	gvc2	gvc2_1	gvc2_2	emp	age	foreign	rd	prod
gvc1	1.0000										
gvc1_1	0.9067	1.0000									
gvc1_2	0.8531	0.7735	1.0000								
gvc2	0.6425	0.5825	0.6363	1.0000							
gvc2_1	0.5765	0.6382	0.5732	0.9128	1.0000						
gvc2_2	0.5934	0.5380	0.6955	0.9235	0.8430	1.0000					
emp	0.1342	0.1291	0.1628	0.2281	0.2125	0.2484	1.0000				
age	0.0631	0.0444	0.0753	0.0901	0.0781	0.0960	0.0981	1.0000			
foreign	0.1609	0.1505	0.1647	0.1665	0.1700	0.1675	0.1271	-0.0819	1.0000		
rd	0.2108	0.2298	0.2025	0.2094	0.2147	0.1858	0.1464	0.0784	0.0786	1.0000	
prod	-0.0099	-0.0112	-0.0079	-0.0048	-0.0058	-0.0041	-0.0084	0.0222	-0.0090	-0.0032	1.0000

Table 4: Correlation Test Results for Dataset Variables

Talking about the sectors that have been taken into consideration for the analysis, the WBES panel has both the industry[58] in which the firm is operating (e.g., manufacturing, services) and the specific detail of the sector in which the firm is operating. One of the limitations of this dataset is that the information on the latter detail is not correct in some of the cases, so it has been decided to keep the detail only of the general area, to avoid working with dirty details.

Sector	Freq.	Percent	Cum.
Manufacturing	478	33.24	33.24
Other services	500	34.77	68.01
Retail Services	460	31.99	100.00
Total	1,438	100.00	

Table 5: Summary details for the sectors of interest

In Table 5 there is a summary of the three sectors taken into consideration for the analysis, where there is a clear distinction from the manufacturing sector, that includes all the firms that performs middle-stream[59] activities of assembling and production of the product, and the service sector, that is divided between retail services and other services. For *retail services*,

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[58] Refer to the variable *Industry_Sa* from Table A1 present in the Appendix.
[59] Already discussed before in chapter 2. For a better understanding of which activities are included in this definition, please refer to Marin-Odio (2014).

are intended all the activities of packaging and distribution of the product, that have been already described previously in this paper while discussing about the downstream activities. As last category, the *other services* variable can be intended as residual of the first two, where are included all the activities that are not included in the production and distribution of the product.

Interesting to note from table 5 that the number of observations within the three sectors is evenly balanced, without a clear predominance of one category on the other two. This will ensure that the results will not be biased by the fact that most of the firms are from one sector and have similar characteristics that will influence the results.

4.3- Econometric model

4.3.1- Model formulation and statistical techniques used for the robustness checks

In this section will be described the model used for the analysis, with an explanation of each of the variables included and then the statistical techniques applied for obtaining the results. The formula used for this model is the following:

$$INNOPROD_{i2019} = \beta_0 + \beta_1 GVC_{i2013} + X_{i2013}^{\gamma}\beta_X + \varepsilon_{i2019}$$

where i refers to the firm, β_0 is a constant of our econometric model, β_1 is the coefficient that captures the effects of the firm i that participates in the GVC in 2013, X is the vector of our control variable and comprehends all the variables already discussed in the previous paragraph[60], γ represents the sector of the firm and ε_{i2019} is a variable that represent the stochastic error for 2019.

The econometric technique utilized for this analysis is the LPM (Linear Probability Model), a statistical model that fits with the dependent variable chosen for this model because usually this model is used in econometrics to analyze the relationship between a binary dependent variable and one or more independent variables. As already said before, our dependent variable assumes value 1 if any innovation has been introduced in that year (in case of success), and it assumes value 0 otherwise. This model doesn't put any constraint related on being dummy or continuous on the independent variables of the model, so it fits also with the independent variables selected for the analysis.

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[60] For reference, the variables inside the vector are number of employees of the firm, age of the company, foreign ownership, productivity and a dummy on R&D investments.

