POLITECNICO DI TORINO

Degree course in Engineering and Management

Politecnico di Torino

Thesis

RESHORING STRATEGIES IN THE WAKE OF GLOBALIZATION AND PANDEMICS: TRENDS, DRIVERS AND IMPLICATIONS

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ABSTRACT

In recent decades, the phenomenon of offshoring, driven by globalization and cost-saving considerations, has led many companies to relocate their manufacturing operations to distant shores. This strategy, while beneficial in terms of reducing production costs and increasing market access, has also exposed businesses to vulnerabilities that became evident during the unprecedented disruption caused by the global COVID-19 pandemic. As a result, relocating manufacturing or business operations back to the home country has gained increasing attention as companies reassess their global supply chain strategies. This thesis provides a comprehensive analysis of reshoring trends, drivers, and implications, drawing on existing literature and empirical data. The study examines the factors motivating companies to reshore, the industries most affected, and the potential economic, social, and environmental outcomes of this strategic shift. Furthermore, the thesis offers insights into the challenges and opportunities that reshoring presents for businesses, policymakers, and local communities. Lastly, this thesis will also provide a method for evaluating and measuring reshoring.

1.0 INTRODUCTION

In the last four decades, the world's economy has become increasingly globalized. Nations, cultures, and economies have become interconnected on an unprecedented scale. Globalization has facilitated the exchange of diverse perspectives and promoted cultural diversity, leading to economic growth, expanded markets, and increased access to innovation. As proof of this, the World Bank (2020) released a report showing that international trade grew, reaching 30% of global GDP before the 2008 Financial Crisis.

As stated by Di Stefano et al., 2022, firms have exploited Global Value Chains by conducting various production activities in different geographic areas around the world, with each area specializing in a particular task. This allows them to benefit from cost differentials and comparative advantages. However, this trend of offshoring has reversed over the past 15 years, primarily due to the risks associated with this strategic choice and its social and environmental impacts. Factors such as the 2008 financial crisis, wage increases in emerging markets, new trade policy tensions, and the fragmentation of Global Value Chains are among the primary reasons why companies are currently engaged in a significant debate about whether to bring previously offshored production activities back to their home countries. Consequently, in recent years, the World Trade-to-GDP ratio has stabilized at its pre-2008 financial crisis level.

Nowadays, Multinational Enterprises (MNEs) still heavily contribute to the world economy, but offshore production seems to be less attractive than before, particularly from a cost-saving perspective. Against this backdrop, COVID-19 has acted as a significant accelerator in understanding the consequences of globalization. This unforeseen, unexpected, and exogenous shock led to the simultaneous collapse of both global GDPs and profits, resulting from physical restrictions, global supply chain bottlenecks, and decreased demand.

Di Stefano et al., 2022 identified the instability arising from an internationally fragmented production value chain. Through comprehensive analysis, they assessed the resilience demonstrated by Italian Multinational Enterprises (MNEs) when confronted with shocks like COVID-19 and the US-China trade war, utilizing a combination of empirical data and theoretical examination. Among the primary outcomes of their research, it was observed that a majority of firms, especially multinational enterprises, did not view COVID-19 as a reason to cease foreign production. This does not apply for domestic companies, that could not

hedge their risk against such event with a network of foreign plants, just like MNEs did. However, trade policy uncertainties such as the US-China trade war were found to be more likely to prompt reshoring and plant closures compared to temporary shocks. Notably, these decisions became more prevalent when the effects of both shocks were considered in conjunction. Overall, not only offshoring seems nowadays to be less advantageous than in the past, but income inequality and environmental concerns are also emerging as unintended consequences of a Global Value Chain (GVC).

It is worthwhile to point out that reshoring and offshoring are not precisely one the reverse of the other.

Dixit (1989) and Dixit and Pindyck (1994) provide an interesting point of view about the asymmetry between internationalization and de-internationalization processes. Specifically, internationalization strategies exhibit hysteresis due to sunk costs. In simpler terms, past investments in offshored locations meant for companies incurring in unrecoverable expenses and this has a long lasting effect on the strategy of the company itself. Then, because of sunk costs, which are cost incurred and not recovered, de-internationalization is not simply the reverse of internationalization. The authors state that there is a threshold of productivity below which companies keep exporting even though efficiency has fallen because of the costs related to setting up facilities abroad, to invest in physical assets, to gather information in the new country, to get used to the local bureaucratic processes, etc.

Damaraju et al (2015), in line with Dixit and Pindyck (1994) and Antras (2020), provide a different insight since they looked at things from the perspective of MNEs. They all agree that when uncertainty is high, companies prefer to wait and see what happens. This is called Real Options Theory and it assumes that companies wait for more information to be available before taking actions. Once again, firms incurred sunk costs that, by definition, cannot be recovered and so they prefer to wait before taking irreversible decisions and damaging their reputation. The larger the size of the MNE and the more pronounced this effect is, because they rather reorganize their activities among their worldwide distributed subsidiaries than divest.

Other academics (Liu and Li, 2020; Oh and Oetzel, 2011, 2017; Dai et al., 2013, 2017) investigated the case of firms exiting from foreign markets because of more country related exogenous unexpected shocks, such as conflicts, terroristic attacks, and natural disasters. However, this is a different scenario from the one analysed by Di Stefano et al, 2022, since

Covid-19 affected the whole world, while country related shocks can bring firms to simply relocate their activities in a less uncertain market.

This thesis will mainly focus on the backshoring of manufacturing activities, and not on services. This is because, as emphasised by Fratocchi et al (2013), service backshoring (i.e. call centres) usually entails lower entry barriers in terms of investments and, therefore, divesting decisions can be much easier than in the case of manufacturing activities. Also, service backshoring is restricted to a smaller number of countries for several reasons, such as language barriers. Lastly, there is not much literature available on such process compared to the manufacturing backshoring.

2.0 GENERAL DEFINITIONS GIVEN BY ACADEMIC LITERATURE

This section sheds some lights on the terminologies that will be used throughout the whole thesis. As a consequence, it provides definitions that are widely accepted by the academic literature about offshoring, reshoring, backshoring and related vocabularies.

According to Fratocchi et al (2013), offshoring is the process of relocating value-adding activities abroad, while they were previously carried out in the country of origin of the company. The reason behind this strategic choice is to serve a global demand, while creating and maintaining a sustainable advantage. This strategy can either be implemented by directly manufacturing in other countries (insourcing) via owned proprietary plants, or by creating a network of foreign suppliers (outsourcing).

A co-evolutionary perspective steps in and tries to explain why firms take such decisions. It is based on the idea that a number of factors influence each other's evolution and thus have a joint effect on the decision to dislocate production activities abroad. Schmeisser (2012) states that offshoring is the outcome of three variable at different layers of a company: the strategic mission (i.e. achieving certain efficiency), environmental factors and organization-specific factors (i.e. international knowledge and expertise).

A company might also decide to terminate its offshored activities abroad. There are different ways through which a company can achieve this outcome. Belderbos & Zou (2011) provides a definition for divestment as the strategic decision of terminating manufacturing activities in an existing affiliate country (total closure of activities abroad). The reason why a company would then take this decision could either be deliberate and voluntary, or due to events of force majeure (i.e. 2008 Financial Crisis).

Another way is to de-internationalize. Calof & Beamish (1995) emphasised that de-internationalization is the process of companies adapting their international exposure to the international environment. It could either be voluntary or forced, full or partial. Casson (1986) adds up saying that there are omission cases where firms should have de-internationalized, but they did not and commission cases where firms should not have started this process, but they did.

Divestment and de-internationalization are therefore different in many aspects. According to Reiljan (2004), divestment focuses on operational issues while de-internationalization focuses

on the target market or product dimension. However, he generally recognized that the reasons for such decisions overlap substantially: lack of international experience, change in strategy, poor performance and increased costs, and miscellaneous.

