How Does Foreign Direct Investment Influence the Productivity of Domestic Firms? Analyzing the Role of Spillovers through Backward Linkages in Italy's Manufacturing Sector

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Abstract

Many countries aim to attract foreign direct investment by creating an attractive business climate through tax breaks and subsidies for multinational enterprises (MNEs). They justify their policies by mentioning the expected positive externalities generated by MNEs. Despite being hugely important to public policy, there is little evidence to support this claim. This study examines firm-level panel data from Italy in an effort to better understand the mechanisms through which potential spillovers occur. The empirical results provide evidence of the existence of spillovers through contracts between MNEs and their local suppliers in upstream sector, so called spillovers through backward linkages. The results also show spillovers occurring within the same industry. Furthermore, this study sheds light upon how spillovers depend on market concentration and in regions with a strong manufacturing industry. It shows that spillovers through backward linkages become weaker as the markets become more concentrated. For spillovers occurring in the same industry opposite effects are found, albeit with less economic relevance. The data also indicate that spillovers through backward linkages become stronger in regions with a strong manufacturing industry – especially Veneto and Emilio-Romagna. For spillovers occurring in the same industry, the effects that were found lack economic relevance.

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1. Introduction

Attracting multinational enterprises (MNEs) is a priority for many governments, as it is believed to bring new technologies, employment opportunities, and increased productivity to domestic firms. To create an attractive business climate, governments often provide subsidies and tax breaks to MNEs. To justify these policies, the positive externalities generated through foreign direct investment (FDI) in terms of productivity spillovers and the transfer of advanced production technology and managerial expertise to local firms are often mentioned. Investigating the impact of FDI on domestic productivity is crucial, as productivity is a key determinant of economic growth. Given the ongoing trends in globalization and the expanding role of MNEs in the global economy, understanding the relationship between FDI and domestic firm productivity becomes increasingly important.

Theoretical models argue that knowledge spillovers are positive production externalities reducing costs for all firms in the market. Spillovers allow firms that did not innovate to imitate the new goods or processes and compete in the market, obtaining costless advantages from competitors' R&D activities (Capuano & Grassi, 2019). MNEs are generally seen as the most productive firms because they can take advantage of economies of scale and must be more productive at all to overcome their large fixed costs of expanding abroad. For this reason, it can be explained that many politicians promote FDI-attracting policies, so that domestic firms can benefit from their presence through spillovers. However, evidence from the literature of the impact of FDI on domestic firms is somewhat mixed. Earlier mostly cross-sectional studies find positive effects, while some later firm-level panel data studies find less convincing evidence for the positive effects (see e.g., Bijsterbosch & Kolasa, 2010, Barry et al., 2001, Konings, 2001).

The number of empirical studies assessing intra-industry spillovers to local firms was fast growing and provided mixed evidence (see e.g., Aitken & Harrison, 1999; Kathuria, 2000; Sinani and Meyer, 2002). The various complex mechanisms through which productivity spillovers of FDI occur, however, remain relatively unexplored. Some of the productivity spillovers from FDI operate via linkages between MNEs and their local suppliers rather than through spillovers from local competitors in the same industry. These spillovers are often referred to as spillovers through backward linkages. Blomström et al. (2000) point out, however, that there are hardly any empirical studies analyzing the role of those linkages explicitly. Several papers have been written in recent years regarding these linkages (e.g., Javorcik, 2004; Marcin, 2008; Arnold et al., 2006; Du et al., 2012; Le & Pomfret, 2011). These papers have conducted careful analyses, but they also had certain data limitations and utilized models that can now be refined. Therefore, it is important to ascertain the impact of FDI and the mechanisms through which the effects occur by the utilization of recent, unexplored data and by employing estimation techniques that address potential sources of bias that are still present in current studies. Moreover, Görg and Greenaway (2001) argued that many researchers found limited evidence for positive spillovers because most of the studies have been carried out at the aggregate or sectoral level, which is not an appropriate way of looking for spillovers. They argue that there are several other reasons for failing to find evidence of spillovers. One reason is the poor quality of data and limited samples of firms studied. A second reason might be in the short panels of firms analyzed and/or hypothesizing a linear relationship between spillovers and local firms' productivity growth. My balanced firm-level dataset comprises 41,958 firms over a time span of 7 years. The abundance of these observations enables accurate determination of the effects. The main research question this paper answers is:

"*What is the impact of spillovers from foreign direct investment (FDI) on the productivity of domestic firms and how does this vary across markets and regions?"*

The analysis is based on data from Orbis which provides very extensive information. The data constitute a strongly balanced panel covering the period 2012-2018. This study focuses on Italy, which is characterized by a strong manufacturing sector. Italy is an attractive destination for foreign investment with one of the largest markets in the EU, making it a likely place for productivity spillovers to occur.

The results can be summarized as follows.[1] The empirical results are consistent with the existence of positive spillovers from FDI taking place through backward linkages and though horizontal channels. In other words, firms' productivity is positively correlated with the extent of potential contracts with multinational customers and with the presence of MNEs in the same industry. The results are economically meaningful. An increase of one percent in the foreign presence in the sourcing sectors is associated with a 0.15 percent increase in productivity of domestic firms. An increase of one percent in the foreign presence in the same industry is associated with a 0.20 percent increase in productivity of domestic firms. This study also examined how benefits from spillovers depend on levels of market concentration. The results also show that as the market becomes one percent less competitive, benefits from spillovers though backward linkages decrease with 0.28 percent. A reverse effect was found for spillovers though horizontal channels as the spillovers increase with 0.09 percent as the market becomes less competitive. Even though this latter effect is highly significant, the economic relevance is questionable. Furthermore, the effects across regions are examined. The results indicate that benefits from spillovers through backward linkages are 0.17 percent higher for firms operating in regions with a strong manufacturing industry. The positive effects are mainly due to two regions in which the strongest

[1] In this paper two main models are used. A standard fixed effects model and the Levinsoh-Petrin (2003) model which corrects for endogeneity from input selection by firms. In this section, only the results of the latter model are summarized as this model is preferred over the fixed effects model.

effects are found: Veneto and Emilio-Romagna. For spillovers through horizontal channels a reverse effect is found. Domestic firms operating in a region with a strong manufacturing industry experiences 0.014 percent less productivity spillovers through horizontal channels, compared to firms not operating in a strong region. This latter coefficient is highly significant, but lacks economic relevance.

The contribution to existing literature is twofold. It adds to the understanding of externalities generated by FDI, which is highly important for policy considerations. This study emphasizes the importance for policymakers to formulate policies on a regional basis, taking into account the specific market context. The potential positive effects are contingent upon the level of competition within a region/industry and the degree of industrial activity within a region. Second, this paper improves existing literature by applying the method suggested by Levinsohn and Petrin (2003) to account for endogeneity from input selection by firms. Earlier work that had not taken into account this econometric concern, may have produced biased results. Moreover, this paper uses a broad and extensive dataset which accounts for trade across industries over time which has, to my knowledge, not been done before when studying backward linkages.

This study is structured as follows. In the next section I will briefly discuss FDI spillovers and their determinants. It is followed by a description of FDI inflows in Italy. Then I will discuss the data and the empirical model which is followed by the estimation results and the closing section.

2. FDI Spillovers and Their Determinants

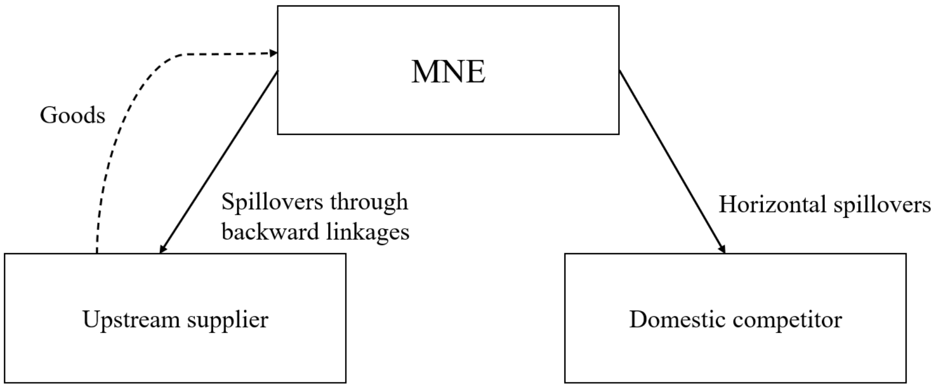
To answer the research question, it is important to know which types of spillovers though FDI exist and how they influence productivity of domestic firms. In general, four main channels through which FDI spillovers occur are discussed in the literature (Görg & Greenaway, 2004). First, firms can acquire technology by imitating MNEs. They can learn from their production processes and if the MNE and domestic firms are working closely together, the MNE might also demonstrate how to produce a certain good efficiently and how to set up a network of distributors from which the domestic firm can learn. Second, domestic firms may hire workers that were previously employed by the MNE. Their knowledge can be implemented in the processes of the domestic firm and boost productivity. Third, MNEs might pave the way for domestic firms to become exporters. Domestic firms can benefit from the infrastructure and networks created by the MNEs. Fourth, the entry of MNEs in the domestic market boosts the competition and forces the domestic firms to become more productive in order to survive.

Spillovers can occur among firms that are competitors or operate at the same level of production. These spillovers are often referred to as *horizontal spillovers* MNEs have incentives to prevent these spillovers to occur, since it could enhance the productivity of their competitors. There are several ways for MNEs to prevent spilling over knowledge to their competitors. By securing legal protection through intellectual property rights, MNEs can limit replication of products by domestic competitors. It reduces knowledge spillovers, making it more difficult for firms to enjoy the advantages of standing on the shoulders of previous researchers from MNEs (Park 2001). Moreover, MNEs can impose stringent confidentiality agreements in their contracts with employees and their suppliers. Another way is by cooperating with domestic firms forming strategic alliances. Firms can carefully select partners that allow them to hold onto (i.e., to protect) their own valuable resources. (Li et al., 2008). Through careful partner selection, MNEs could control the flow of knowledge and only share what is necessary while keeping essential information safe.

In contrast, spillovers can also occur across industries between local suppliers and MNEs. MNEs may be less concerned about spillovers to their suppliers since they are not direct competitors, and the MNE itself may benefit from a more productive supplier. These spillovers are often referred to as spillovers through *backward linkages*. Figure 1 shows a schematic overview of the described spillovers:

Figure 1

Schematic overview of horizontal and vertical spillovers



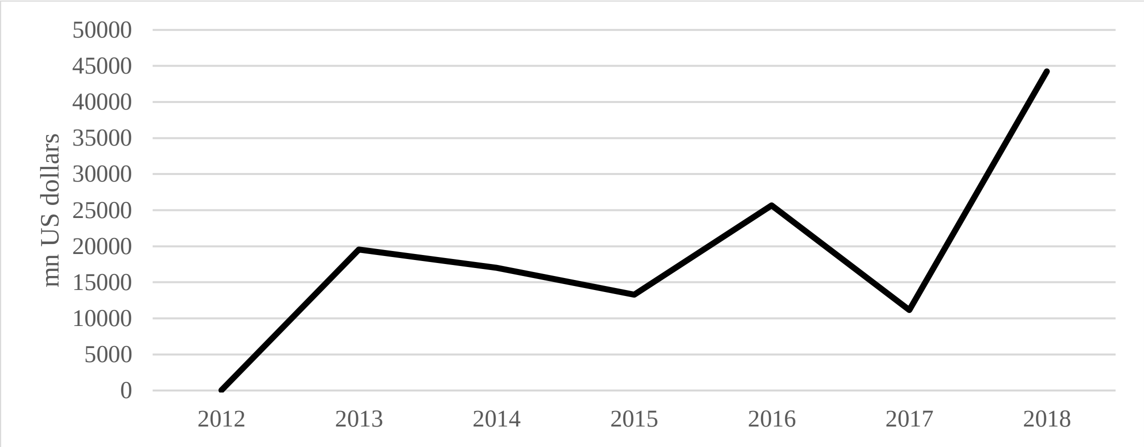
3. Empirical Context: FDI in Italy

Italy has a strong manufacturing industry and is known for its expertise in luxury goods, fashion, leather products and furniture. Furthermore, Italy occupies a significant position within the automotive industry. In Italy, the value added by the manufacturing sector as a percentage of GDP is on average 16.27, based on data from 1990-2021.[2] For comparison, the world average in 2021 is 12.32 percent. There is also a relatively high level of FDI in this industry: in terms of sectorial distribution of FDI, the percentage of FDI stock in the manufacturing sector is 25.32% in 2018.[3]

[2] Source: The Global Economy (2023)
[3] OECD (2023)

Figure 2

Net FDI inflows into Italy



Source: The World Bank (n.d.)