The null hypothesis to be tested is that the β_1 is positive, proving the fact that participation in a GVC will have positive effects on the firm probability to introduce a product innovation. This model has been chosen also for its simplicity, nevertheless it has some limitations that needed to be addressed before proceeding with the analysis of the results. The first problem that is usually related with LPM is the one related to heteroscedasticity.

INNOPROD	GVC1	GVC1.1	GVC1.2	GVC2.1	GVC2.1	GVC2.2
emp	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
age	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
foreign	0.019	0.024	0.025	0.024	0.030	0.024
	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)
R&D	0.314***	0.315***	0.321***	0.320***	0.325***	0.322***
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
productivity	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
manufacturing	0.061*	0.062**	0.070**	0.069**	0.077**	0.071**
	(0.031)	(0.032)	(0.031)	(0.031)	(0.031)	(0.031)
retail	-0.026	-0.026	-0.027	-0.028	-0.029	-0.028
	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)	(0.029)
GVC1	0.115***					
	(0.041)					
GVC1.1		0.088**				
		(0.039)				
GVC1.2			0.077*			
			(0.045)			
GVC2				0.107*		
				(0.057)		
GVC2.1					0.037	
					(0.054)	
GVC2.2						0.108*
						(0.062)
Constant	0.417***	0.416***	0.420***	0.424***	0.423***	0.424***
	(0.045)	(0.045)	(0.046)	(0.046)	(0.046)	(0.046)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1438	1438	1438	1438	1438	1438
R^2	0.122	0.120	0.118	0.118	0.116	0.118
VIF	0.140	0.140	0.140	0.140	0.140	0.140
RAMSEY (p-value)	0.375	0.365	0.255	0.416	0.215	0.255

Robust standard errors in parentheses. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 6. GVC and product innovation. Full sample. Linear probability model.

Looking at table 6, all the standard errors are robust to heteroscedasticity, so in the results that will be analyzed in this chapter in the following paragraph, those will not be influenced by heteroscedasticity.

Another issue related to this model is the one related to multicollinearity, that will happen when the independent variables are highly correlated.

Anyway, this issue has been already addressed in the paragraph above, more specifically in table 4, where the author checked for the correlation among different variables and it has been cleared the risk of multicollinearity from the dataset.

Another control on the multicollinearity that has been performed is the VIF[61] , a test that is a valuable tool for detecting multicollinearity and deciding whether it needs to be addressed in a regression analysis. By identifying which variables contribute to high VIF values, steps can be taken to improve the stability and reliability of the regression model. The VIF is a statistic used to assess multicollinearity in regression analysis and that can lead to unstable and unreliable coefficient estimates in regression models. It is calculated on each independent variable in the following way. Firstly, a separate regression model is fitted with that variable as the dependent variable and all other variables as independent variables.

The VIF for a specific variable is equal to 1 divided by (1 - R^2), where R^2 is the coefficient of determination from this regression model and it measures how much the variance of the estimated coefficient is increased due to multicollinearity. If VIF equals 1, it indicates no multicollinearity (perfect independence between predictors). As the VIF increases beyond 1, it indicates a higher degree of multicollinearity. Typically, a VIF value above 5 or 10 is considered high and suggests the presence of multicollinearity in the model.

The other test performed whose results can be seen in table 6 is the Ramsey test. The null hypothesis of this test is that the model has been correctly specified and no key variables have been omitted from the econometric model. The Ramsey test helps in assessing whether the model is correctly specified and it's often used in multiple regression analysis, like the one of this paper.

To better explain the null hypothesis briefly explained above, with this test the author is trying to ensure that the relationship between the independent variables and the dependent variable is captured correctly. This null hypothesis is tested against the negative hypothesis that the model is not correctly specified.

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[61] Variance Inflation Factor.

To run this test, the existing regression model is extended with additional terms that represent higher-order powers of the predicted (fitted) values of the model. From this alternative and extended model, an F-statistic is computed and, if this is significant, there is evidence that some variables are omitted and needs to be included.

From the results of table 6 the higher p-values shows that the null hypothesis can't be rejected and no important variables have been omitted from the model.