As the debate about relocating previously offshored activities becomes prominent, it is also true that there are different forms of international reorganization available for a firm. In other words, reshoring cannot be explained with a unique definition.

Liao (2010) suggests that a firm is in-shoring a good when it is procured within the boundaries of the company's home country. Specifically, in-shoring is the process of domestically procuring goods, either inside the company itself or from third party suppliers located in the firm's home country. On the other side, De Backer et al (2016) define onshoring as the process of locating production activities close to market demand. This means that an US firm might decide to locate in China some activities of its value chain because their Chinese market is rapidly growing.

According to Fratocchi et al (2013), backshoring is the voluntary decision of partially or fully relocating value-adding activities to the country of origin of the parent company. Specifically, captive backshoring implies that the company owns production sites in its home country and will proceed by manufacturing such products with its own assets, while outsourcing backshoring implies that the company relies on a supplier in its home country. Backshoring is not completely equivalent to foreign exits, divestment, and disinvestment, because the company could be still using foreign production plants to serve the local/regional market while having relocated back home other production activities.

Barney (1991) and Teece et al (1997, 2002) emphasised that the resource-based view of the firm can be applied to explain backshoring strategies. They argue that routines and organizational processes developed by a firm are acquired by expertise rather than the market. As a consequence, a company might decide to backshore because it did not develop and maintain such critical capabilities abroad or because it was not able to exploit the resources of the hosting country to gain a competitive advantage over competitors (Canham & Hamilton, 2013).

According to Dachs et al (2017), transaction cost theory can also help to understand backshoring since high and growing transaction and coordination costs can be the reason why companies decide to bring production activities back home.

Di Stefano et al, 2022 shaded some lights on nearshoring, saying that a company might also decide to relocate previously offshored activities not necessarily back to the home country of the company but rather to a neighbouring country (i.e. Mexico for US companies: flexibility, lower labour cost, improvements in training and infrastructure, changes in trade policies).

Overall, offshoring and reshoring are asymmetric. As stated by Di Stefano et al, 2022, in presence of sunk costs, a company is not willing to relocate back home its production activities, unless there are some large and permanent shocks to demand, trade, and foreign costs to induce such behavioural change. Also, reshoring does not necessarily involve the repatriation or closure of all the previously offshored activities. US companies may decide to backshore production activities from China back to the United States (or nearshore to Mexico), while at the same time continuing production in China to serve the local/regional market.

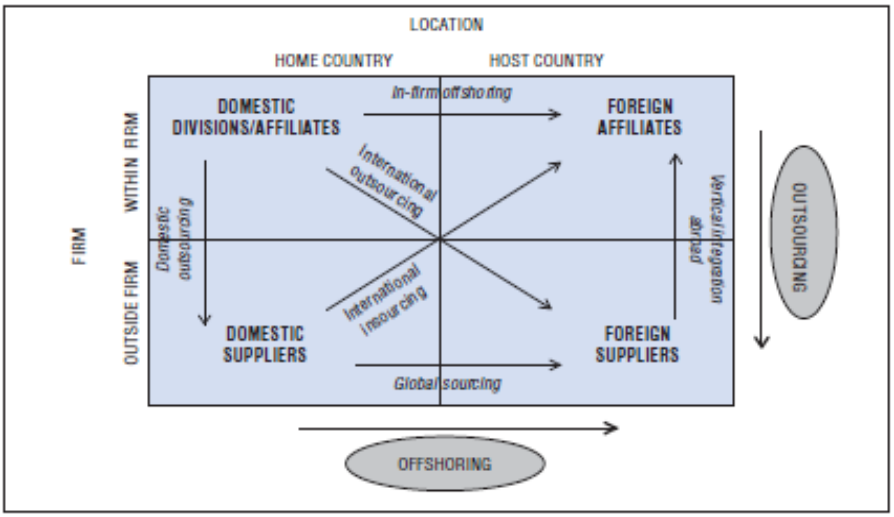


Figure 1 - Outsourcing and Offshoring
Source: OECD (2013)

3.0 A GROWING ATTENTION FOR RESHORING

Globalization made the world a more connected and interdependent place from economic, cultural, technological, and political perspectives. On the other hand, discussions about reshoring became more prominent when companies realized the problems associated with offshoring strategies.

As a natural consequence, offshoring is a younger phenomenon than reshoring. Specifically, the following graph by Cranfield University (2015) counts the number of media articles referencing to both of them. While the first media articles referencing reshoring appeared at the beginning of the 80s', offshoring was already a topic on the table from more than 10 years before.

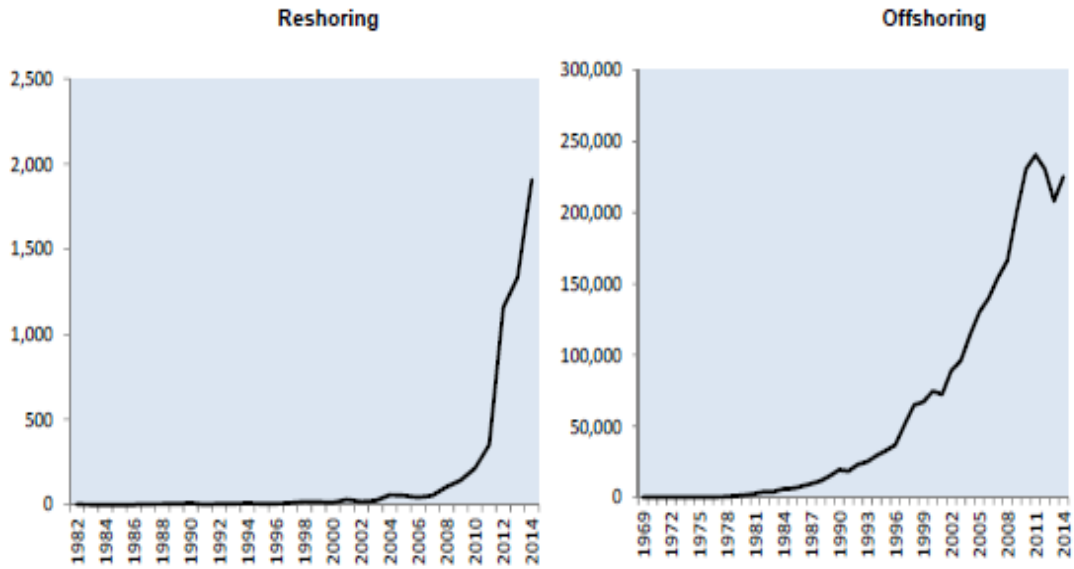


Figure 2 - Count of media articles referencing to reshoring and offshoring
Source: White Paper on Reshoring by Cranfield University (2015)

It is very interesting to observe that while reshoring became more and more important between 2010 and 2014, offshoring experienced a period of decline. However, as stated by De Backer et al (2016), the number of media articles referencing reshoring is only a fraction of those mentioning offshoring because of a higher availability of data and metrics.

De Backer et al (2016) also states that reshoring is nowadays a hot topic for the members of the Organization for Economic Cooperation and Development (intergovernmental entity with

38 member countries, as of August 2023). They hope that bringing back production activities will eventually tackle the high unemployment rate that is affecting most of them.

Specifically, the US are more concerned than European states about offshored manufacturing activities because they have not been historically exposed to this effect like the north American country did. In this context, the Boston Consulting Group (2011) released a report were 200 US companies with sales greater than USD 1 billion have been interviewed and approximately half of them was planning to bring back home some manufacturing activities to create more jobs.

However, not heavy reshoring trend seems to be undergoing at a global level. It appears that the world is still at the first stages of such phenomenon.

4.0 REASONS TO RESHORE: IS REGIONAL THE NEW GLOBAL?

There are many reasons why companies offshore value creating activities abroad. Among them, cost advantage and market proximity seem to be the most widespread. But why companies are now relocating back these manufacturing activities?