During the investigated period in this paper, a significant increase in net FDI inflows can be observed. In 2012, the balance was nearly zero, whereas in 2018, it reached nearly 45 billion USD. This upward trend may serve as a harbinger of the future where MNEs could potentially play an even more significant role in the economy. Italy's relatively affluent domestic market, access to the European Common Market, proximity to emerging economies in North Africa and the Middle East, strong manufacturing industry and skilled workforce, remain attractive to many investors. This makes Italy an interesting country to investigate how spillovers from FDI influence firm productivity.

Table 1
FDI inflows into South-European EU-members

	NET FDI inflow (millions US dollars)							FDI inflows 2018		FDI inflows 2012-2018	
Country Name	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**As % of GDP**	**Per capita**	**In million US dollars**	**Per capita (US dollars)**
Spain	20,848	47,373	32,943	23,037	44,253	31,565	58,626	4,1%	1253	258,647	5,550
Cyprus	69,973	25,966	51,739	28,961	8,508	14,407	-1,110	-4,3%	-911	198,443	167,099
Italy	**35**	**19,531**	**17,033**	**13,303**	**25,657**	**11,138**	**44,250**	**2,1%**	**732**	**130,947**	**2,168**
Portugal	21,396	15,745	12,046	1,270	7355	10,684	7,846	3,2%	763	76,342	7,357
Malta	3,324	510	156	3,641	2,776	3,890	4,465	29,2%	9,213	18,761	41,910
Greece	1,662	2,945	2,697	1,269	2,699	3,439	4,025	1,9%	375	18,737	1,726
Croatia	1,465	966	3,180	35	424	451	1,315	2,1%	322	7,836	1,869
Slovenia	34	104	1,019	1,730	1,446	1,196	1,538	2,8%	742	7,068	3,424

Source: The World Bank (n.d.)

As seen from Table 1, Italy ranks third among South-European EU countries in terms of cumulative FDI inflows. Italy ranks 6th in terms of FDI per capita. Cyprus and Malta score significantly higher in this regard, which is logical considering these countries are perceived as tax havens.

In addition to Italy being an intriguing country to study in this domain, there is also a wealth of data available for this country. As part of the EU, companies are obliged to adhere to specific reporting guidelines for data. This availability of rich data allows for a detailed analysis of the effects of FDI on firm productivity.

3. Insights from the Literature

Much has been written in the literature about the positive effects of attracting FDI, but not all findings are consistent and there are doubts whether these spillovers actually exist. As Kugler (2006) remarked: “econometric evidence of positive spillovers through FDI is rather scarce”. Since MNEs locate their subsidiaries to avoid rent erosion due to local competition, the MNEs deployment of subsidiaries via FDI is designed to minimize risk of propagation of specific knowledge to potential competitors. Determining and disentangling the precise effects of FDI on domestic productivity is often very difficult due to data limitations and complexity of the mechanisms trough which effects occur. The broad literature on this topic has produced mixed results over the past decades, with some studies demonstrating a positive and significant association between FDI and productivity while others show little to no effects or even negative impacts (see Marcin, 2008; Bitzer and Görg, 2005; Bijsterbosch & Kolasa, 2010; Javorcik, 2004; Konings, 2001; Barry et al., 2001). Broadly speaking, the empirical research on this topic can be classified into three types of analyses: case studies, sectorial studies and firm-level (panel) data studies.

3.1 Case Studies

A number of case studies in which researchers studied large-scale FDI-projects produced mixed evidence. Hanson (2001) studied three cases of FDI-attracting policies and examines whether domestic firms benefit from this through productivity spillovers through FDI. He appointed the most common policies like partial or complete exemption from corporate taxes and import duties. He examined FDI-attracting policy cases of Ford and General Motors in Brazil and Intel in Costa Rica. He found weak evidence that FDI generates positive spillovers for host economies. Moran (2001) examined numerous FDI projects, including those in the computer/electronics sector and the automotive industry. Additionally, he investigated the effects of FDI spillovers through backward linkages. His research generally points to the existence of positive spillovers in the domestic economy. While case studies can be useful for gaining a deep understanding a specific context, results are hard to extrapolate, and no conclusions can be drawn in general.

3.2 Sectoral Studies

Industry-level studies allow for meta-analyses and to draw conclusions in a broader context than case studies. Most industry-level studies show positive and significant effects of FDI on productivity. Bijsterbosch and Kolasa (2010), for example, found a positive correlation between the level of FDI and sector productivity in which the magnitude of the effect depends on the absorptive capacity of the industries. Moreover, Bitzer and Görg (2005) used country-level data from 17 OECD countries and found productivity benefits from FDI inflows. It is possible, however, that these positive associations are caused by the fact that MNEs are more likely to settle in countries and industries characterized by higher productivity rather than their knowledge spilling over to domestic firms. In these industries, MNEs could have access to a high-quality labor pool and can benefit from other advantages such as good infrastructure. It may also be the case that more productive MNEs push less productive domestic firms out of the market increasing their own market share. This also leads to higher productivity of a given sector but is not sourced through positive externalities or FDI. These econometric concerns make it difficult to determine the direction of causality.

3.3 Firm-Level Analyses

Firm-level studies evolved which examine whether productivity of domestic firms is correlated with FDI inflow in their industry and region. This allows for more precise estimates since panel data can control for time-invariant firm, sector and region-specific effects whereas cross-sectional studies may overestimate the spillover effects from FDI. This is because part of the positive effect that is found is not due to the FDI in that area but rather due to the sector or region itself, leading estimates to be upward biased. Konings (2001) examined the effects of FDI on firm productivity using a panel dataset including Bulgaria, Romania and Poland. He found limited evidence of productivity spillovers to domestic firms. Only positive effects were found with regard to an accelerated diffusion of new technology. Increased competition led to a reduction in the production of domestic firms which vanished positive technology effects from FDI. Moreover, Barry et al. (2001) found that foreign presence in a sector had negative effects on productivity of domestic exporting firms but no effect on domestic non-exporters in the same sector, using firm-level panel data from Ireland.

3.4 Hypothesized Links Between FDI and Domestic Firm Productivity

Even though some empirical studies found positive effects, the overall evidence is far from convincing. Javorcik (2004) mentioned that researchers might have been looking for FDI spillovers in the wrong place. She studied the effects of backward linkages on productivity of domestic firms in Lithuania and found positive and significant results. She argues that MNEs have an inventive to prevent knowledge leakages to their local competitors that would enhance their performance. On the other hand, MNEs could potentially benefit from spilling over knowledge to their local suppliers as they would get more productive and sell products to the MNE at lower costs and/or at higher quality. Hence, domestic firms could benefit from the presence of foreign MNEs in downstream sectors (in which the MNE is a customer of the domestic firm). As a fundament of this research and in line with the work of Javorcik (2004), the first hypothesis is as follows:

H1: *Domestic firm-productivity benefits from productivity spillovers of FDI through backward linkages.*

Generally, productivity spillovers are said to take place when the entry or presence of MNEs lead to productivity or efficiency benefits in the host country’s local firms, and the MNEs are not able to internalize the full value of these benefits (Blomström & Kokko, 2000). The simplest example of such a spillover is the case where a local firm improves its own productivity by copying technology used by the MNE. The limited support of positive spillovers, however, indicates that MNEs are indeed extremely effective when it comes to protecting their assets (Görg & Greenaway, 2001). While local competitors of the MNEs can learn from their presence and achieve higher productivity as a result, these horizontal spillovers may be limited as MNEs strive to minimize such spillover effects to enhance their own competitive position.

Spillovers from FDI may be more likely to be directed to local suppliers than to local competitors, as a strategy to build efficient supply chains for MNEs (Blalock & Gertler, 2008). The primary motivation for multinationals to transfer technology to their suppliers is to enable higher quality inputs at lower prices. Moreover, the entry of MNEs in the domestic market tend to raise the demand for local intermediate inputs and services, inducing a productivity increase in upstream sectors and, therefore, mainly at an inter-industry level (Reganati & Sica, 2007). Some authors have argued that positive vertical externalities are more probable than horizontal ones, because the possibly negative effect associated with the competition and labor mobility channels is more likely at the intra-sectoral level. Moreover, the efficiency for gains for MNEs are easier to obtain through backward linkages, due to greater incentive to cooperate (Kugler 2001). Based on these prior findings, the second hypothesis is as follows:

H2: *Productivity spillovers from FDI through backward linkages outweigh benefits from horizontal spillovers.*

Market characteristics may also influence to what extent spillovers occur. In markets characterized by high concentration, a small number of firms hold a relatively large share of the total market, resulting in less competition. In contrast, markets with low concentration exhibit a larger number of firms competing for market share, leading to higher levels of competition. For firms operating in the same market as the MNE, the effect of competition on FDI spillovers may be ambiguous. On one hand, competitive pressure often serves as a driving force for domestic firms to acquire knowledge from foreign MNEs. Heightened competition imposes a sense of urgency on domestic firms, compelling them to upgrade their technologies and adopt advanced management practices to withstand competitive pressures (Blomström & Kokko, 1998). On the other hand, in highly competitive markets, MNEs may allocate greater resources towards safeguarding their intellectual property and innovations, thereby diminishing the probability of horizontal spillovers. This can be attributed to the fact that the success of firms in competitive markets relies on the quality of knowledge (Rahimli, 2012). Hence, MNEs may have greater incentives to not spillover their knowledge to local competitors as the market becomes more competitive.