The Ramsey test is also useful to assess if nonlinearity in the functional form is present or if any interaction term has been omitted, so looking at results in table 6 it can also be said that the model used in this paper does not have these issues.

A test that has been performed to address the endogeneity of the model is the one of the 2SLS[62], and the results will be discussed later in this chapter. In this paragraph there will be the theoretical explanation of how the model works, while the results of this check will be discussed later. As the name says, this statistical method is composed of two subsequent stages. In the first stage, there is the regression of the endogenous variable[63] on the instrument[64]. The purpose of this stage is to estimate the relationship between X and Z and the model in the first stage is typically of the form:

$$X = \alpha + \beta Z + \varepsilon$$

where X is the endogenous variable, Z is the instrumental variable, α and β are parameters to be estimated and ε is the error term. After running this regression, estimates for α and β are obtained. These estimates allow to calculate predicted or fitted values of X, denoted as X-hat.

In the second stage, the predicted values of X[65] from the first stage are used as a substitute for X in the main regression model, with the model that has typically this form:

$$Y = \delta + \theta X - hat + \mu$$

where Y is the dependent variable, X-hat is the predicted value of the endogenous variable from the first stage, δ and θ are parameters to be estimated and μ is the error term. By running this second-stage regression, the effect of X on Y is estimated while accounting for the potential endogeneity and omitted variable bias. This two-stage process allows to obtain

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[62] Two-Stages Least Squares. It is a statistical method used in econometrics to address endogeneity and estimate causal relationships in regression models. It's commonly used in instrumental variable (IV) analysis, which helps correct for the biases introduced by endogeneity in the regression model.

[63] From now on in this paragraph the author will refer to the endogenous variable as "X" for simplicity.

[64] From now on in this paragraph the author will refer to the instrument variable as "Z" for simplicity.

[65] From now on in this paragraph the author will refer to the predicted or fitted values as "X-hat" for simplicity.

unbiased and consistent estimates of the causal relationship between X and Y. Anyway, this system is not without some limitations. The success of 2SLS relies on the relevance and exogeneity of the instrumental variables. By relevance, the author means that the instrumental variables should be correlated with the endogenous variable X and by exogeneity means that the instrumental variables should not be correlated with the error term in the main regression.

4.3.2- Results of the analysis

In this paragraph the author will present the results of the analysis, controlling if the initial hypothesis for which a firm that enters or that is part of a GVC contributes to an higher probability for the firm to introduce a product innovation.
The dependent variable, as said previously, is a dummy variable measured in 2019 while the other independent variables of the model are measured in 2013. There are no measurements for the years in between, reducing the risk of endogeneity.
It's worth to highlight the fact that, even if the Ramsey test provided the results expected and the fact that we are measuring variables with a temporal gap, there could be some reverse causality due to persistent innovation behaviors from the firms analyzed. These firms that have a persistent innovative behavior could be more likely to be targeted by GVCs since these firms are more likely to have higher productivity levels compared to the one without persistent innovation behavior.

Starting the analysis of our results from Table 6, it can be seen GVC participation has positive and significant effects on the firm probability to introduce a product innovation, becoming less significant going from the *GVC1* definition to the *GVC2.2*. In the case of *GVC2.1*, the estimates lose significance but this can be explained by the fact that the variable is less strict than the others[66]. This means that having an internationally recognized quality certification doesn't ensure a higher probability of introduce a product innovation, even if it's widely documented in the existing literature that it helps in entering in a GVC. Further analysis needs to be performed on this topic, but it was not possible with the available dataset.

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[66] Because it includes both direct and indirect exports, meaning that this firm could not directly export to a foreign country but uses an intermediary for this. Further analysis on this topic needs to be performed, unluckily it was not possible to perform this detailed analysis with the dataset available.