This paragraph aims at uncovering the problems related to the length and complexity of international and fragmented production networks, which are subject to a higher degree of risk and exposure from exogenous shocks.

To this extent, De Backer et al (2016) provided a detailed analysis about the many different reasons why nowadays reshoring is becoming a hot topic.

A) Higher Cost Structure

One of the most important changes over time is the higher cost structure in emerging countries. In other words, production costs have increased in emerging countries to the point that the competitive advantage that companies had is not anymore substantial as before. Also, overhead costs, such as energy and building, have increased. Sirkin et al (2012) stated that from 2010 to 2015 the Chinese labour cost grew from 31% to 69% of the corresponding American cost, at least in the most industrialized and developed areas of the country.

However, in case the increase in productivity rate offsets the increase in wage, then it might be still worth to invest in emerging markets. Also, offshoring value creating activities might still be advantageous, according to Akamatsu (1961) and Ozawa (2008), because companies tend to move their operations in the next emerging markets after that the previous country is not anymore appealing. This is called 'flying geese pattern', a metaphor that has often been used to describe industrial upgrading in Asia: Japan was the first goose in a V shaped formation, leading other economies towards industrialization, passing older technologies down to followers as it moves into newer ones. However, since these countries (Vietnam, Cambodia, etc) are in the middle of their growth process, might lack infrastructure and the adequate level of skills required in the labour force.

B) New Technologies

On the other side, new technologies have been developed over the last decades and now the digitalization process of manufacturing activities is pushing OECD economies to re-shore

value adding activities. These new technologies advances are expected to lower cost and increase quality production, making offshoring not so appealing.

C) Presence of Hidden Costs

Often companies miscalculate the costs when offshoring activities. They might not properly evaluate management, logistics, or operational problems. These 'hidden costs' ultimately shrink the expected profit margin of the company. On top of that, quality problems might arise, being the product manufactured below standards, and thus requiring new production runs and/or recall of deficient products. Kinkel & Maloca (2009) surveyed a pool of companies that offshored their activities and reported that quality concerns have been indicated by 53% of them as a major drawback. It is worth noticing that this problem has been mainly encountered when manufacturing products in China. This is one of the reasons why nowadays US companies prefer to nearshore to Mexico.

D) Corelated activities far from each other

There are a number of activities along the value chain (R&D, production, etc) that needs to be close to each other because the feedback coming from one of them heavily influence the outcome of the others. For this reason, shorter value chain are easier to manage.

E) Intellectual Property

Companies that offshore innovative activities in other countries are indirectly showing them their finest technologies, as well as patents, etc. On the other side, Intellectual property is not always well protected as in the company's home country. This ultimately leads to the fear that the supplier might become a competitor once they gain insights about the production processes of the company. This translates into additional efforts and costs for the companies to enforce their ownership rights over their intellectual properties.

F) Risks associated to a fragmented GVC

When fragmenting their value chain in geographically dispersed production activities, firms are exposing more and more their operations to disruption from unexpected events. One breakdown in one part of the supply chain often leads to repercussion all over their production processes. To hedge this risk, some companies are adding redundancy for some activities, while others are reducing the length of their GVC, bringing production closer to the market.

G) Proximity to the market can support flexibility

To gain flexibility and shorten lead times, some companies decide to move production close

to end markets. This fastens the time to market, allowing companies to quickly respond to changes in demand.

H) A weakening dollar and the shale gas/oil revolution in the US

Before the Ukraine-Russian war, energy costs were falling because of the increasing availability of shale gas and tight oil. This has been one of the reasons why energy-intensive industries were relocating back some production activities. For other industries, where energy costs are just a small fraction of total production costs, the impact has been much more limited.

After three years from the start of the pandemic, companies are adapting their strategies to diversify their risk and exposure to exogenous shocks. Some companies are reshoring production activities, other companies are increasing the number of their suppliers. Overall, firms want to gain flexibility and agility, while reducing the length of their GVC.

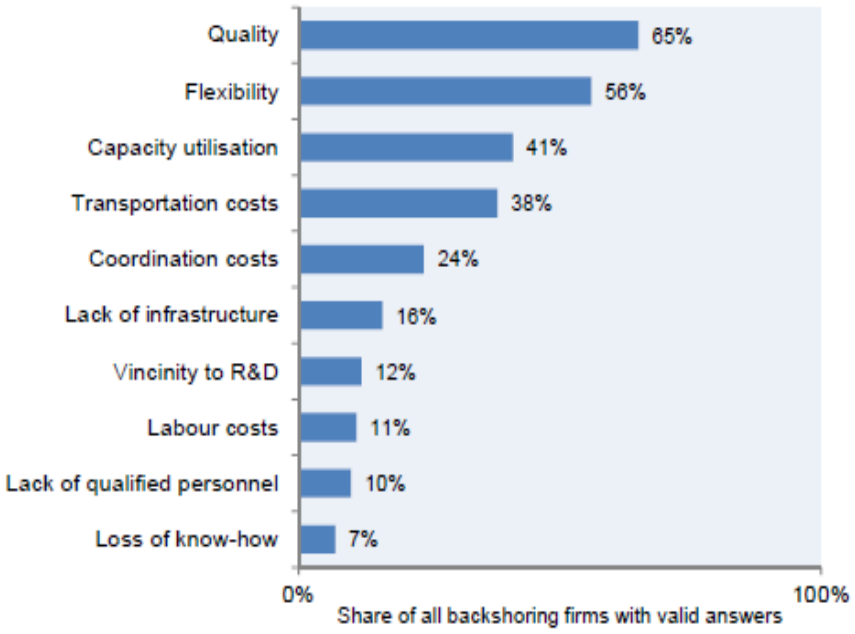


Figure 3 - Reasons for backshoring production, 2010-mid2012
Source: Dachs and Zanker (2014)

5.0 EVIDENCE ON RESHORING: MIXED AND FRAGMENTED

As emphasized by Fratocchi et al (2014), quantitative evidence on reshoring is still fragmented. This is because companies often do not disclose such strategic decision, otherwise the management would have to admit having made a serious mistake. On the other side, companies bringing activities back make an extensive and positive advertisement about this.

However, some secondary data have been collected in the form of reports about individual reshoring decisions, coupled with other information coming from a variety of sources. In addition, survey data are also available for several countries, even though their representativeness has not always been assessed.

5.1 EUROPE

The European Manufacturing Survey (EMS) has been organized by a consortium of research institutes and universities from and across Europe since 2001. It takes place every three year since then and it investigates technological and non-technological innovation in European industries. Compared to other surveys (i.e. Community Innovation Survey), it focuses more on diffusion and organizational innovation. For this reason, offshoring and reshoring trend have been depicted by the EMS.

Dachs and Zanker (2014) analysed the data from 2010 to mid-2012 for European companies based on the EMS. Specifically, data was based on the activities of 11 countries (Austria, Switzerland, Germany, Denmark, Spain, France, Hungary, Portugal, Netherlands, Sweden and Slovenia) and showed that just 4% of firms backshored production, while 17% of firms have offshored activities in the decade before. During this timeframe, offshoring was more important than backshoring.

This same survey showed that European companies share some common traits: the bigger the size of the firm and the higher the degree of technology of an industry and the higher the degree of backshoring. Eastern Europe countries represented almost two thirds of the source countries for backshoring by EU companies.

5.1.1 GERMANY, UK

A clear example of these European common traits is Germany. Between 1450-1650 observations have been gathered from the German Manufacturing Survey (1997, 1999, 2001, 2003, 2009 and 2012), and between 400 and 700 companies per year have backshored activities. More specifically, backshoring has followed a downward trend between 2010 to 2012, with a figure of roughly 2% of companies. This also applies for offshoring trend, which seems to be decreasing as well. However, companies offshoring activities abroad are nevertheless 4 times higher in number than companies backshoring production processes to Germany.