In contrast, in terms of vertical linkages, domestic firms operating in a highly competitive environment are more effective and therefore better prepared to cooperate with foreign clients, which are usually more demanding and high-quality oriented (Marcin, 2008). As mentioned, competition induces domestic firms to innovate and be more productive. This is likely to reduce the technology gap between domestic suppliers and MNEs, thus increasing opportunities for potential spillovers (Lesher & Miroudot, 2008). As a result, local firms are able to enhance their collaboration with MNEs and improve their supplying capabilities, thereby increasing the possibilities of spillovers through backward linkages. Based on preceding findings, I propose the third hypothesis:

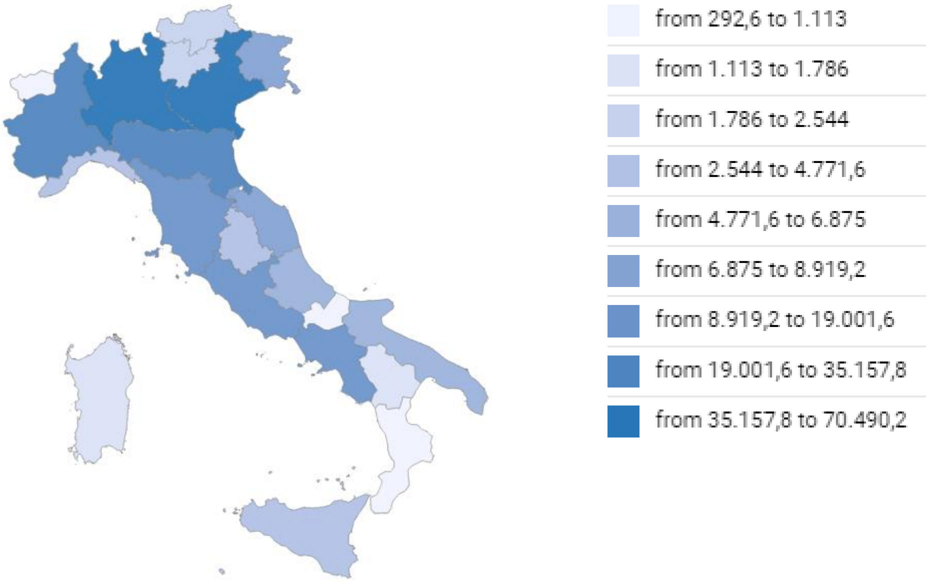
H3: *The extent of productivity benefits derived from FDI spillovers through backward linkages will be higher for firms operating in markets with lower levels of market concentration.*

In Italy, several regions are known for having strong manufacturing sectors. While the strength of manufacturing sectors can vary over time, historically, some regions have been recognized for their industrial prowess. The regions in the North-East are the most economically dynamic and those with the highest rate of GDP growth (+ 4.9 percent) in the first half of the 1990s. The performance of the North-East can be explained by a catching-up of regional economic systems, such as Veneto and Emilia-Romagna (Cantwell & Iammarino, et al., 1998). Inward FDI is concentrated in the four leading regions – namely Lombardy, Piemonte, Veneto and Emilia-Romagna. Those four regions accounted 67 percent of the total foreign plants in Italy in 1995. The success of these four 'champions' may be attributed to different regional styles showing their own specific characteristics (Iammarino & Santangelo, 2000). Lombardy is one of Italy's most industrially developed regions. It has a diverse manufacturing sector, including machinery, automotive, fashion and chemical industries. Emilia-Romagna is known for its strong automotive industry, machinery, ceramics and food processing. Piemonte hosts major manufacturing facilities for automotive giants like Stellantis and various aerospace companies. By contrast, the center and south are less developed. Unemployment in some southern areas is three times that of the north and per capita incomes are substantially lower.[4] The concentration of economic activity can be visualized in Figure 3:

[4] Fastener Eurasia (2022)

Figure 3

Value added by region in the Italian manufacturing industry



Source: Istat (n.d.). The numbers in the legend are denoted in millions of euros (at current valuation). This figure shows information on 2017 which is the most recent year for which this data was available.

In regions characterized by a strong manufacturing industry, FDI can potentially have a more pronounced impact on productivity due to complementarities between foreign investors and the existing industrial base. In these regions, the utilized technology and production processes are likely to be more advanced compared to other regions. The presence of established firms and industrial clusters can facilitate knowledge spillovers and technological diffusion and therefore enhance the productivity spillovers from FDI. Particularly, spillovers through backward linkages are more likely to occur in these regions as MNEs can strategically utilize this approach to establish efficient supply chains (Blalock & Gertler, 2008). On one hand, the MNE can collaborate with an upstream supplier, located in a strong manufacturing region, while on the other hand, the upstream domestic supplier can experience an increase in productivity by learning and trading with MNEs.

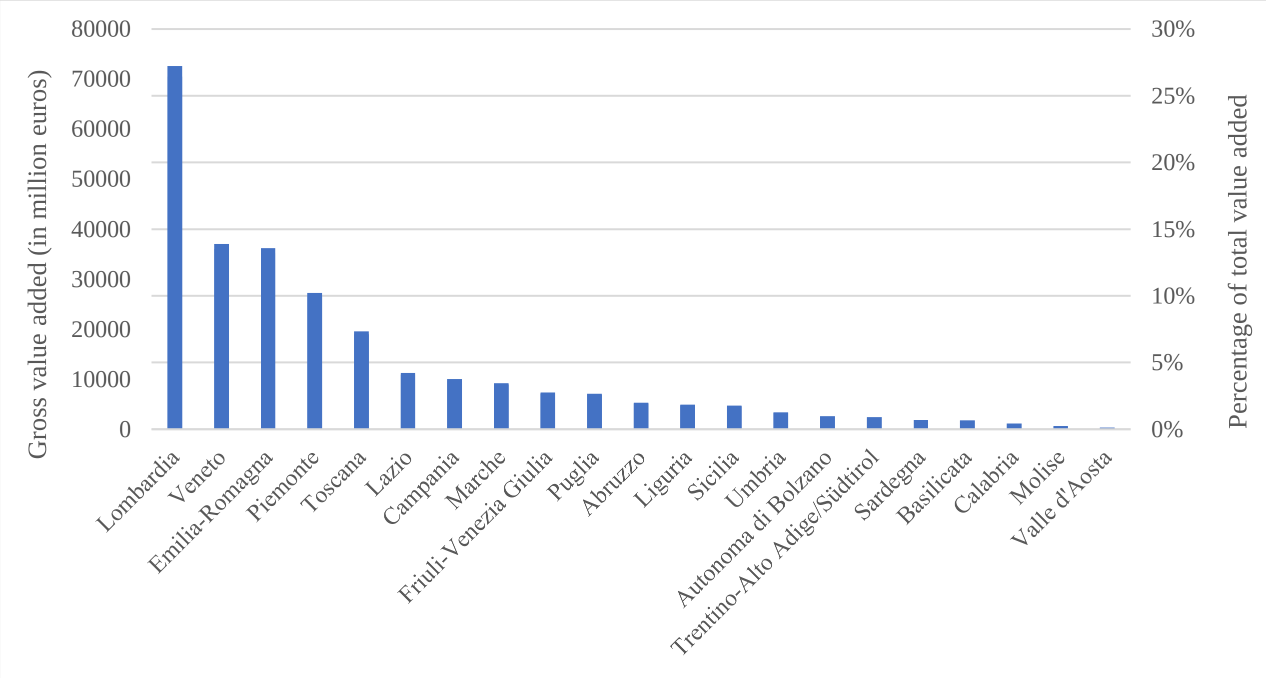
FDI spillovers have a circumscribed geographical dimension or, at least, that they decrease with physical distance (Audretrsch & Feldman, 1996; Sjöholm, 1999; Ponomareva, 2000). Firms in these 'dense' regions are therefore more likely to be in touch with MNEs and potentially experience more spillovers from FDI. Based on these findings, the fourth hypothesis is as follows;

H4: *The extent of productivity benefits derived from FDI spillovers will be higher for firms operating in regions with a strong manufacturing industry.*

As shown in Figure 4, there are a few regions that contribute significantly to the total gross value added of the manufacturing industry in Italy. Lombardy stands out as the largest region in this regard, accounting for 27% of the total gross value added. In the analysis, regions with a share exceeding 10% are characterized as having a strong manufacturing sector. This pertains to Lombardy, Veneto, Emilia-Romagna and Piemonte.

Figure 4

Gross value added per region in the Italian manufacturing industry



Source: Istat (n.d.).

4. Data and Methodology

4.1 Data

The data used in this study come from Orbis. The Orbis database, from Bureau van Dijk is the largest cross-country firm-level database which includes information on firms' financial statements, firm activities, balance sheets, income statements, and detailed information on firms' locations, industry, and domestic and foreign owners and subsidiaries. It collects business information about private companies and gives access to information on more than 400 million companies worldwide.[5] This paper will focus on firms in the manufacturing sector (NACE sectors 10-33) in Italy. By restricting the data to manufacturing firms only, the unit of variation is kept as small as possible. The data constitute a strongly

[5] Bureau van Dijk (n.d.)

balanced panel covering the period 2012-2018. The number of firms per year is 41,958 which leads to 293,706 observations in total. Due to the substantial number of observations and the extensive firm data provided by Orbis, the effects of spillovers from FDI can be accurately quantified and disentangled.

In addition to financial statements, the database contains information on the nationality of the firm, its shareholder(s), and the percentage of total ownership of the shareholder(s). This allows calculating the percentage of foreign equity within a firm. Furthermore, the dataset also includes, among other things, information on sales, the number of employees and materials used in the production process. In this study, the focus is on manufacturing firms only, which is divided into 17 sub-categories. The European NACE Rev.2 code has been used to classify firms into a certain class of economic activity. The NACE Rev.2 code that is assigned to a firm is that of the main activity, i.e., the activity that contributes most to the total added value of that firm. Moreover, the dataset provides information on which NUTS2-region the firm is active in. The sectorial distribution of firms in the last year of the sample are presented in Table 2:

Table 2

Distribution of firms by industry in 2018

NACE code	Industry description	Domestically owned firms	Firms with foreign capital	All firms	% with foreign capital*	Horizontal	Backward	HHI
10,11,12	Food products, beverages and tobacco	3,536	77	3613	2.1%	10.3%	3.0%	0.016
13,14,15	Textiles, textile products, leather and footwear	4,542	85	4627	1.8%	6.0%	3.0%	0.012
16	Wood and products of wood and cork	1,403	7	1410	0.5%	1.3%	9.0%	0.038
17,18	Paper products and printing	2,157	21	2178	1.0%	7.1%	7.8%	0.030
19	Coke and refined petroleum products	84	9	93	9.8%	66.7%	18.1%	0.472
20	Chemical and chemical products	1,196	97	1293	7.5%	34.3%	14.1%	0.029
21	Pharmaceuticals, medicinal chemical and botanical products	125	37	162	23.0%	41.6%	11.9%	0.193
22	Rubber and plastics products	2,243	83	2326	3.6%	15.4%	14.9%	0.020
23	Other non-metallic mineral products	2,062	32	2094	1.5%	8.0%	12.7%	0.024
24	Basic metals	754	30	784	3.8%	12.4%	24.7%	0.078
25	Fabricated metal products	9,373	117	9490	1.2%	4.7%	17.5%	0.006
26	Computer, electronic and optical equipment	1,155	67	1222	5.5%	41.3%	16.9%	0.096
27	Electrical equipment	1,554	65	1619	4.0%	29.0%	11.1%	0.055
28	Machinery and equipment, nec	4,904	242	5146	4.7%	14.8%	10.9%	0.034
29	Motor vehicles, trailers and semi-trailers	498	45	543	8.3%	28.7%	9.6%	0.064
30	Other transport equipment	378	16	394	4.1%	24.8%	6.9%	0.212
31,32,33	Manufacturing nec; repair and installation of machinery and equipment	4,854	110	4964	2.2%	12.0%	12.7%	0.018
	Total	40,818	1,140	41,958	2.8%			

Notes. Foreign share at least 10% of total capital. The HHI denotes an industry average since the HHI is calculated by industry *and* NUTS1 region.