Other interesting findings that emerge from the analysis and that confirms what already studied in the existing literature is the fact that *age*, *R&D* and *productivity* are all significant. Looking more in detail to each of them, for what regards the age of the firm, there is a negative relationship within this variable and the dependent variable *INNOPROD*, highlighting the fact that the older a firm become the less likely it is to perform innovation activities. This could signal that older firms feel already established in the market and don't feel incentivized to improve their existing products, creating a path dependency behavior that can be dangerous in the long run for the company. Younger companies could be more incentivized to innovate because they need to gain market share and establish themselves in the market. For younger companies, entering in a GVC represents an opportunity to gain knowledge and more advanced technology from the other companies in the value chain. Looking at the *R&D* variable, it shows that companies that are performing R&D activities are on average 32% more likely to introduce a product innovation compared to the one for which the R&D variable has value equal to 0. Making a further distinction, it can be seen that companies that have an internationally recognized certification are slightly more likely to introduce a product innovation. This result is in line with what found in the literature analysis in the previous chapters.

Focusing on the estimates of the impact of firms' productivity on the probability of introducing a product innovation, all the results are significant and proves that there is a positive relation, confirming that more productive firms are more likely to innovate. This could be explained by several factors, such as that the firm will be able to use its resources more efficiently and being able to allocate the resources saved in R&D activities, that will lead to innovations. Another reason that can justify this result is that the most productive firms are the one that are more easily targeted by GVCs and that, by entering in contact with foreign intermediate inputs, foreign technologies and through knowledge transfers from the companies part of the value chain, can receive more inputs for designing and generating new innovative products.

Looking instead at the variables *manufacturing* and *retail* estimated in table 6, interesting findings arise regarding our initial hypothesis: product innovation is more likely to happen in manufacturing companies than in companies that are operating in the retail sector. Estimates for the manufacturing sector are positive and significant, showing that companies in the manufacturing sector that are part of a GVC are 7% more propense to introduce a product innovation than firms in other sectors. The estimates for the retail sector instead are not significant, meaning that there should not be any impact on the probability of introducing a product innovation if a company is operating in the retail sector.

For what regards the *foreign* variable instead, it's not significant so it can be assumed that having a foreign or local ownership doesn't have any impact on the company's probability to introduce product innovation.

4.3.3- Sector impact on the probability of introducing a product innovation

	SERVICES	MANUF	SERVICES	MANUF
INNOPROD	(1)	(2)	(3)	(4)
emp	0.000	0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
age	-0.001	-0.003**	-0.002	-0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
foreign	0.080	-0.062	0.086	-0.055
	(0.062)	(0.068)	(0.063)	(0.068)
R&D	0.295***	0.354***	0.305***	0.359***
	(0.054)	(0.054)	(0.053)	(0.054)
productivity	0.001***	0.042***	0.001***	0.040***
	(0.000)	(0.006)	(0.000)	(0.007)
GVC1	0.138*	0.119**		
	(0.070)	(0.052)		
GVC2.2			0.087	0.130*
			(0.168)	(0.073)
Constant	0.416***	0.444***	0.424***	0.452***
	(0.052)	(0.082)	(0.052)	(0.083)
Country FE	Yes	Yes	Yes	Yes
N	960	478	960	478
R^2	0.099	0.142	0.094	0.139

Robust standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7. GVC and product innovation: services vs. manufacturing.

Looking at table 7, a more detailed analysis has been performed to check the impact of the sector on the *INNOPROD* variable, for two reasons: the first goal of this analysis is to check the robustness of the results based on the sector, the second goal is to better assess the different impacts that being part of the manufacturing or service sector can have on the *INNOPROD* variable. Instead of taking into consideration all the six GVCs variables discussed in the previous paragraphs, for simplicity have been included only the *GVC1* and *GVC2.2* results. The results for these two variables are in line with what found in table 6, confirming the robustness of the analysis performed and that an internationally recognized quality certification is not enough by itself to ensure positive effects on the *INNOPROD* variable.

What can be seen is that for both the *R&D* and *productivity* variables are still significant in both GVC definitions and in both sectors, meaning that the results of table 6 are confirmed. Regarding the *age* variable, it's significant only in the manufacturing sector and not in the service one, with the same negative relation present in table 6.

The reason for such a difference between the companies operating in the manufacturing and in the service sector on the *INNOPROD* variable can be that firms in the latter sector don't have huge impacts on the production process, so it's less likely that they can significantly influence the way in which the product is produced and it's also difficult for them to gain the knowledge required to produce an innovation on the product. Even if not in scope of this analysis, it can be assumed that companies operating in the service sector will be more likely to introduce process innovation in any form (e.g., organizational, marketing) compared to firms operating in the manufacturing sector.