Leibl et al (2011) analysed 13 cases of backshoring strategies adopted by 11 German companies and found out that Germany brought activities back home mainly from China and Eastern Europe countries.

More interesting findings come from the "Innovation on Production" survey, which is developed by the Fraunhofer Institute for Systems and Innovation Research, and it is performed every two years starting from 1997.

Kinkel and Maloca (2009) found out that:

- just 2.5% of the 1663 firms surveyed backshored activities between 2004 and 2006;
- 17% of firms offshored activities between 2000 and 2001 and subsequently backshored those same activities between 2004 and 2006;
- 10% of companies that went through offshoring between 2002 and 2003, then backshored activities between 2004 and 2006.

Based on these findings, Kinkel and Maloca stated that between 15% and 25% of offshoring activities are countered by backshoring, during the subsequent 4-5 years to activation.

Therefore, reshoring seems to be a short-term correction for prior location misjudgements, rather than long term reactions to slowly emerging local development trends.

The same study pointed out the region of origin of the backshoring activity:

- 39% from new European Union members;
- 30% from EU15 members;
- 2% from China;
- 12% from the rest of Asia.

Evidence on backshoring to the United Kingdom is available from a variety of surveys, like the Business Brimingham in 2013. This survey uncovered that one third of manufacturers believe to source more domestically over the coming years. Other surveys are actually more focused on companies already brining activities back, such as the Manufacturing Advisory Science (2013) and the EEF – The Manufacturers' Organisation (2013), according to which just 15% of the companies surveyed were engaged in backshoring.

5.2 UNITED STATES (VS EUROPE)

A report from 2011 realized by Boston Consulting Group estimated that reshoring of US manufacturing could create between 2.5 and 5 million jobs by 2020. This survey underlines the decreasing cost advantage of establishing production activities in China. As a consequence, more and more US manufacturers are reaching a point where backshoring activities in their home country will be more convenient.

In 2013, Boston Consulting Group surveyed about 200 US companies with sales greater than USB 1 billion and found out that 54% of executives was planning to reshore some activities and that more than 20% of them were actively undergoing the process of bringing manufacturing activities back to the US soon.

However, the analysis undertaken by Hackett Group in 2012 shows that the increase in manufacturing capacity returning to developed nations only slightly counterbalances the ongoing offshoring of capacity. One more important finding coming from this study is that there will be a reallocation of production activities among low-cost countries, with China losing a considerable share of this market.

Fratocchi et al (2015) emphasised the differences in reshoring between USA and Europe. Even though there are quite the same numbers of reshoring cases for both of them, there are some quite interesting differences.

- reshoring in EU started way before than in the US, with cases of European companies dating back to the 1980s and the 1990s;
- nearshoring is slightly more frequent in Europe than in the US, although in both continents backshoring is still way larger than nearshoring;
- source countries for reshoring by US companies are especially China and other Asian countries, while for European countries are especially Eastern European countries;
- the phenomenon of "backshoring" is observed in various manufacturing sectors, encompassing both industries with lower technological demands, such as clothing in the EU

and furniture in the US, as well as those with higher technological requirements like electronics and appliances; on the other hand, "nearshoring" appears to be more focused on a limited range of industries, notably prominent in the European textiles and clothing sector.

5.3 ITALY

Di Stefano et al (2022) provide new evidence for Italian Multinational Enterprises. To do so, they based their research work on quantitative information for 5000 Italian firms coming from the Survey of Industrial and Service Firms, which provides firm-level data. They combine such data with qualitative information coming from the Business Outlook Survey of Industrial and Service Firms, which refers to 3000 industrial firms and 1000 non-financial private service firms. Both the survey and the investigation have been conducted by Bank of Italy in 2021.

5.3.1 MNEs AND NON MNEs (DURING THE PANDEMIC)

Despite the ongoing pandemic, multinational enterprises (MNEs) were found to record approximately double the revenues of non-MNEs on average, while also maintaining a workforce that was over 80% larger. Additionally, MNEs exhibited higher levels of productivity and engagement in export-related endeavours in comparison to non-MNEs, with 39% of their revenues originating from exports, as opposed to the 18% seen in non-MNEs.

	Non MNEs	MNEs
Age	40.74 (23.04)	43.57 (23.01)
Revenues	28453.2 (181856.6)	57495.9 (412257.6)
% of revenues from exports	0.179 (0.274)	0.395 (0.323)
Employment	90.5 (727.9)	157.6 (792.7)
Labor productivity (ln)	5.385 (0.902)	5.647 (0.875)
N	2809	443

Figure 4 - Descriptive Statistics
Source: Di Stefano et al (2022)

This analysis aims at understanding if Covid-19 pushed MNEs to close foreign plants and reshore their manufacturing activities in other countries. Di Stefano et al (2022) found out that the pandemic has been perceived as a temporary shock that did not cause MNEs to change their internationalization strategies, since settling a new plant in foreign countries entails incurring sunk costs.

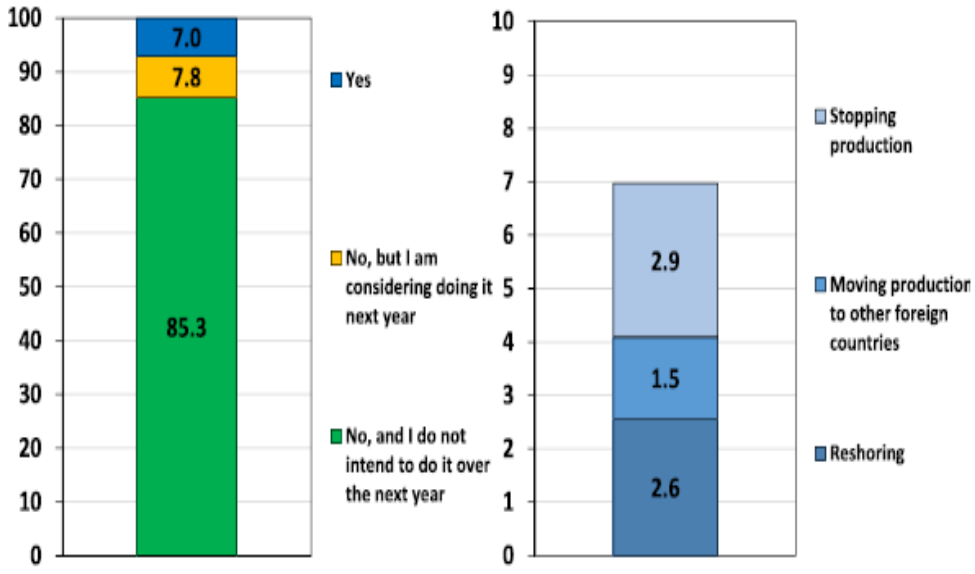


Figure 5 – Italian MNEs and plant closures
Source: Di Stefano et al (2022)

The graph provided illustrates that during the period from 2018 to 2020, over 85% of Italian multinational enterprises (MNEs) did not enact any closures of their international facilities. What's even more significant is that these MNEs have no imminent intentions of closing down operations, despite the ongoing pandemic. Among the companies surveyed, merely 7% responded affirmatively to this question. Furthermore, upon closer examination, only 2.6% reported instances of reshoring, while fewer than 2% opted to relocate their production to alternative locations.

This indicates that multinational enterprises (MNEs) favour alternative strategies to enhance their resilience. Approximately 60% of companies intend to diversify their supplier base, while nearly half of the total is contemplating raising the optimal inventory levels for both raw materials and finished goods. This approach aims to enable a more adaptable and rapid response to uncertainties.

Furthermore, the act of reshoring production from China has displayed a declining pattern over the past decade, decreasing from 22% in 2012, to 15% in 2015, and further down to 11% in 2020. Merely 4% of US multinational corporations had intentions to fully bring back production from China to the US.