As can be seen from this table, there are variations in the number of observations from the different sectors. The sector *Fabricated metal products* exhibits the highest number of firms by a significant margin. This sector is the largest among all manufacturing sectors in the EU, with 388 thousand firms in 2010. Moreover, this sector is labor intensive, with occupying 11.9% of the total workforce of the manufacturing sector.[6] The abundance of organizations in this sector, coupled with its labor-intensiveness, explains the low Herfindahl-Hirschman Index (HHI) found for this sector. In

[6] Eurostat (2016)

contrast, some sectors, such as *Coke and refined petroleum products*, exhibit high levels of market concentration. This can be explained by the capital-intensive nature of the sector, where large companies can benefit from economies of scale. It is possible that the spillovers from backward linkages may be lower for firms supplying this sector due to the lower levels of competition.

Some industries, such as *Basic metals* and *Computer, electronic and optical equipment*, are characterized by a high value for the backward variable. This implies that these sectors primarily supply other sectors with a high foreign presence (e.g., a high value for the horizontal variable). According to the IOTs from the OECD database, the *Basic metals* sector supplies the largest proportion of output (39% in 2018) to the *Computer, electronic and optical equipment* sector, which has a relatively high value for the horizontal variable at 41.3%.

The *Pharmaceuticals, medicinal chemical and botanical products* sector has the highest percentage of firms with foreign capital. The pharmaceutical sector requires substantial investments in research and development to develop new drugs, therapies and medical technologies. Therefore, it is plausible that this market is characterized by a relatively high foreign presence, as large MNEs possess the financial resources to do these investments. On the other hand, the *Wood and products of wood and cork* sector is characterized by a low foreign presence. The companies operating in this sector are predominantly domestic and rely on local resources for their products.

Table 3

Summary statistics

Variable	No. of obs	Mean	Std. Dev.	Min	Max
Real output (thousand US dollars)	293,706	11,001	80,075	0.00109	8,131,544
No. of employes	293,706	27	141	1	17,330
Capital (thousand US dollars)	293,706	3,209	37,999	0.00544	5,570,243
Material inputs (thousand US dollars)	293,706	5,037	43,852	0.00883	5,072,852
Fixed assets (thousand US dollars)	293,706	3,236	38,229	0.00527	5,453,267
Foreign capital share	293,706	2.2%	14.0%	0,0%	100%
Horizontal	293,706	11.7%	9.8%	0.9%	70.3%
Backward	293,706	10.6%	5.3%	2.4%	24.7%
HHI	293,706	0.029	0.054	0.003	0.861

As shown in Table 3, the dataset exhibits a range of companies, from small local enterprises with limited output, employees, and material resources, to enormous MNEs with substantial resources.

The markets in which these companies operate vary from highly concentrated to highly competitive. Given that the dataset encompasses information from all types of companies in the manufacturing sector, a careful analysis can be conducted.

4.2 Methodology

4.2.1 Econometric model

To examine the correlation between firm productivity and foreign presence in the same industry, the same approach taken by the earlier literature is followed (i.e., Javorcik 2004; Marcin 2008; Arnold et al., 2006; Du et al., 2012; Le & Pomfret, 2011):

$$\ln Y_{ijrt} = \beta_0 + \beta_1 lnK_{ijrt} + \beta_2 lnL_{ijrt} + \beta_3 lnM_{ijrt}\ \beta_4 FS_{ijrt} + \beta_5 HHI_{jrt} + \beta_6 Horizontal_{jt} + \beta_7 Backward_{jt} + \alpha_t + \alpha_r + \alpha_j + \varepsilon_{ijrt} \quad (1)$$

Y_{ijrt} stands for the real output of firm i operating in sector j in region r at time t. This is calculated by adjusting sales for changes in inventories of finished goods deflating the value by the Producer Price Index (PPI) for the corresponding NACE sector.[7] K_{ijrt} , capital, is defined as the value of fixed assets of firm i in region r, deflated by the PPI of sector r at time t. M_{ijrt} , material inputs, represents the costs of materials used in the production of goods in firm i in sector j in region r at time t, deflated by the PPI of sector r at time t. It includes the costs of all inputs that are directly used in the production process, such as raw materials, packaging materials, fuels electricity and other supplies. L_{ijrt}, labor, is defined as the total number of employees of firm i in sector j in region r at time t.[8] FS_{ijrt} indicates the share of foreign capital in a firm. HHI_{jrt} stands for the Herfindahl-Hirschman Index by industry, region and year.[9] The HHI is a common measure of market concentration and is used to determine market competitiveness. The HHI is calculated as the sum of the squared market shares of all firms operating in a given market. In this setting, the market share MS_{ijrt} of firm i is its share of real output in sector j and region r. This index ranges from 0 to 1 where larger numbers indicate more concentrated markets.

$$HHI_{jrt} = \sum_{i-1}^{n} MS_{ijrt}^2 \quad (2)$$

[7] The PPI per NACE sector per year is obtained via the Eurostat (n.d.) database.

[8] Ideally, I would have liked information on hours worked but, unfortunately this was not available in the Orbis database. Neither could I differentiate between high and low skilled workers. Hence, the results should be interpreted with this caveat in mind.

[9] In calculating the HHI, the NUTS1 region was employed due to insufficient observations resulting from the grouping by industry, NUTS2 region, and year. By aggregating at the NUTS1 level, the sample size increases, ensuring a more representative and stable estimation of the HHI.

Orbis does not provide information of all firms in the market. Therefore, one could argue that the calculated HHI does not reflect the true HHI. However, this limitation is not expected to pose a significant problem considering the method that is used to calculate the HHI. Orbis primarily provides data from large firms, thus the firms that are missing in my dataset are likely to be the smaller firms. The market shares of larger firms have much greater influence on the HHI due to the squaring of market shares. For this reason, the calculated HHI is still expected to provide a reliable indication of the competitiveness of Italy's manufacturing sectors.

$Horizontal_{jt}$ captures the extent to which foreign firms are present in sector j at time t. It is defined as foreign equity participation averaged over all firms in the sector, weighed by each firm's share of output in that sector.

$$Horizontal_{jt} = \frac{\sum_{i\ for\ all\ i \in j} FS_{ijrt} * Y_{ijrt}}{\sum_{i\ for\ all\ i \in j} Y_{ijrt}} \qquad (3)$$

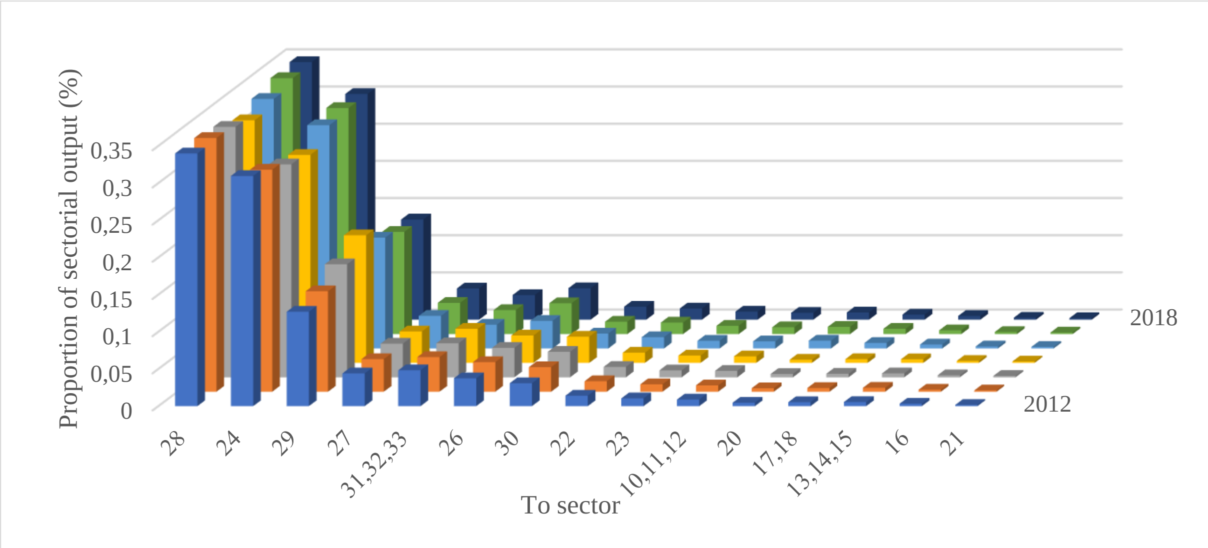
The variable *Backward* is a proxy for the foreign presence in the industries that are being supplied by the sector to which the firm belongs. Consider an economy with three sectors: j, k and m. Sector j supplies 50% of its output to both sector k and m. The foreign presence in sector k and m is 50% and 25% respectively. The potential contracts between domestic suppliers and their multinational customers is then 0,5*0,5+0,5*0,25 = 38%. The backward variable is defined in the following way:

$$Backward_{jt} = \sum_{k\ if\ k \neq j} \alpha_{jkt} Horizontal_{kt} \qquad (4)$$

α_{jkt} is the proportion of the output of sector j supplied to sector k in year t. This information is taken from the input-output tables (OITs) from the OECD (2021) database. This database describes the production and purchase relationship between the different NACE sectors within an economy. α_{jkt} is calculated by dividing the output supplied from sector j to k by the total output of sector j in year t. The OECD database provides yearly OITs, allowing to calculate α for every sector and for every year. This is a strong addition to existing literature (i.e. Javorcik 2004; Barrios et al. 2011; Marcin 2008; Le & Pomfret 2011) since previous papers only had access to the OIT of one year and assumed the trade between industries to be constant over time. OITs tend to be available only for long time intervals, making it difficult to account for changes in inter-industry over time in yearly panel datasets. Even though it is not expected that trade across industries changes rigorously, there can still be seen some changes over time. For example, Figures 5 and 6 show the trends in inter-industry trade over time for the two sectors which appear the most in my dataset:

Figure 5

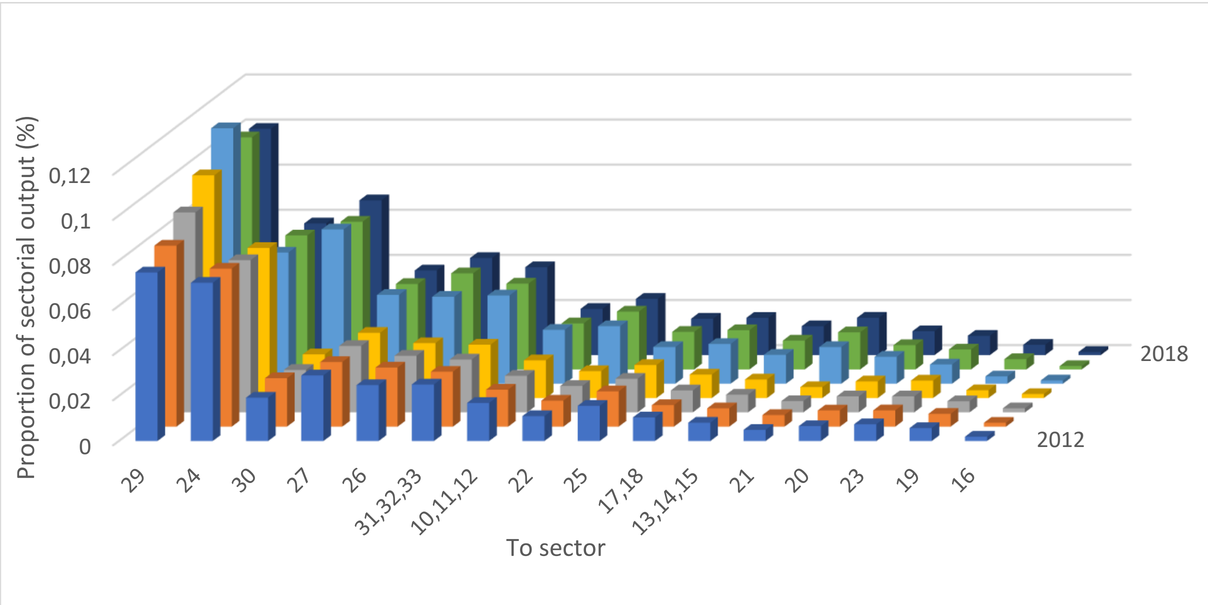
Proportion of output from sector 'Fabricated metal products' supplied to other sectors



Notes. Supplied sectors are sorted from highest average proportion (left) to lowest average (right). See Table 2 in section 4.2 for the industry descriptions.