4.3.4- Robustness check results

To avoid any endogeneity or omitted variable bias in the regression analysis performed in this paper, a 2SLS analysis using an IV[67] has been performed. The instrumental variable is a statistical technique widely used in econometrics and provides a way to correct the endogeneity problem. The instrumental variable is a variable that is used as a proxy for the endogenous independent variable. This instrumental variable needs to have the following characteristics to be used in the 2SLS: it should be correlated with the independent variable[68] but not directly correlated with the dependent variable of the model and it shouldn't be part of the causal relation between the independent variable and the dependent one.

The most common method for implementing the IV technique is the 2SLS method, that is performed in two subsequent stages. Following the approach of Gopalan (2022), as external instrument the variable *website* has been chosen. The ratio behind this decision is that the *website* variable doesn't have a direct impact on *INNOPROD*, since having a website is not related with an increased probability in introducing a product innovation but can be used as a proxy for GVC participation because it signals to foreign suppliers the services that it provides and increase its visibility on the global market. Looking at the results obtained by

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[67] Instrumental Variable
[68] In our case the *GVC* variable.

Gopalan (2022), the author is confident that this will be a strong instrument. If the instrument is weak, it will lead to imprecise parameter estimates and reduced statistical power.

In the first stage, the *GVC* variable will be regressed on the *website* variable, generating some predicted values that will be uncorrelated with the error term. In the second stage, these predicted values will be used as substitutes of the *GVC* variable and the *INNOPROD* variable will be regressed on these predicted values.

2SLS	(1)	(2)	(3)	(4)	(5)	(6)
GVC1	2.105^{***}					
	(0.640)					
GVC1.1		1.630^{***}				
		(0.439)				
GVC1.2			3.682^{**}			
			(1.562)			
GVC2				4.590^{***}		
				(1.641)		
GVC2.1					3.331^{***}	
					(0.999)	
GVC2.2						6.582^{**}
						(2.962)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
N	1438	1438	1438	1438	1438	1438
F	16.32	24.38	6.69	10.08	17.01	5.66
First stage						
Website	0.065^{***}	0.084^{***}	0.037^{**}	0.030^{***}	0.041^{***}	0.021^{**}
	(0.016)	(0.017)	(0.014)	(0.009)	(0.010)	(0.009)

Robust standard errors in parentheses. $^{*}\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

Table 8. GVC and product innovation: 2SLS regressions

Looking at table 8, that represents the two stages of the 2SLS regression, there are a few new variables that needs to be briefly explained before proceeding with the results of robustness check. *Controls* is a dummy variable that has the purpose to control for the correctness of the model and it includes all the other variables of the model while *Country FE* is a dummy variable that checks for the country fixed effects. Both assume value equal to *YES* so the assumptions of the model are satisfied.

Looking at the first stage first, we can see that the *website* variable is significant for all six the GVC definitions, allowing to continue with the second stage of the analysis. All the instruments in the second stage are significant, meaning that the estimates are robust to inverse causality.

Lastly, looking at the F statistic, the rule of thumb in this type of model is that it should be higher than 10 to define that the instrument used is statistically strong, and at least higher than 5 to not reject the instrument. These conditions have been both satisfied, so it can be concluded that the analysis performed in this paper is robust to reverse causality and not influenced by endogeneity or omitted variables.

The only point of attention that could make the estimates less reliable is related to the attenuation bias, a measurement error due to some measurements errors that could be present in the dataset and that have not been possible to avoid. Among the main causes for the attenuation bias in the model there are endogeneity, omitted variables and heteroscedasticity, but all these issues have been already controlled previously in this chapter. Anyway, the fact that in this estimate the F coefficient are much larger than usual it could be related to a measurement error.

5. Conclusions

Proceeding towards the conclusion of this paper, the analysis performed in the previous chapter has uncovered some interesting discoveries. These findings align with what previous studies have shown, and they provide a more detailed look into the data than what was previously available, focusing on firm level data.