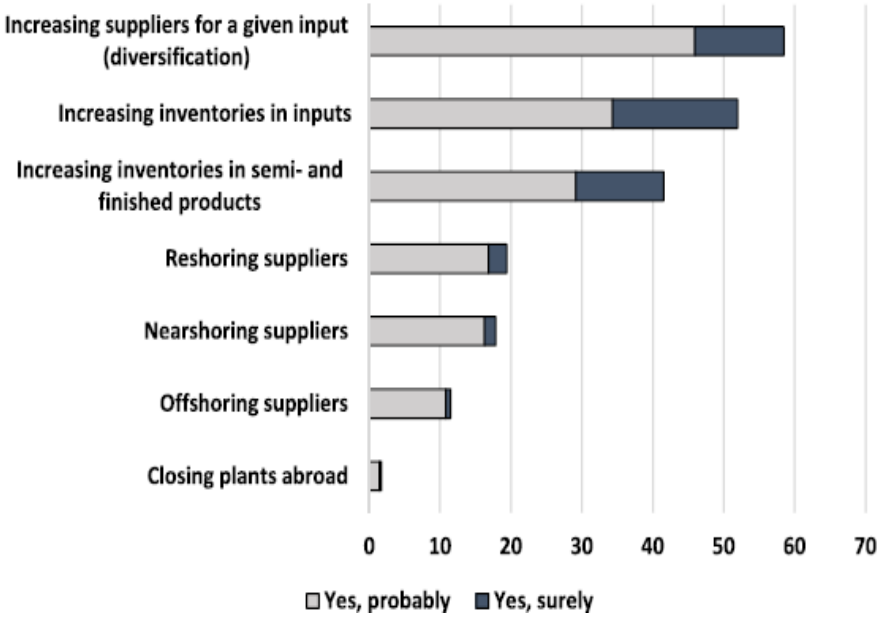


Figure 6 - Planned strategies to increase resilience
Source: Di Stefano et al (2022)

However, it's worth noting that the dataset under analysis only encompasses a span of one or two years into the pandemic. It's plausible that shifts in firms' internationalization strategies might necessitate more time to become evident. There might be new developments for future reshoring trends, especially in response to recent geopolitical disruptions that have impacted the global economy.

5.3.2 MNEs AND NON MNEs (DURING THE PANDEMIC) – DETAILED PERFORMANCE ANALYSIS

Going further in their analysis, Di Stefano et al (2022) built a linear regression model to analytically understand if there has been a difference in performance between Italian MNEs and Italian non-MNEs.

They conducted a regression analysis involving various indicators of a firm's performance (denoted as Y) and compared it with the firm's level of internationalization, a dummy taking value 1 if the company has plants abroad (MNE) or if it is a two ways trader with no plants

abroad (ImpExp).

$$Y_i = \alpha + \beta MNE + \gamma ImpExp + Z_i' \Gamma + \epsilon_i$$

In particular, firm's performance proxies are:

- dRev2020, growth in revenues between 2020 and 2019;
- DropRev2020, a dummy taking value 1 if the firm has reported a drop in revenues higher than 30% over the entire 2020;
- DropRevQ1Q3, same as above but in the first three quarters of the year;
- drev2020F, growth in revenues coming from selling in the foreign markets;
- dSmartWork, percentage change in the share of employees in remote working in 2020 with respect to 2019;
- dRev2020-E[dRev(2020)], the difference between the realized growth in revenues in 2020 and the expected growth formulated right after the Covid-19 outbreak;
- SupplyProbl, a dummy taking value 1 in the firm has faced supply shortages;
- SupplyProdStop, a dummy taking value 1 in the firm has faced sever supply shortages that led to plant shutdowns;

Other characteristics of firms (age, employment productivity in 2019, etc) have been added as covariates (in the matrix Z). Also, there is a dummy taking value 1 if the firm stopped the production in 2020 due to shutdowns mandated by national or local decrees (GovStop).

The coefficients β and ϒ measure the effect on performance of the degree of international involvement of the firm, for given characteristics of the firm itself. They are evaluated in 2020 with respect to simple exporters and domestic firms, which are the reference category in the regression.

Multinational enterprises (MNEs) demonstrated greater adeptness in managing the challenges posed by the Covid-19 crisis when compared to two-way traders and exporters who shared similar attributes. This was evident in several dimensions:

- MNEs exhibited higher revenue growth in 2020 (as shown in column 1);
- They experienced less substantial contractions in revenues, both exceeding 30%, in 2020 as well as during Q1-Q3 of 2020 (highlighted in columns 2 and 3);
- MNEs displayed higher sales in foreign markets compared to firms solely engaged in exporting (as indicated in column 4);
- The disparity between their realized and anticipated sales in 2020 was more pronounced

among MNEs, indicating an outperformance relative to other companies after the pandemic's onset (column 6);

- MNEs embraced increased remote working and engaged more extensively in two-way trading activities (column 5);

- Both MNEs and the other categories encountered supply disruptions (column 7);

- While both groups faced a heightened vulnerability to production stoppages due to supply shortages caused by foreign shocks, their resilience resulted in a lower probability of production halts (particularly pronounced among MNEs). Conversely, small and medium-sized enterprises endured more substantial losses.

	(1) dRev2020	(2) DropRev2020	(3) DropRevQ1Q3	(4) $dRev2020_F$
MNEs	2.050*	−0.063**	−0.105***	7.515***
	(1.80)	(−2.49)	(−2.64)	(3.24)
Two-way traders	−0.863	0.002	−0.009	1.672
	(−0.99)	(0.09)	(−0.29)	(0.98)
GovStop	−0.856	−0.002	0.045	−2.893
	(−0.82)	(−0.06)	(1.21)	(−1.45)
Age	−1.269**	0.016	0.009	−0.798
	(−2.00)	(1.02)	(0.41)	(−0.59)
$log(labprod)_{2019}$	0.566	−0.001	−0.047**	−2.817
	(0.75)	(−0.04)	(−2.00)	(−1.60)
$log(emp)_{2019}$	0.128	−0.005	0.008	−0.543
	(0.29)	(−0.56)	(0.51)	(−0.75)
Observations	2045	2045	2076	1666
NUTS3 FE	Y	Y	Y	Y
3-digit Sector FE	Y	Y	Y	Y
	(5) dSmartWork	(6) dRev2020-E(dRev2020)	(7) SupplyProbl	(8) SupplyProdStop
MNEs	3.937***	4.961**	0.106***	0.067**
	(3.15)	(2.14)	(2.90)	(2.01)
Two-way traders	2.489***	0.609	0.062*	0.047*
	(3.50)	(0.32)	(1.98)	(1.76)
GovStop	−1.343	0.882	−0.015	0.001
	(−1.27)	(0.36)	(−0.51)	(0.03)
Age	−0.324	−0.030	−0.032	−0.029
	(−0.41)	(−0.02)	(−1.14)	(−1.50)
$log(labprod)_{2019}$	4.167***	−0.608	0.046**	0.007
	(4.59)	(−0.40)	(2.03)	(0.37)
$log(emp)_{2019}$	3.518***	−0.628	−0.023	−0.024**
	(8.09)	(−0.74)	(−1.62)	(−2.19)
Observations	1973	941	1889	1889
NUTS3 FE	Y	Y	Y	Y
3-digit Sector FE	Y	Y	Y	Y

Note: Standard errors clustered at the 3-digit sector level. Sample weights are used in the regressions. *t*-statistics in parentheses. *: $p < 0.1$; **: $p < 0.05$; ***: $p < 0.01$.

Figure 7 - MNEs performance in 2020
Source: Di Stefano et al (2022)

This discrepancy can be attributed to MNEs' diversified presence across foreign nations, which enabled them to hedge against disruptions caused by Covid-19. Their capacity to mitigate risks was bolstered by a network of suppliers and buyers situated in different countries, minimizing the impact of simultaneous shocks. MNEs enjoyed enhanced flexibility in seeking alternative suppliers and buyers, enabling them to counterbalance specific idiosyncratic shocks more effectively.