Figure 6

Proportion of output from sector 'Machinery and equipment, nec' supplied to other sectors



Notes. Supplied sectors are sorted from highest average proportion (left) to lowest average (right). See Table 2 in section 4.2 for the industry descriptions.

Increases can be seen in e.g. the proportion of output supplied by the *Machinery and equipment, nec* sector to the *Motor vehicles, trailers and semi-trailers* and *Other transport equipment* sectors. This may be due to the development and adoption of environmentally friendly transportation solutions. Italy has a large automotive industry and may therefore especially be exposed to this increase. Companies within the *Machinery and equipment, nec* sector that specialized in producing environmentally equipment, such as EV components, may have experienced an increase in demand from the automotive sector. According to data released by the National Union of Foreign Vehicles Representatives, in 2017 the registrations of EVs in Italy increased by 38.6 compared to 2016.[10] The automotive industry as a whole experienced a significant increase in production. In the period 2012-2018, the annually produced cars in Italy grew by 70%.[11] These examples highlight the importance of accounting for changes in market dynamics. Summary statistics are presented in the previously reported Table 2 and Table 3.

4.2.2 Omission of unobserved variables

The first concern is the omission of unobserved variables. There may be unknown time, region and sector related factors that influence both firm productivity and foreign presence and thus bias the results when not controlled for. For example, Wan and Zhang (2018) found positive and significant effects of infrastructure quality on firm productivity. Firm productivity is also positively influenced by overall access to highly educated individuals and with individuals with an occupation in management and administration in the surrounding area (Backman, 2014). Because MNEs are drawn toward these areas/sectors, it is impossible to determine whether the potentially positive effects come from FDI spillovers or from the favorable conditions in that area. To address this problem, I will use a fixed effects linear model which eliminates unobserved time-invariant individual effects by de-meaning the variables using a within transformation:

$$
\begin{aligned}
lnY_{ijrt} - ln\overline{Y_{ijr}} = {} & \beta_0 + \beta_1\left(lnK_{ijrt} - \overline{lnK_{ijr}}\right) \\
& + \beta_2\left(lnL_{ijrt} - \overline{lnL_{ijr}}\right) + \beta_3\left(lnM_{ijrt} - \overline{lnM_{ijr}}\right) + \beta_4\left(FS_{ijrt} - \overline{FS_{ijr}}\right) \\
& + \beta_5\left(HHI_{rt} - \overline{HHI_{rt}}\right) + \beta_6\left(Horizontal_{jt} - \overline{Horizontal_{jt}}\right) \\
& + \beta_7\left(Backward_{jt} - \overline{Backward_{jt}}\right) + \left(\alpha_t - \overline{\alpha_t}\right) + \left(\alpha_r - \overline{\alpha_r}\right) + \left(\alpha_j - \overline{\alpha}_j\right) \\
& + \left(\varepsilon_{ijrt} - \overline{\varepsilon_{ijr}}\right)
\end{aligned} \tag{5}
$$

Where $\overline{X}_i = \frac{1}{T}\sum_{t=1}^{T} X_{it}$. Since variables like region and sector remain constant over time ($\overline{\alpha_r} = \alpha_r, \overline{\alpha}_j = \alpha_j$), their bias gets eliminated.

[10] Cavasola & Ciminelli, 2018
[11] Statista (2022)

4.2.3 Endogeneity from input selection by firms

The use of ordinary least squares may not be appropriate when estimating productivity since it treats input variables like labor, capital and materials as exogenous variables. However, the level of inputs are chosen by the firm based on its productivity, which is observed by the firm but not by the researcher. Firms respond to positive productivity shocks by expanding output requiring more input. On the other hand, firms decline output and demand for input when they are subject to a negative productivity shock. The positive correlation between the observable input levels and the unobservable productivity shocks is a source of bias in OLS when estimating productivity. Several models were developed to avoid this source of bias. Javorcik (2004) used a model developed by Olley and Pakes (1996) in which they showed the conditions under which an investment proxy controls for the correlation between inputs levels and unobserved productivity shock. The intuition behind their model is that the investment proxy captures the effects of the unobserved productivity on the level of inputs. Including this variable in the production function allows for separating the effect of the level of inputs on output from the unobserved productivity shock.

4.2.4 The model of Levinsohn and Petrin

Although the model of Olley and Pakes is broadly used in existing literature, it has a major drawback in empirical implications which limits the range of applications: it assumes that firm investments are strictly positive. In panel data many firms report zero investment, it forces researchers to drop a large fraction of their observations in the dataset. Moreover, Levinsohn and Petrin (2003) argued that the investment proxy may not always be appropriate to separate the effects. Levinsohn and Petrin refined the model of Olley and Pakes and introduced an estimator that uses intermediate inputs as a proxy which can be used to account for endogeneity from input selection by firms. Intermediates inputs respond more smoothly to productivity shocks since they are cheaper and easier to adjust when facing a shock, compared to investments. By exploiting the variation in inputs as a source of exogenous variation, the Levinsohn-Petrin model provides a way to estimate production function parameters in the presence of endogenous input selection. Overall, the Levinsohn-Petrin correction provides a more flexible and accurate approach to estimating productivity, compared to the Olley-Pakes correction and will therefore be used in my analyses. In my results I will show the estimates of the individual fixed effects OLS model and the estimates with the Levinsohn-Petrin correction. I will provide a concise exposition of the model in this section. A more detailed version can be found in Appendix A.

Consider the following Cobb-Douglas production function:

$$y_t = \beta_0 + \beta_k K_t + \beta_l L_t + \beta_m M_t + \omega_t + \eta_t \tag{6}$$

Where subscript t stands for time, y, K, L and M stand for output, capital, labor and materials, respectively. ω stands for productivity and η stands for either measurement error or a shock in productivity which could not be forecasted.

Productivity can be expressed as a function of the known variables materials and capital and be substituted in the production function for the first stage of estimation:

$$y_t = \beta_l L_t + \phi_t(m_t, K_t) + \eta_t \tag{7}$$

Where

$$\phi_t(m_t, K_t) = \beta_0 + \beta_k K_t + \beta_m M_t + \omega_t(m_t, K_t) \tag{8}$$

β_l can be obtained using OLS and with a third-order polynomial in M_t and K_t, since the functional form of $\phi_t(\cdot)$ is not known. Hence. consistent estimates of β_k and β_m cannot be obtained in this stage.

Olley and Pakes had assumed earlier that ω_t follows a first-order Markov process in which the productivity probability distribution of the current state relies on the previous state.

$$\omega_t = E[\omega_t | \omega_{t-1}] + \xi_t \tag{9}$$

Productivity in period t can be decomposed into two components: the expected value of productivity given the previous period and a 'surprise' in productivity ξ_t.

The second stage can be estimated by calculating the net effect of L_t and substitute (9) into the total factor productivity function:

$$y_t^* = y_t - \beta_l L_t = \beta_0 + \beta_k K + \beta_m M_t + E[\omega_t | \omega_{t-1}] + \eta_t^* \tag{8}$$

Where $\eta_t^* = \xi_t + \eta_t$. In this equation, regressing y_t^* on K_t produces a consistent estimate of β_k, because both η_t and ξ_t are uncorrelated with β_k. Moreover, firms choose their level of intermediate inputs at t-1 before η_t^* is realized and should therefore be uncorrelated with η_t^*.

4.2.5 Multicollinearity

Multicollinearity is an important consideration as it can affect the internal validity of the model. High correlations between independent variables can lead to unstable estimates and inflated standard errors, thereby deteriorating the interpretation and reliability of the results. In this study, I address the potential presence of multicollinearity by conducting an assessment of the correlation structure among independent variables. A correlation matrix is presented below:

Table 4

Correlation matrix of independent variables

	ln K	ln L	ln M	FS	HHI	Horizontal	Backward
ln K	1						
ln L	0.681	1					
ln M	0.626	0.699	1				
FS	0.114	0.174	0.177	1			
HHI	0.012	0.006	0.026	0.025	1		
Horizontal	0.038	0.047	0.114	0.103	0.415	1	
Backward	0.001	-0.001	-0.059	0.001	0.011	0.036	1

There is no universally applicable threshold determining whether multicollinearity will or will not pose a problem. This is contingent upon the specific context of the research. In cases of high correlations, additional caution is required during the analysis. Coefficients with remarkably high magnitudes and/or inflated standard errors may indicate issues pertaining to the internal validity of the model.

5. Estimation Results

The results of the models described in the previous section are presented in Tables 5 and 6. Table 5 shows the results of the fixed effects linear regression and Table 6 shows the results of the Levinsohn-Petrin regression. In both tables, the first four columns show the effects on all firms and the last four columns show the effects on a subsample of domestic firms.

Table 5

Fixed effects regression results. Spillovers associated with market concentration

	All firms				Domestic firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln K	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln L	0.214***	0.214***	0.214***	0.214***	0.212***	0.212***	0.212***	0.212***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ln M	0.401***	0.401***	0.401***	0.401***	0.399***	0.399***	0.399***	0.399***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Foreign Share	0.038**	0.038**	0.038**	0.038**				
	(0.016)	(0.016)	(0.016)	(0.016)				
HHI	-0.108**	-0.127	0.089	-0.004	-0.118**	-0.126	0.093	0.004
	(0.053)	(0.100)	(0.078)	(0.109)	(0.054)	(0.101)	(0.080)	(0.111)
Horizontal	0.219***	0.215***	0.206***	0.177***	0.207***	0.205***	0.193***	0.164***
	(0.037)	(0.043)	(0.037)	(0.044)	(0.038)	(0.044)	(0.038)	(0.044)
Backward	0.138***	0.137**	0.227***	0.231***	0.156***	0.156***	0.251***	0.255***
	(0.059)	(0.059)	(0.062)	(0.062)	(0.060)	(0.060)	(0.063)	(0.062)
Horizontal × HHI		0.063		0.380		0.029		0.368
		(0.296)		(0.294)		(0.302)		(0.300)
Backward × HHI			-2.216***	-2.368***			-2.268***	-2.511***
			(0.663)	(0.661)			(0.688)	(0.687)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	293,706	293,706	293,706	293,706	285,691	285,691	285,691	285,691

Notes. Standard errors in parenthesis. *** and **denote significance at the 1 and 5% level respectively.