The null hypothesis for which companies from the manufacturing sector that enters in the GVC experience an increase in the probability of introducing a product innovation has been confirmed, independently from the fact that the companies directly or indirectly export. It has also been found that having an internationally recognized quality certification does not make a significant difference on the probability of introducing a product innovation. This could be explained by the fact the certification can help the company in making part of a GVC, but then it does not have any direct impact on the innovation capabilities of the firm. *Productivity*, *R&D* and *age* are all variables that have been found to have a significant relation with the fact of introducing a product innovation from the company, in line with what previously found in the existing literature.

From these results is also possible to find some interesting policy implications for what concerns Central and eastern European countries, but more in general for all the emerging economies that aims to improve their economies. Any policy that aims at attracting FDI from GVCs could be beneficial for the single company and the overall industry in which the company it's involved. This is because it has been proven that participating in a GVC will increase the productivity and innovativeness of the company involved. This analysis also suggests focusing more on measures that makes the manufacturing sector more attractive to foreign GVCs, also given the fact that for what concerns the retail sector the results of our analysis hasn't shown any significant result. On this topic, any action done by a national government to increase the attractiveness of its economy to foreign investor, like improving the laws to protect the IPRs or enhancing both the formal and informal channel of communications between the companies, will have positive effects on the long term for the country.

Especially for the country of this region, characterized by a weak economic structure in some cases, especially in these last three years where economic uncertainty and a series of exceptional events, like the COVID-19 pandemic outbreak and the conflict between Ukraine and Russia, caused a general slowdown of all the economies of the region, an increase in the FDI will generate positive a series of significant positive effects that will be fundamental to go through this situation.

Concluding with some areas and hypothesis to be further analyzed, it was not possible to assess the impact of GVC participation on the probability to introduce a non-product related innovation, especially for what concerns the retail sector. In this paper, as already written, due to limitation in the dataset it was not possible to investigate this analysis, but in the existing literature an analysis like this is missing with firm level data, so it would be interesting to see if the existing findings on this topic at industry level data will be confirmed or not.

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7- Dataset and Websites

- Britannica;

- Investopedia

- OECD;

- Pmi.it

- World Bank Enterprise Survey;

- World Trade Organization;

8. Appendix

In the table A1 hereunder it can be found the complete list of the all the indicators in the dataset with the original codification *Old Code*, the new codification *new name* assigned by the author to make the variable more understandable and, in the column *description*, what is the original definition of the variable according to the World Bank.

Old Code	New Name	Description
a0	Sector	Manufacturing
a1	Country	Country
a3	Pop	Size of locality
a4a	Industry_Sa	Industry- Sampling Sector
a4b	Industry_Sc	Industry- Screener Sector
a6a	Size_Sa	Sampling Size
a6b	Size_Sc	Screener Size
a7	firm+1	Establishment is part of a larger firm
b1	Legal_status	What is this firm 's current legal status?
B2a	Dom_own	Private domestic individuals, companies or organizations
b2b	For_own	Private foreign individuals, companies or organizations
b2c	Gov_own	Government or State
b2d	Oth_own	Other
b3	Lar_own_%	What percentage of this firm does the largest owner or owners own?
B4	Fem_own	Amongst the owners of the firm, are there any females?
B5	Est_year	In what year did this establishment begin operations?
B6	Emp_atstart	How many full-time employees did this establishment employ when it started operations? Please include all employees and managers.
B6a	Est_formally	Was this establishment formally registered when it began operations?

b6b	Reg_year	In what year was this establishment formally registered?
b8	Certification	Does this establishment have an internationally-recognized quality certification?
c22b	Website	At the present time, does this establishment have its own website?
d12a	Dom_input	Material inputs or supplies of domestic origin
d12b	For_input	Material inputs or supplies of foreign origin
d13	Dir_input	Were any of the material inputs or supplies purchased in fiscal year [insert last complete fiscal year], imported directly?
d1a1x	Main_prod	In fiscal year [insert last complete fiscal year], what was this establishment's main product, that is, the product that represented the largest proportion of annual sales?
d1a3	Main_prod_%	What percentage of total sales does the main product represent?
d2	Annual_sales	In fiscal year [insert last complete fiscal year], what were this establishment's total annual sales for all products and services?
d3a	%sales_nat	National sales
d3b	%sales_indexp	Indirect exports (sold domestically to third party that exports products)
d3c	%sales_direxp	Direct exports
d8	Exp_year	In which year did this establishment first export directly or indirectly?
e1	Main_market	In fiscal year [insert last complete fiscal year], which of the following was the main market in which this establishment sold its main product?
e6	For_tech	Does this establishment at present use technology licensed from a foreign-owned company, excluding office software?