Subsequently, they conducted a distinct regression analysis focusing on the subset of companies for which plant locations were observable.

$$dRev2020_i = \beta_0 + \beta_1 \#of locations + \beta_2 log(GDP) + \beta_3 CovidCases + Z_i \Gamma + u_i$$

This aimed to assess whether the performance during 2020 was influenced by the following factors:

- The extent of cross-country diversification in the international portfolio, indicated by the count of countries where the MNE maintains foreign plants (#oflocations).
- The average exposure to Covid-19 across foreign locations, represented by the mean number of Covid-19 cases in the foreign locations where the firm operates (CovidCases).
- An additional parameter employed to control for the average real GDP across the various foreign locations.
- Firm-level characteristics specific to the domestic market (Z), including factors such as age, productivity, changes in domestic revenues during 2020, and production stoppages resulting from government decisions.

	(1) dRev2020	(2) $dRev2020_D$	(3)	(4) $dRev2020_F$
# of locations	0.14*	−0.42	0.20*	0.22***
	(1.77)	(−1.08)	(1.87)	(2.83)
log(GDP)	0.99	−0.29	2.94**	1.17*
	(1.18)	(−0.14)	(2.07)	(1.66)
CovidCases	−1.43	1.54	−3.00*	−1.63**
	(−1.60)	(0.74)	(−1.85)	(−2.10)
GovStop	−2.17	1.91	1.17	−2.29
	(−0.83)	(0.33)	(0.27)	(−0.97)
$dRev2020_D$				0.19***
				(4.16)
Age	−3.89**	−2.82	−5.36**	−3.38**
	(−2.30)	(−0.74)	(−2.14)	(−2.25)
$log(labprod)_{2019}$	−0.15	9.49*	−1.17	−2.01
	(−0.10)	(1.97)	(−0.42)	(−1.44)
Observations	206	205	203	202
Sector	Y	Y	Y	Y
NUTS2 Region	Y	Y	Y	Y

Note: Robust standard errors. Sample weights are used in the regressions. *t*-statistics in parentheses. *: $p < 0.1$; **: $p < 0.05$; ***: $p < 0.01$.

Figure 8 - Italian MNEs diversification and performance
Source: Di Stefano et al (2022)

Their findings indicate that the diversification of the international portfolio holds significance and serves as a pertinent avenue for predicting the comprehensive revenue shift in 2020 (shown in column 1). Notably, there is an absence of correlation between diversification and alterations in domestic revenues (column 2), whereas revenues originating from foreign markets experience a positive impact (columns 3 and 4). Furthermore, heightened exposure to Covid-19 in foreign markets corresponds to decreased revenues. Taken together, the existence of diverse supply and demand sources has the potential to diminish susceptibility to risks.

5.3.3 REAL CAUSES FOR RESHORING AND PLANT CLOSURES (FEW CASES)

To illuminate the influence of various shock types, Di Stefano et al (2022) employ a Probit model in which the dependent variable is the likelihood of multinational enterprises (MNEs) closing one or more foreign plants between 2018 and 2020. This likelihood is contingent on the following factors:

$$Pr(Close_{i,18-20} = 1) = \Phi(\beta_0 + \beta_1 TradePolicy_i + \beta_2 CovidShock_i + Z_i\Gamma + u_i)$$

- Trade policy effects, represented by variables such as UStariff (a binary indicator taking the value 1 if the MNE reports adverse impacts on sales due to US tariffs in 2018-2019) and Brexit (a binary indicator taking the value 1 if the MNE anticipated post-Brexit tariff introductions before the EU deal).

- The impact of the Covid shock, with variables like GovStop (a proxy indicating whether production was externally halted due to government decrees) and SupplyPRobl (reflecting Covid-19-related supply disruptions).

Lastly, the variable Z includes supplementary proxies for firm performance and size, encompassing factors such as average labor productivity, employment figures, the percentage change in revenues between 2015 and 2017, and the age of firms.
Given the specific nature of the phenomenon under investigation, the analysis involved a limited volume of observations. Nonetheless, this modest dataset was sufficient to discern that MNEs respond diversely depending on the specific type of shock they encounter.

	(1)	(2)	(3)	(4)	(5)	(6)
			$Prob(Close_{i,18-20} = 1)$			
UStariffs	0.098**	0.122***	0.116***	0.102***	0.076**	0.076**
	(2.35)	(3.06)	(2.90)	(2.74)	(2.12)	(2.12)
Brexit				0.086***	0.085**	0.084**
				(2.61)	(2.57)	(2.50)
GovStop	0.030	0.048	0.040	0.026	0.027	0.029
	(0.76)	(1.24)	(1.11)	(0.69)	(0.72)	(0.77)
SupplyProbl		−0.038	−0.047	−0.050	−0.043	
		(−1.11)	(−1.32)	(−1.48)	(−1.21)	
SupplyProdStop						−0.001
						(−0.22)
$dRev_{2020}$	−0.003**	−0.002*				
	(−2.41)	(−1.86)				
$DropRev_{2020}$			0.132***	0.145***	0.128***	0.126***
			(2.95)	(3.25)	(2.82)	(2.80)
$dRev_{15-17}$	−0.006**	−0.006**	−0.006**	−0.005***	−0.004*	−0.004*
	(−2.21)	(−2.41)	(−2.44)	(−2.62)	(−1.82)	(−1.79)
Age	−0.084***	−0.103***	−0.101***	−0.076***	−0.058**	−0.052*
	(−2.64)	(−3.23)	(−3.21)	(−2.67)	(−1.97)	(−1.69)
$log(labprod)_{15-17}$	−0.061**	−0.062**	−0.055**	−0.054**	−0.054**	−0.051**
	(−2.14)	(−2.35)	(−2.36)	(−2.31)	(−2.34)	(−2.11)
$log(emp)_{15-17}$	0.010	0.008	0.007	0.007	0.008	0.009
	(0.95)	(0.84)	(0.75)	(0.78)	(0.81)	(0.88)
Observations	265	244	244	244	234	234
Sector-NUTS1 Region	Y	Y	Y	Y		
Sector					Y	Y
NUTS2 Region					Y	Y

Notes: The table reports marginal effects. Robust standard errors. *t*-statistics in parentheses. *: p < 0.1; **: p < 0.05; ***: p < 0.01.

Figure 9 - Determinant of plant closures
Source: Di Stefano et al (2022)

In the first column of analysis, several insights can be drawn:

- Italian multinational enterprises (MNEs) experience both direct and indirect effects due to US Tariffs, exemplifying protectionist trade policies. The presence of these policies increases the likelihood of MNEs closing foreign plants.
- The risk of plant closures diminishes for the same companies in relation to shutdowns triggered by the Covid-19 outbreak.
- Furthermore, companies that exhibit growth in revenues and productivity between 2015 and 2017 demonstrate a lowered estimated probability of plant closures. Thus, firms that experience revenue and productivity growth are less prone to shuttering foreign plants.

In column 3, it becomes evident that significant revenue loss in 2020 correlates strongly with plant closures. This underscores that although the revenue shock is transitory, substantial losses lead to plant closures, particularly when the magnitude is significant.

Columns 4 to 6 introduce Brexit as an additional proxy of trade protectionism, revealing that it wields nearly the same influence on the likelihood of plant closures as US Tariffs.

In summary, the decisions to close foreign production facilities are significantly impacted by trade policies and trade-related uncertainties. The Covid-19 shock, represented by external plant closures and supply disruptions, does not appear to adversely affect internationalization strategies. However, the sharp decline in recent revenues, a hallmark of classic demand shock, plays a role.