Table 6

Levinsohn-Petrin regression results. Spillovers associated with market concentration

	All firms				Domestic firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ln K	0.060***	0.028***	0.030***	0.026***	0.036***	0.029***	0.044***	0.025***
	(0.003)	(0.004)	(0.002)	(0.004)	(0.003)	(0.005)	(0.004)	(0.002)
ln L	0.208***	0.208***	0.208***	0.208***	0.207***	0.207***	0.207***	0.207***
	(0.003)	(0.004)	(0.001)	(0.002)	(0.003)	(0.005)	(0.002)	(0.003)
ln M	0.367***	0.362***	0.362***	0.364***	0.361***	0.362***	0.365***	0.361***
	(0.008)	(0.005)	(0.002)	(0.004)	(0.005)	(0.002)	(0.005)	(0.004)
Foreign Share	0.061***	0.021***	0.038***	0.048***				
	(0.003)	(0.004)	(0.003)	(0.002)				
HHI	-0.085***	-0.115***	-0.106***	-0.103***	-0.120***	-0.123***	-0.097***	-0.121***
	(0.004)	(0.002)	(0.008)	(0.002)	(0.005)	(0.002)	(0.004)	(0.001)
Horizontal	0.247***	0.214***	0.220***	0.222***	0.207***	0.207***	0.218***	0.196***
	(0.004)	(0.002)	(0.004)	(0.006)	(0.011)	(0.004)	(0.003)	(0.002)
Backward	0.156***	0.133***	0.143***	0.139***	0.157***	0.151***	0.169***	0.148***
	(0.007)	(0.006)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.007)
Horizontal × HHI		-0.002		0.099***		-0.004		0.087***
		(0.009)		(0.002)		(0.004)		(0.004)
Backward × HHI			-0.101***	-0.269***			-0.104***	-0.279***
			(0.005)	(0.005)			(0.007)	(0.001)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	293,706	293,706	293,706	293,706	285,691	285,691	285,691	285,691

Notes. Standard errors in parenthesis. *** denotes significance at the 1% level.

As expected, positive and significant coefficients on the changes in production inputs and in the share of foreign equity are revealed in all models. Consequently, an increase in production inputs as well as the foreign equity share are associated with an increase in output. Furthermore, all models indicate positive and significant coefficients for both horizontal spillovers and spillovers through backward linkages. The magnitudes of the effects are economically meaningful. In the fixed effects linear regression table, column 4 shows that an increase of one percent in the foreign presence in the same industry is associated with a 0.177 percent increase in output for all firms on average, ceteris paribus. This increase is slightly lower for domestic firms (column 8) where an increase of one percent is associated with an increase of 0.164 percent in output, ceteris paribus. On the other hand, an increase in the foreign presence in the sourcing sectors (i.e., an increase in the backward variable by one percent) is associated with a 0.231 percent rise in output for all firms on average, ceteris paribus. This increase in slightly higher for domestic firms where an increase of one percent is associated with an increase of 0.255 percent, ceteris paribus. In the Levinsohn-Petrin regression table, column 4 shows an increase of one percent in the foreign presence in the same industry is associated with a 0.222 percent increase in output for all firms on average, ceteris paribus. This increase is slightly higher for domestic firms (model (8)) where an increase of one percent is associated with an increase of 0.196 percent in output, ceteris paribus. On the other hand, an increase in the foreign presence in the sourcing sectors is associated with a 0.139 percent rise in output for all firms on average, ceteris paribus. This increase in slightly higher for domestic firms where an increase of one percent is associated with an increase of 0.148 percent, ceteris paribus. All effects are significant at the 1% level.

Positive effects of foreign presence in downstream sectors on firm productivity are found in both models, providing compelling evidence for Hypothesis 1. The results pertaining to this hypothesis are robust to both estimation approaches. The results partly align with the findings of Javorcik (2004), Barrios et al. (2011) and Du et al. (2012) who did not find evidence supporting positive and significant effects of horizontal spillovers but did found evidence of positive effects for spillovers through backward linkages. Marcin (2008), however, found similar results for both horizontal and spillovers through backward linkages, suggesting that there is some learning from both direct foreign competitors and foreign companies operating in downstream sectors.

In the fixed effects linear regression, the coefficients for spillovers through backward linkages exceed the coefficients for horizontal spillovers when the interaction between backward linkages and market concentration is added. The interaction term shows negative estimates in all models. This suggests that the benefits from spillovers vary depending on the specific context of market concentration. In markets characterized by lower concentration levels, the advantages derived from FDI through backward linkages tend to surpass the benefits obtained from horizontal spillovers. Conversely, in markets characterized by higher concentration levels, the benefits form horizontal spillovers outweigh the benefits from spillovers through backward linkages. Based on the fixed effects linear regression results, the second hypothesis is thus not universally supported, but only at a certain level of market concentration.

In contrast to the fixed effects linear regression, the coefficients for horizontal spillovers in the Levinsohn-Petrin regression are higher than the coefficients for spillovers through backward linkages in all models. In contrast to the fixed effects model, where the second hypothesis was supported under certain market conditions, I did not find evidence to support the second hypothesis performing the Levinsohn-Petrin regression. Spillovers from FDI are thus directed towards both the MNEs' suppliers and their competitors. As said, it can be beneficial if spillovers accrue to MNEs' suppliers, while it can be disadvantageous if they accrue to competitors. However, the MNE cannot prevent the upstream suppliers from also selling to the multinational's competitors in the downstream market. The lower input prices may induce entry and therefore more competition in the downstream market, thereby lowering prices and increasing productivity for local competitors as well (Blalock & Gertler, 2008).

As can be seen in above tables, the interaction terms between the backward variable and HHI show negative and significant estimates in all models. The less competitive the market becomes (i.e., a rise in the HHI), the less firms benefit from productivity spillovers through backward linkages. This is in line with the findings of Marcin (2008) who found similar results. Firms in competitive markets (i.e., a low HHI) may be more effective and better prepared to cooperate with MNEs in downstream markets. Due to their higher effectiveness, they are capable of adapting to the processes and requirements of MNEs yielding higher productivity gains. Hence, compelling evidence for the third hypothesis is found based on this analysis. I find no significant effects of the interaction term between the horizontal variable and HHI in the fixed effects linear regression. In the Levinsohn-Petrin model, however, positive and significant estimates are observed for this interaction term. As mentioned earlier, the expected effect of market competition on horizontal productivity spillovers is ambiguous. The fixed effects model reveals that the positive and negative effects of competition elevate each other. Based on the Levinsohn-Petrin model, however, one can see that the negative effects outweigh the positive ones in terms of significance. In competitive markets, MNEs allocate more resources towards safeguarding their knowledge, preventing it from spilling over to competitors. Consequently, domestic firms operating in the same market would experience reduced benefits from productivity spillovers originating from MNEs as competition increases.

The next issue to be addressed is whether potential spillovers vary across regions with a strong or weaker manufacturing industry. In this analysis, strong regions are regions that contribute at least 10% to the total gross value added of the manufacturing industry in Italy. The first results are shown in Tables 7 and 8. The results of both the fixed effects and the Levinsohn-Petrin regression are shown.

Table 7

Fixed effects regression results. Spillovers associated with strong manufacturing regions

	All firms			Domestic firms		
	(1)	(2)	(3)	(6)	(7)	(8)
ln K	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln L	0.214***	0.214***	0.214***	0.212***	0.212***	0.212***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ln M	0.401***	0.401***	0.401***	0.399***	0.399***	0.399***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Foreign Share	0.038**	0.038**	0.038**			
	(0.016)	(0.016)	(0.016)			
HHI	-0.104**	-0.119**	-0.116**	-0.116**	-0.131**	-0.131**
	(0.053)	(0.054)	(0.054)	(0.054)	(0.054)	(0.055)
Horizontal	0.252***	0.218***	0.241***	0.223***	0.206***	0.208***
	(0.066)	(0.037)	(0.066)	(0.066)	(0.038)	(0.067)
Backward	0.140**	0.054	0.060	0.157***	0.049	0.050
	(0.059)	(0.085)	(0.086)	(0.060)	(0.087)	(0.087)
Horizontal × Strong Region	-0.056		-0.038	-0.028		-0.005
	(0.077)		(0.078)	(0.078)		(0.079)
Backward × Strong Region		0.133	0.126		0.171*	0.170*
		(0.091)	(0.092)		(0.093)	(0.094)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	293,706	293,706	293,706	285,691	285,691	285,691

Notes. Standard errors in parenthesis. ***, **, * denote significance at the 1, 5 and 10% level respectively. The results of the base model without interactions are not shown is this model as the results are the same as column 1 of Table 5. The variable 'Strong Regions' equals 1 if the region is either Lombardy, Veneto, Emilio-Romagna or Piemonte.

Table 8

Levinsohn-Petrin regression results. Spillovers associated with strong manufacturing regions

	All firms			Domestic firms		
	(1)	(2)	(3)	(6)	(7)	(8)
ln K	0.042***	0.030***	0.031***	0.049***	0.034***	0.028***
	(0.004)	(0.001)	(0.004)	(0.004)	(0.003)	(0.002)
ln L	0.208***	0.208***	0..208***	0.207***	0.207***	0.207***
	(0.003)	(0.004)	(0.001)	(0.001)	(0.002)	(0.003)
ln M	0.366***	0.363***	0.362***	0.365***	0.362***	0.365***
	(0.008)	(0.004)	(0.001)	(0.004)	(0.004)	(0.004)
Foreign Share	0.065***	0.029***	0.040***			
	(0.008)	(0.005)	(0.002)			
HHI	-0.077***	-0.126***	-0.131***	-0.079***	-0.133***	-0.136***
	(0.006)	(0.003)	(0.011)	(0.003)	(0.008)	(0.003)
Horizontal	0.276***	0.214***	0.239***	0.244***	0.203***	0.202***
	(0.007)	(0.003)	(0.001)	(0.009)	(0.001)	(0.002)
Backward	0.155***	0.024***	0.063***	0.171***	0.036***	0.029***
	(0.000)	(0.002)	(0.001)	(0.007)	(0.004)	(0.002)
Horizontal × Strong Region	-0.037***		-0.041***	-0.005		-0.014***
	(0.007)		(0.003)	(0.018)		(0.002)
Backward × Strong Region		0.127***	0.135***		0.169***	0.166***
		(0.003)	(0.002)		(0.001)	(0.003)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	293,706	293,706	293,706	285,691	285,691	285,691

Notes. Standard errors in parenthesis. ***, **, * denote significance at the 1 and 5% level respectively. The results of the base model without interactions are not shown is this model as the results are the same as column 1 of Table 6. The variable ‘Strong Regions’ equals 1 if the region is either Lombardy, Veneto, Emilio-Romagna or Piemonte.

As in the previous models, positive effects and significant effects are found for production inputs and foreign share. In models without interactions, positive and significant effects are observed for both horizontal spillovers and spillovers through backward linkages, with the magnitude of horizontal spillovers being higher. In the fixed effects model, no significant effects were found for the interaction between strong regions and horizontal spillovers, indicating that there is no evidence that the degree of horizontal spillovers depends on the strength of the manufacturing industry in a region. By introducing the interaction between strong regions and backward linkages, the main effect of backward linkages becomes insignificant. The effect of how strong regions influence productivity spillovers through backward linkages is stronger for domestic firms. Domestic firms operating in strong regions experience a 0.17 percent higher impact on productivity from backward spillovers compared to domestic firms that do not operate in these strong regions, ceteris paribus. This coefficient is significant at the 10% level.