h1	Innov1	During the last three years, has this establishment introduced new or significantly improved products or services? Please exclude the simple resale of new goods purchased from others and changes of a solely aesthetic nature.
j10	App_imp	Over the last two years, did this establishment submit an application to obtain an import license?
n2a	Lab_cpst	Total annual cost of labor including wages, salaries, bonuses, social security payments
n2b	elect_cost	Total annual costs of electricity
n2e	Mat_cost	Total annual cost of raw materials and intermediate goods used in production
n3	Rev_3yearsago	In fiscal year [insert three complete fiscal years ago], three fiscal years ago, what were total annual sales for this establishment?
_2013_2019_d2x	_2013_2019_Total_sales	In fiscal year [insert last complete fiscal year], what were this establishment's total annual sales for all products and services? (text)
_2013_2019_BMd1a	_2013_2019_Sales_outcome	Considering the next year, are this establishment's total sales expected to increase, decrease, or stay the same?
_2013_2019_BMd1b	_2013_2019_Sales_outcome_%	In percentage terms, what is the expected change in total sales?
_2013_2019_e2b	_2013_2019_Competitors	In fiscal year [Insert last complete fiscal year], for the main market in which this establishment sold its main product, how many competitors did this establishment's main product face?
_2013_2019_h2	_2013_2019_Newtomarket	Were any of the new or improved products or services also new for the establishment's main market?

_2013_2019_h5	_2013_2019_Establishment_new	During the last three years, has this establishment introduced any new or improved process? These include: methods of manufacturing products or offering services; logistics, delivery, or distribution methods for inputs, products, or services; or supporting activities for processes?
_2013_2019_BMh1	_2013_2019_Ext_know	Over the last three years, did this establishment spend on the acquisition of external knowledge? This includes the purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other businesses or organizations
_2013_2019_BMh2	_2013_2019_R&D_exp_3years	Over the last three years, did this establishment spend on research and development activities within the establishment?
_2013_2019_BMh3	_2013_2019_R&D_ext_3years	Over the last three years, did this establishment spend on research and development activities contracted with other companies?
_2013_2019_h9	_2013_2019_Exp_on_R&D	During last fiscal year, how much did this establishment spend on research and development activities, either in-house or contracted with other companies?
_2019_h8	_2019_R&D_exp	During last fiscal year, did this establishment spend on research and development activities, either in-house or contracted with other companies, excluding market research surveys?
_2019_n2p	_2019_cost_of_sales	Total cost of sales
_2019_n2e1	_2019_cost_of_raw	Total cost of raw materials and intermediate goods used in production in [Insert last complete fiscal year minus one]
_2013_ECAq15a	_2013_Gov_sales%	In fiscal year [insert last complete fiscal year], what percentage of your national sales were to government or government agencies, excluding state-owned enterprises?

_2013_h3	_2013_Proc_innov	During the last three years, has this establishment introduced any new or significantly improved methods for the production or supply of products or services?
_2013_h4	_2013_Org_innov	During the last three years, has this establishment introduced any new or significantly improved organizational or management practices or structures?
_2013_h6	_2013_R&D_exp	During the last three years, did this establishment spend on research and development activities, either in-house or contracted with other companies (outsourced)?
_2013_ECAh4	_2013_logistic_innov	During the last three years, has this establishment introduced any new or significantly improved logistical or business support processes?
_2013_ECAh8	_2013_Empl_innov	During the last three years, did this establishment give employees some time to develop or try out a new approach or new idea about products or services, business process, firm management, or marketing?
_2013_ECAo1a	_2013_Innov1_Number	How many new or significantly improved products or services did this establishment introduce in the market over the last three years?
_2013_ECAo2a	_2013_Innov_newtolocal	In the establishment's local market – main product or service sold mostly in same municipality where establishment is located
_2013_ECAo2b	_2013_Innov_newtocountry	In [INSERT COUNTRY] – main product or service sold mostly across the country where establishment is located
_2013_ECAo2c	_2013_Innov_newtoall	In the international market – main product or service sold mostly to nations outside country where establishment is located