The subsequent table indicates that firms have adapted their expectations and strategies as the pandemic has unfolded. This adaptation accounts for various shocks, including the Ukrainian-Russian conflict and Brexit. Both these events emerge as primary sources of uncertainty for firms when it comes to internationalization strategies involving plant closures, reshoring suppliers, or diversifying input sources.

	(1) $Prob(Close_{22-23})$	(2) $Prob(ReshSupply_{22-23})$	(3) $Prob(DivSupply_{22-23})$
Brexit	0.031*	0.073**	0.107***
	(1.83)	(2.18)	(2.77)
UKR-RUS War	0.047*	0.176***	0.168***
	(1.91)	(5.42)	(5.40)
GovStop	0.027	−0.029	0.046
	(1.31)	(−0.78)	(1.12)
SupplyProbl	0.038*	0.172***	0.141***
	(1.94)	(5.61)	(3.65)
$dRev_{2021}$	−0.013	−0.043	0.220**
	(−0.32)	(−0.51)	(2.48)
$dRev_{2020}$	−0.007	0.034	0.132
	(−0.08)	(0.33)	(1.19)
Age	0.003	−0.000	0.040
	(0.17)	(−0.00)	(1.38)
$log(labprod)_{2020}$	0.003	−0.072***	−0.098***
	(0.26)	(−3.01)	(−4.18)
$log(emp)_{2020}$	0.002	0.032**	0.038***
	(0.26)	(2.45)	(2.76)
Observations	394	1257	1439
Sector	Y	Y	Y
NUTS2 Region	Y	Y	Y

Notes: The table reports marginal effects. Robust standard errors. *t*-statistics in parentheses. *: $p < 0.1$; **: $p < 0.05$; ***: $p < 0.01$.

Figure 10 - Internationalization strategies in the near future
Source: Di Stefano et al (2022)

Notably, the results show that Covid-related supply disruptions now hold predictive power for foreign plant closures, reshoring of suppliers, and increased diversification of suppliers. This underscores that, after two years into the pandemic, firms have potentially revised their perceptions of the pandemic's duration, beginning to perceive it as a long-lasting phenomenon.

5.3.4 DIFFERENT PERCEPTIONS AND INTERNATIONALIZATION STRATEGIES

Di Stefano et al (2022) also formulated a theoretical framework outlining how varying perceptions of shocks can influence the internationalization strategies of multinational enterprises (MNEs). They demonstrated the asymmetrical nature of decisions to offshore and reshore production due to hysteresis stemming from sunk costs. They emphasized that not only the magnitude of the shock, but also its perceived persistence over time, holds significance.

To achieve this, they constructed a model where:
- The demand aspect adheres to conventional practices, featuring a representative consumer who derives utility from a homogeneous standard good and a differentiated good encompassing a range of varieties;
- The supply aspect focuses on two key components: establishing a plant either domestically or abroad, and firms maximizing profits within a multi-period context, driven by forward-looking behaviour.

As their interest lies in the production location decision, they narrow down the firm's choices to three: domestic production, foreign production, and the decision to continue or cease operations. Firm profits are contingent on variable production costs associated with each location and the sunk costs linked to establishing production facilities.

At the outset of the model, they simulate that all firms are inactive (at time 0), differing solely in productivity levels. Only a small fraction (around 5%) of firms opt for offshore operations.

In subsequent simulation rounds, the focus shifts to internationalized firms, delving into the impact of diverse shock types—namely, changes in demand and tariffs. Notably, a temporary demand shock alone doesn't influence the proportion of offshoring firms. This implies that the initial shock wasn't significant enough to warrant the sunk cost associated with changing production locations. In contrast, even though the increase in tariffs is relatively modest, it

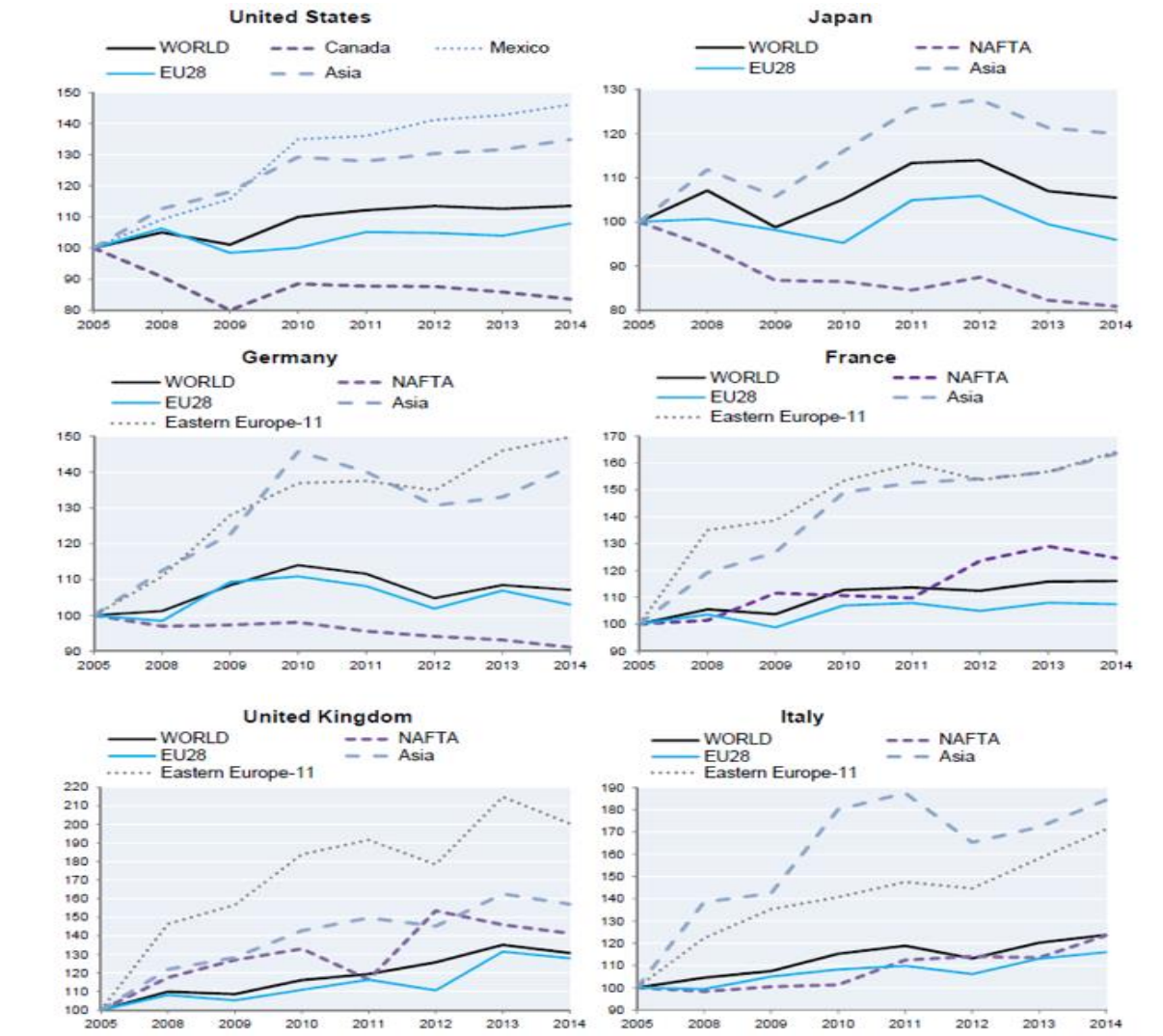
triggers reshoring due to its permanent nature. The combined impact of these factors further stimulates reshoring. Firms opting for relocation are those where the reduction in future profit streams outweighs the sum of profit margins and the sunk cost of relocating.