In the Levinsohn-Petrin model, similar effects are found in terms of magnitude, whereas they differ in significance. Columns 8 shows that domestic firms operating in strong regions experience 0.014 percent less productivity spillovers from firms operating in the same market, compared to firms not operating in strong regions. Even though this effect is highly significant in statistical terms, the economic relevance of it could be questioned. Domestic firms operating in strong regions experience 0.17 percent more productivity spillovers through backward linkages, compared to firms not operating in strong regions. The effects are significant at the 1% level. The Levinsohn-Petrin model shows the most convincing evidence to support the third hypothesis, but only for the spillovers through backward linkages.

In this analysis, the four most prominent industries have been combined into one dummy variable. However, in practice, the effects may still vary across these regions. To obtain a more detailed understanding, the above analysis will be replicated, but with individual examinations of each region to capture their specific effects.

Table 9

Fixed effects regression results. Spillovers associated with strong manufacturing regions – split up

	All firms			Domestic firms		
	(1)	(2)	(3)	(6)	(7)	(8)
ln K	0.038***	0.038***	0.038***	0.038***	0.038***	0.038***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ln L	0.214***	0.214***	0.214***	0.212***	0.212***	0.212***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
ln M	0.401***	0.401***	0.401***	0.399***	0.399***	0.399***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Foreign Share	0.038**	0.037**	0.037**			
	(0.016)	(0.016)	(0.016)			
HHI	-0.116**	-0.129**	-0.135**	-0.127**	-0.143***	-0.150***
	(0.056)	(0.054)	(0.057)	(0.056)	(0.054)	(0.058)
Horizontal	0.230***	0.223**	0.216***	0.211***	0.210***	0.193***
	(0.072)	(0.037)	(0.072)	(0.073)	(0.038)	(0.073)
Backward	0.139**	0.064	0.061	0.157***	0.056	0.049
	(0.059)	(0.098)	(0.099)	(0.060)	(0.099)	(0.101)
Horizontal × Lombardy	-0.008		-0.003	0.018		0.030
	(0.094)		(0.096)	(0.096)		(0.097)
Horizontal × Veneto	-0.059		0.010	-0.053		0.025
	(0.100)		(0.101)	(0.100)		(0.101)
Horizontal × E-R	-0.058		-0.035	-0.050		-0.019
	(0.116)		(0.117)	(0.119)		(0.119)
Horizontal × Piemonte	0.117		0.132	0.065		0.086
	(0.178)		(0.182)	(0.180)		(0.184)
Backward × Lombardy		-0.143	-0.141		-0.133	-0.125
		(0.113)	(0.115)		(0.115)	(0.116)
Backward × Veneto		0.523***	0.528***		0.576***	0.586***
		(0.129)	(0.131)		(0.131)	(0.133)
Backward × E-R		0.322**	0.323**		0.401***	0.407***
		(0.139)	(0.140)		(0.141)	(0.142)
Backward × Piemonte		-0.039	-0.026		-0.030	-0.018
		(0.170)	(0.175)		(0.174)	(0.180)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	293,706	293,706	293,706	285,691	285,691	285,691

Notes. Standard errors in parenthesis. ***, ** denote significance at the 1 and 5% level respectively. The results of the base model without interactions are not shown is this model as the results are the same as column 1 of Table 5. E-R denotes Emilia-Romagna.

Table 10

Levinsohn-Petrin regression results. Spillovers associated with strong manufacturing regions- split up

	All firms			Domestic firms		
	(1)	(2)	(3)	(6)	(7)	(8)
ln K	0.036***	0.032***	0.031***	0.027***	0.029***	0.037***
	(0.007)	(0.004)	(0.002)	(0.005)	(0.001)	(0.001)
ln L	0.208***	0.208***	0.208***	0.208***	0.208***	0.208***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.001)
ln M	0.369***	0.365***	0.363***	0.372***	0.364***	0.362***
	(0.006)	(0.002)	(0.004)	(0.003)	(0.005)	(0.004)
Foreign Share	0.041***	0.036***	0.038***			
	(0.003)	(0.001)	(0.002)			
HHI	-0.112***	-.0110***	-0.126***	-0.142***	-0.141***	-0.118***
	(0.003)	(0.005)	(0.002)	(0.005)	(0.002)	(0.002)
Horizontal	0.235***	0.221***	0.222***	0.211***	0.218***	0.224***
	(0.004)	(0.002)	(0.003)	(0.007)	(0.002)	(0.002)
Backward	0.145***	0.067***	0.069***	0.118***	0.049***	0.068***
	(0.003)	(0.002)	(0.004)	(0.003)	(0.004)	(0.007)
Horizontal × Lombardy	0.006***		0.002	-0.026***		0.005**
	(0.002)		(0.002)	(0.009)		(0.002)
Horizontal × Veneto	-0.056***		0.016***	-0.078***		0.013***
	(0.009)		(0.004)	(0.002)		(0.002)
Horizontal × E-R	-0.055***		-0.032***	-0.082***		-0.032***
	(0.008)		(0.004)	(0.002)		(0.001)
Horizontal × Piemonte	0.111***		0.134***	0.095***		0.131***
	(0.003)		(0.004)	(0.006)		(0.002)
Backward × Lombardy		-0.138***	-0.129***		-0.158***	-0.139***
		(0.001)	(0.002)		(0.005)	(0.003)
Backward × Veneto		0.529***	0.533***		0.523***	0.533***
		(0.004)	(0.002)		(0.005)	(0.002)
Backward × E-R		0.328***	0.331***		0.320***	0.333***
		(0.001)	(0.002)		(0.005)	(0.003)
Backward × Piemonte		-0.037***	-0.032***		-0.039***	-0.019***
		(0.005)	(0.001)		(0.005)	(0.003)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	293,706	293,706	293,706	285,691	285,691	285,691

Notes. Standard errors in parenthesis. ***, ** denote significance at the 1 and 5% level respectively. The results of the base model without interactions are not shown is this model as the results are the same as column 1 of Table 6. E-R denotes Emilia-Romagna.

The above results indicate that the positive effects found in Tables in 7 and 8 were primarily driven by the regions Veneto and Emilia-Romagna. In the fixed effects model, significant effects are only observed for the interaction between Backward and these two regions. In the Levinsohn-Petrin model, multiple significant effects are found for other interactions, but the effects identified for Veneto and Emilia-Romagna are economically the most relevant. Based on the preferred Levinsohn-Petrin model, domestic firms operating in Veneto or Emilio-Romagna experience respectively 0.53 and 0.33% more productivity spillovers through backward linkages, compared to firms operating in other regions, ceteris paribus. These effects are significant at the 1%. It is important for policymakers to examine the effects of FDI on a regional basis since the potential spillovers to domestic firms depend on the specific characteristics of the regions. By considering regional-specific factors, policymakers can better understand how FDI impacts different areas and tailor their policies accordingly.

Differences between the fixed effects and Levinsohn-Petrin models can occur because of the different estimation techniques that are used. The Levinsohn-Petrin model explicitly considers firm's input choices, which helps disentangling the effects of productivity from other factors. It combines a production function framework with a two-step estimation procedure whereas the fixed effects linear model involves a single estimation step. The fixed effects linear model is likely to show biased estimates due to input selection by firms. These differences in addressing endogeneity can result in variations in estimated magnitudes, showing downward biased estimates for the interaction term between Backward and HHI in the fixed effects model, for example. Overall, the Levinsohn-Petrin regression provides a more robust and nuanced approach to investigating firm productivity by effectively addressing endogeneity concerns.

6. Conclusion

Many countries are trying to attract MNEs by offering them favorable conditions such as tax breaks and subsidies. Policymakers justify their generous packages by mentioning the productivity gains for domestic firms. These productivity gains are told to occur through positive externalities generated by MNEs. These policies take a prominent place in the domestic political debate. However, the capacity to afford such policies is lacking. Previous literature in fact, found mixed and limited evidence on the existence of such spillovers generated by MNEs. This study is an effort to further understand the nature of spillovers and through which mechanisms they occur.

This study examines whether there exists a correlation between productivity growth of domestic firms and the presence of MNEs in downstream sectors. It improves existing literature by further exploiting the econometric foundation on this topic by Javorcik (2004). This study takes into account endogeneity concerns which have not always been taken into account by earlier studies. It takes into account trade across industries over time whereas earlier studies assumed trade to be fixed in the short term. Moreover, it used the correction by Levinsohn and Petrin (2003) to account for input selection by firms. It is a refined model of the model by Olley and Pakes (1996) which is broadly used in literature surrounding this topic. Furthermore, this study utilized an extensive dataset spanning a period of seven years, addressing previous research limitations in providing sufficient firm-level data.

The estimation results, based on firm-level panel dataset from Italy, are consistent with the presence of productivity spillovers taking place through backward linkages and horizontal channels. They suggest that an increase of one percent in foreign presence in the sourcing sectors is associated with a 0.15 percent increase in productivity of domestic firms. An increase of one percent in the foreign presence in the same industry is associated with a 0.20 percent increase in productivity of domestic firms. This study also shed light on how the productivity gains from FDI depend on the level of market concentration and on the industry strength of a region. The results indicate that productivity gains from spillovers through backward linkages decrease as the competition in the market decreases. For horizontal spillovers, reverse effects are found albeit with a lower economic relevance. The results also indicate that productivity gains from spillovers through backward linkages increase for firms operating in a region with a strong manufacturing sector. The positive effects that were found were predominantly due to Veneto and Emilio-Romagna which showed the highest coefficients. For horizontal spillovers, negative and significant effects were found between the interaction of strong regions, but they lack economic relevance.

7. Challenges

As always in empirical studies, the results should be interpreted with some caveats in mind. Despite Orbis providing extensive and rich data, it is not without its flaws. Certain observations from relevant companies had to be removed due to documentation errors. A commonly occurring mistake, for instance, was the total ownership of shareholders exceeding or falling below 100%. Additionally, not all necessary data from the companies, such as the number of employees, sales, inventories, etc., were provided. As a result, the sample size was reduced. Hence, this study represents a subsample of the Italian manufacturing industry as it does not encompass all companies. When extrapolating the results to the entire Italian industry, this limitation should be taken into consideration. In addition, Orbis does not provide data on the entry and exit if firms and could therefore not be controlled for. The entry of MNEs may result in less productive domestic firms exiting the market. Consequently, this leads to an overall increase of productivity, but this would not be the intended effect of a FDI attracting policy. The labor input variable is measured as the number of employees. This does not fully reflect the amount of labor that is used in the production process. Ideally, I would have wanted to use hours worked, but this data was not available in Orbis. Neither could I disentangle high or low skilled labor.

This study aimed to control endogeneity from input selection by firms by utilizing the model of Levinsohn and Petrin (2003). This model is a suitable choice when productivity is the main variable of interest, but it also comes with its own assumptions that can be questioned in this context. Their procedure rests on the assumption of adjusting intermediate inputs to shocks in each period and markets being perfectly competitive. In the real world, it is unlikely that these assumptions are likely to hold in any situation. Therefore, the results should always be interpreted with these limitations in mind.

Future research is needed to disentangle different channels through which FDI spillovers operate. Acquiring even more extensive on entry, exit and labor is needed to do so.

Appendix A

Estimation procedure with Levinsohn-Petrin correction

The estimation of the production function parameters suggested by Levinsohn and Petrin (2003) is used to account for endogeneity of input selection by the firms.