_2013_ECAo3 a	_2013_Innov_newfe atures	New product/service has added new functions/characteristics to the existing product/service
_2013_ECAo3 e	_2013_Innov_new	New product/service is completely new to the establishment
_2013_ECAo3 f	_2013_Innov_newot her	Other (SPECIFY)
_2013_ECAo5	_2013_Innov_newde scr	Which of the following best describes the way in which the main new or significantly improved product or service was introduced or developed?
_2013_ECAo6	_2013_Innov_patent	Did the establishment have to purchase or license any inventions, patent or know-how in order to start offering this new or significantly improved product or service?
_2013_ECA_o 7a	_2013_Innov_proc_ meth	Methods of supplying products or services
_2013_ECAo7 b	_2013_Innov_log_m eth	Logistics, delivery or distribution methods for this establishment's inputs and products or services
_2013_ECAo7 c	_2013_Innov_anc_m ethod	Ancillary support services, such as purchasing, accounting, computing and maintenance
_2013_ECAo1 0a	_2013_Innov_tech_c han	Techniques
_2013_ECAo1 0b	_2013_Innov_mach_ chan	Machinery and equipment
_2013_ECAo1 0c	_2013_Innov_soft_c han	Software
_2013_ECAo1 0d	_2013_Innov_man_c han	Management
_2013_ECAo1 4a	_2013_Innov_org_k now	New knowledge management systems to better use or exchange information, knowledge and skills within the establishment

_2013_ECAo1 4b	_2013_Innov_org_s up	Introduction of management systems for general production or supply operations, such as supply chain management systems, lean production, business reengineering, quality management systems
_2013_ECAo1 4c	_2013_Innov_org_re sp	New methods for distributing responsibilities and decision making among employees
_2013_ECAo1 4d	_2013_Innov_org_st ru	A significant change to the management structure of the establishment, such as creating new divisions or departments, integrating different departments or activities
_2013_ECAo1 4e	_2013_Innov_org_c ollab	New types of collaborations with other businesses, research organizations or consumers
_2013_ECAo1 4f	_2013_Innov_org_o ut	Outsourcing or subcontracting of business activities in production, procurement, distribution, recruiting or ancillary services
_2013_ECAo1 5a	_2013_Innov_mark_ app	Significant changes in the product's appearance
_2013_ECAo1 5b	_2013_Innov_mark_ adv	Introduction of a new method of advertising or product promotion, such as use of a new media for advertising, a new brand image or logo, a new trademark
_2013_ECAo1 5c	_2013_Innov_mark_ chan	Introduction of a new method of product placement or sales channels, such as product licensing, franchising, direct selling, exclusive retailing, tailoring or customizing the presentation of the product to different types of customers
_2013_ECAo1 5d	_2013_Innov_mark_ pric	New pricing strategies to market the establishment's goods or services, excluding pricing methods used solely to differentiate prices by customer segments

_2013_ECAo17	_2013_Innov_R&D_exp	In fiscal year [INSERT last complete fiscal year], how much did this establishment spend on research and development activities performed within this establishment? Please include personnel cost, materials and purchase of fixed assets.
_2013_ECAo19	_2013_Innov_R&Dexp_ext	In fiscal year [INSERT last complete fiscal year], how much did this establishment spend on research and development activities contracted with other companies?
_2013_ECAo23a	_2013_Innov_pat	Has this establishment ever been granted a patent?
_2013_ECAo23b	_2013_Innov_pat_app	During the last three years, did this establishment apply for a patent or a trademark?

Table A1: Dataset Variable description, elaboration of the author from "*Enterprise Survey: Indicator Description*"