Consider the following Cobb-Douglas production function:

$$y_t = \beta_0 + \beta_k K_t + \beta_l L_t + \beta_m M_t + \omega_t + \eta_t \tag{1}$$

Where subscript t stands for time, y, K, L and M stand for output, capital, labor and intermediate inputs respectively. ω stands for productivity and η stands for either measurement error or a shock in productivity which could not be forecasted. ω is a state variable and therefore influences a firm's decision making process whilst η has no effect on a firm's decisions. Inputs are divided into freely variables L and M and a state variable K. A freely variable is determined outside of the model and is allowed to take one value. The models of Olley-Pakes and Levinsohn-Petrin assumed labor and intermediate inputs to be a fixed factor in production, meaning that the amount of labor and intermediate inputs used in the production process is held constant in the short run. A state variable is a variable that summarizes the history of a system up to the current point in time and affects the behavior of the system in the future. Capital is considered a state variable since it represents the stock of physical capital that is accumulated by the firm over time. It is a sustained factor that influences the firm's output and productivity.

Hence, the intermediate input's demand function depends on firm productivity and on the capital stock:

$$M_t = M_t(\omega_t, K_t) \tag{2}$$

By inverting this equation, productivity can be expressed as a function of the known variables materials and capital:

$$\omega_t = \omega_t(m_t, K_t) \tag{3}$$

Equation (3) can be substituted in (1):

$$y_t = \beta_l L_t + \phi_t(m_t, K_t) + \eta_t \tag{4}$$

Where

$$\phi_t(m_t, K_t) = \beta_0 + \beta_k K_t + \beta_m M_t + \omega_t(m_t, K_t) \tag{5}$$

The functional form of $\phi(\cdot)$ is not known, so therefore the coefficient of β_k cannot be estimated at this stage. β_l can be obtained using OLS with a third-order polynomial in M_t and K_t. Including these polynomial terms allows the regression model to capture potential nonlinear relationships. This flexibility is useful when the functional form of the relationship is not known in advance. The idea is to identify the variable input coefficients using only the variation unrelated to K_t and M_t. The first stage identifies the coefficients of the variable inputs (except the coefficient on the proxy input). A second stage is required to obtain the estimates of the capital coefficient. This second stage starts by calculating the net effect of L_t to output, obtaining a new variable y_t^*:

$$y_t^* = y_t - \beta_l L = \beta_0 + \beta_k K + \beta_m M_t + \omega_t + \eta_t \quad (6)$$

Olley and Pakes had assumed earlier that ω_t follows a first-order Markov process in which the productivity probability distribution of the current state relies on the previous state.

$$\omega_t = E[\omega_t|\omega_{t-1}] + \xi_t \quad (7)$$

Productivity in period t can be decomposed into two components: the expected value of productivity given the previous period and a 'surprise' in productivity ξ_t.

To estimate total factor productivity and substitute (7) in (8), the second stage becomes:

$$y_t^* = \beta_0 + \beta_k K + \beta_m M_t + E[\omega_t|\omega_{t-1}] + \eta_t^* \quad (8)$$

Where $\eta_t^* = \xi_t + \eta_t$. In this equation, regressing y_t^* on K_t produces a consistent estimate of β_k, because both η_t and ξ_t are uncorrelated with β_k. Moreover, firms choose their level of intermediate inputs at t-1 before η_t^* is realized and should therefore be uncorrelated with η_t^*.

To perform the Levinsohn-Petrin estimation, I used the 'prodest' command in Stata which is available in a package developed by Rovigatti and Mollisi (2020).

References

Aitken, B. J., & Harrison, A. E. (1999). Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. *American economic review*, *89*(3), 605-618.

Ansari, M. R. (2012). HHI: Stata module to compute Herfindahl index (Statistical Software Components S457512). Retrieved from Boston College Department of Economics website: https://EconPapers.repec.org/RePEc:boc:bocode:s457512

Arnold, J., Javorcik, B., & Mattoo, A. (2006). The productivity effects of services liberalization: Evidence from the Czech Republic. *World Bank working paper*, 1-38.

Audretsch D, Feldman M (1996) Knowledge spillovers and the geography of innovation and production. *American Economic Review* 68: 630–640

Backman, M. (2014). Human capital in firms and regions: Impact on firm productivity. *Papers in regional science*, *93*(3), 557-575.

Barrios, S., Görg, H., & Strobl, E. (2011). Spillovers through backward linkages from multinationals: Measurement matters!. *European economic review*, *55*(6), 862-875.

Barry, F., Görg, H., & Strobl, E. (2001). Foreign direct investment and wages in domestic firms: productivity spillovers vs labour-market crowding out. *University College Dublin/University of Nottingham*.

Bijsterbosch, M., & Kolasa, M. (2010). FDI and productivity convergence in Central and Eastern Europe: an industry-level investigation. *Review of World Economics*, *145*, 689-712.

Bitzer, J., & Görg, H. (2005). *The impact of FDI on industry performance* (No. 2005, 09). Research Paper.

Blalock, G., & Gertler, P. J. (2008). Welfare gains from foreign direct investment through technology transfer to local suppliers. *Journal of international Economics*, *74*(2), 402-421.

Blomström, M., & Kokko, A. 1998. Multinational corporations and spillovers. *Journal of Economic Surveys, 12: 247–277*

Blomstrom, M., Kokko, A., & Zejan, M. (2000). *Foreign direct investment: Firm and host country strategies*. Springer.

Bureau van Dijk. (n.d.). *Orbis | Compare Private Company Data | Bureau van Dijk*. Bvd. https://www.bvdinfo.com/en-gb/our-products/data/international/orbis

Cantwell, J.A. and Iammarino, S. (1998) 'MNCs,Technological Innovation and Regional Systems in the EU: Some Evidence in the Italian Case', *International Journal of the Economics of Business5 (3)*: 383–407.

Capuano, C., & Grassi, I. (2019). Spillovers, product innovation and R&D cooperation: a theoretical model. *Economics of Innovation and New Technology*, *28*(2), 197-216.

Cavasola, P., & Ciminelli, M. (2018, August 2). *Electric vehicle regulation and law in Italy*. CMS Law.Tax. https://cms.law/en/int/expert-guides/cms-expert-guide-to-electric-vehicles/italy

Du, L., Harrison, A., & Jefferson, G. H. (2012). Testing for horizontal and vertical foreign investment spillovers in China, 1998–2007. *Journal of Asian Economics*, *23*(3), 234-243.

Eurostat. (2016). *Archive:Manufacture of fabricated metal products statistics - NACE Rev. 2*. ec.europa.eu.https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Archive:Manufacture_of_fabricated_metal_products_statistics_-_NACE_Rev._2

Eurostat. (n.d.). *Producer prices in industry, domestic market - monthly data*. ec.europa. https://ec.europa.eu/eurostat/databrowser/view/STS_INPPD_M__custom_4986494/default/table?lang=en

Fastener Euraisa. (2022, November 23). *ITALY OVERVIEW*. fastenereurasia.com. https://fastenereurasia.com/?h1955/italy-overview#

Görg, H., & Greenaway, D. (2001). Foreign direct investment and intra-industry spillovers: a review of the literature.

Hanson, G. (2001) Should Countries Promote Foreign Direct Investment. G-24 Discussion Paper Series.

Iammarino, S., & Santangelo, G. D. (2000). Foreign direct investment and regional attractiveness in the EU integration process: some evidence for the Italian regions. *European urban and regional studies*, *7*(1), 5-18.

Istat. (n.d.). *Value added by industry* [Dataset]. https://esploradati.istat.it/databrowser/#/en/dw/categories/IT1,DATAWAREHOUSE,1.0/UP_ACC_TERRIT/IT1,93_500_DF_DCCN_TNA_1,1.0

Javorcik, B. S. (2004). Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages. *American economic review*, *94*(3), 605-627.

Kathuria, V. (2000). Productivity spillovers from technology transfer to Indian manufacturing firms. *Journal of international development*, *12*(3), 343-369.

Kugler M (2001) The diffusion of externalities from Fforeign direct investment: Theory ahead of measurement. Mimeo, University of Southampton

Kugler, M. (2006). Spillovers from foreign direct investment: within or between industries?. *Journal of Development Economics*, *80*(2), 444-477.

Konings, J. (2001). The effects of foreign direct investment on domestic firms: Evidence from firm-level panel data in emerging economies. *Economics of transition*, *9*(3), 619-633.

Marcin, K. (2008). How does FDI inflow affect productivity of domestic firms? The role of horizontal and vertical spillovers, absorptive capacity and competition. *The Journal of International Trade & Economic Development*, *17*(1), 155-173.

Meyer, K. E., & Sinani, E. (2002). Identifying spillovers of technology transfer from FDI.

Moran, T. H. (2001). *Parental supervision: The new paradigm for foreign direct investment and development* (Vol. 64). Peterson Institute.

Le, H. Q., & Pomfret, R. (2011). Technology spillovers from foreign direct investment in Vietnam: horizontal or vertical spillovers?. *Journal of the Asia Pacific Economy*, *16*(2), 183-201.

Lesher, M. and S. Miroudot (2008), "FDI Spillovers and their Interrelationships with Trade", *OECD Trade Policy Papers, No. 80*, OECD Publishing. http://dx.doi.org/10.1787/235843308250

Levinsohn, J., & Petrin, A. (2003). Estimating production functions using inputs to control for unobservables. *The review of economic studies*, *70*(2), 317-341.

Li, D., Eden, L., Hitt, M. A., & Ireland, R. D. (2008). Friends, acquaintances, or strangers? Partner selection in R&D alliances. *Academy of management journal*, *51*(2), 315-334.

OECD. (2021). *Input-Output Tables* [Dataset]. https://stats.oecd.org/Index.aspx?DataSetCode=IOTS_2021

OECD (2023), Inward FDI stocks by industry (indicator). doi: 10.1787/2bf57022-en

Park, W. G. (2001). *R&D, spillovers, and intellectual property rights*. mimeo, Dept. of Economics, American University, December.

Olley, Steven G. and Ariel Pakes. 1996. "The Dynamics of Productivity in the Telecommunications Equipment Industry," Econometrica 64(6), pp. 1263-1297.

Ponomareva N (2000) Are there positive or negative spillovers from foreign-owned to domestic firms? Working Paper BSP/00/042, New Economic School, Moscow

Rahimli, A. (2012). Knowledge management and competitive advantage. In *Information and Knowledge Management* (Vol. 2, No. 7, pp. 37-43).

Reganati, F., & Sica, E. (2007). Horizontal and vertical spillovers from FDI: Evidence from panel data for the Italian manufacturing sector. *Journal of Business Economics and Management*, *8*(4), 259-266.

Rovigatti, G., & Mollisi, V. (2020). PRODEST: Stata module for production function estimation based on the control function approach.

Sjöholm F (1999) Productivity growth in Indonesia: The role of regional characteristics and direct foreign investment. *Economic Development and Cultural Change* 47: 559–584

Statista. (2022, September 28). *Number of passenger cars produced in Italy 2010-2020*. https://www.statista.com/statistics/656211/number-of-passenger-vehicles-produced-in-italy/

The Global Economy. (2023). *Italy Share of manufacturing*. TheGlobalEconomy.com. https://www.theglobaleconomy.com/Italy/Share_of_manufacturing/#:~:text=For%20that%20indicator%2C%20we%20provide,from%202021%20is%2014.9%20percent.

The World Bank. (n.d.). *World Development Indicators | DataBank*. data.worldbank.org. https://databank.worldbank.org/reports.aspx?source=2&series=SP.POP.TOTL&country=EUU#

Wan, G., & Zhang, Y. (2018). The direct and indirect effects of infrastructure on firm productivity: Evidence from Chinese manufacturing. *China Economic Review*, *49*, 143-153.