In a simplified two-period version of the model, where firms decide between domestic and foreign production locations, they highlight that firms choosing to offshore tend to be more productive from the outset. Additionally, even after a shock, these firms might opt to remain abroad. Larger and more productive firms are more inclined to offshore, as their past decisions hold weight and internationalization strategies aren't easily reversible or modifiable. Instead, they tend to exhibit hysteresis effects, demonstrating that past decisions significantly impact present choices. This suggests that certain shocks could substantially decrease a firm's profits yet not necessarily influence its location decisions.

While these findings provide insightful perspectives, the sample size remains limited. Moreover, only a subset of the sample possesses information regarding the effects of both trade policies and Covid-19. Additionally, the observation period is constrained, and the consequences of the shock could evolve based on the pandemic's progression and policy responses. Notably, significant shifts in international exposure and patterns might not be immediately apparent due to the time required for reorganization.

5.4 AGGREGATE DATA - THE SHARE OF IMPORTS IN DOMESTIC DEMAND

De Backer et al (2016) tackled the examination of backshoring by adopting an approach that hinges on its aggregate ramifications, commencing from conventional economic data. The initial logical metric utilized to contribute to the reshoring discourse is the proportion of domestic demand met by imports. The underlying notion here is that if the resurgence of backshoring is gaining prominence, one could anticipate a gradual transition of domestic demand from imports to domestic production. Essentially, as backshoring potentially replaces outsourcing and offshoring with local production, the portion of domestic demand satisfied by imports should decline over time.



Note: Eastern Europe-1 includes Poland, Hungary, the Czech Republic, the Slovak Republic, Romania, Bulgaria, Estonia, Latvia, Lithuania, Slovenia and Croatia.
Source: Calculations based on different OECD databases (Bilateral Trade by Industry and End-use, Trade in Value Added, and Mai Economic Indicators).

Figure 11 - Evolution in [import/domestic demand], 2005-2014
Source: De Backer et al (2016)

On the graphical representation, the y-axis represents the proportion of domestic demand fulfilled by foreign products (imports), while the x-axis represents time.

From the graph, it is discernible that for the majority of countries, the fraction of domestic demand served by imports has displayed a deceleration in recent years. However, a complete reversal from offshoring to reshoring has not yet materialized. In nations like the US, France, and Italy, offshoring trends continue to rise. Conversely, in countries like Japan, Germany, and the UK, the share of imports in domestic demand has dwindled in recent years.

Zooming in, it's evident that the Asian region (with the exception of Japan and Korea) remains pivotal for several significant countries in terms of imports. This could be attributed to the redirection of production from China to other nations, as China's cost structure experiences an increase.

This evidence doesn't negate the existence or significance of backshoring; rather, it underscores that although backshoring is a reality, its pronounced aggregate impacts on national economies are not yet distinctly manifest.

5.5 GEOGRAPHICAL DISTRIBUTION OF PRODUCTIVE RESOURCES

De Backer et al (2016) delve further into their research by elaborating that if backshoring activities were indeed occurring, one would anticipate observing shifts in the geographical allocation of multinational enterprises' (MNEs) production factors. This would manifest as a growing portion of productive resources being deployed in the home countries of these companies.

To investigate this, they scrutinize the OECD Activity of MNEs database, a repository containing data on inward and outward investments. The focus countries for analysis encompass the United States, France, Germany, Sweden, Finland, Hungary, and Poland. Notably, the data on US MNEs offers the most comprehensive insight, enabling an exploration of the geographic dispersion of both labour and capital (including investments in machinery, buildings, etc.) within MNE networks.

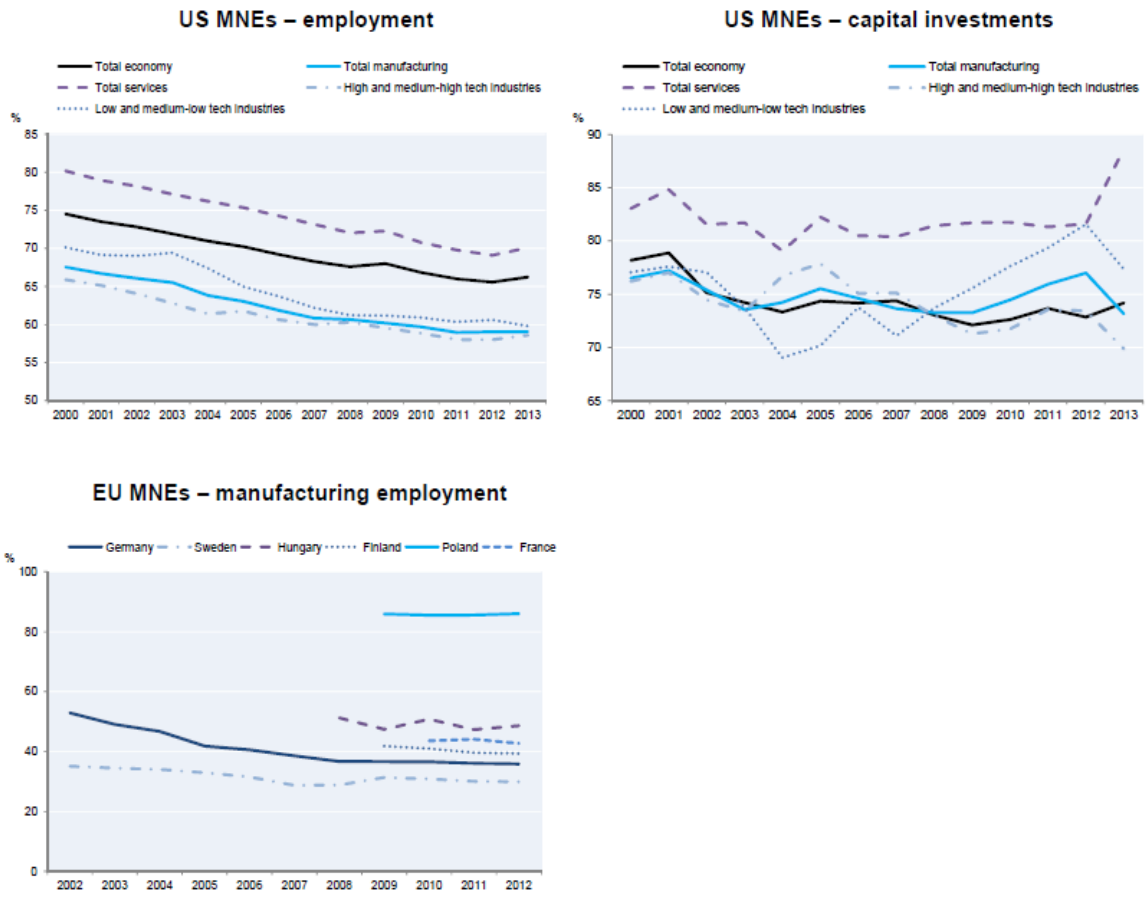


Figure 12 - Home country share in MNEs' deployment of productive resources
Source: De Backer et al (2016)

For US MNEs, the findings reveal no discernible increase in the proportion of employment situated within their home country. However, there's some evidence indicating a heightened concentration of capital investment within the US. Specifically, until 2013, US MNEs in low and medium-low technology manufacturing sectors have allocated a rising share of capital investments domestically. Likewise, other manufacturing industries exhibit indications of backshoring through capital investments until 2013, with the service sector witnessing a surge in backshoring activity in 2013. Overall, the results once again present a somewhat mixed picture and even cast doubts on the direct employment implications of backshoring. The return of US MNEs' activities doesn't necessarily translate into an increase in the number of jobs but rather seems to signify a reversal of the decline in manufacturing jobs.

The analysis also considers the emergence of nearshoring, particularly by US MNEs. The data provides stronger support for nearshoring to Mexico compared to backshoring to the US.

There's a clear upward trend in the proportion of both employment and capital investments allocated by US MNEs in Mexico, specifically in the manufacturing sector. However, the data does not support the notion of significant nearshoring to Canada.

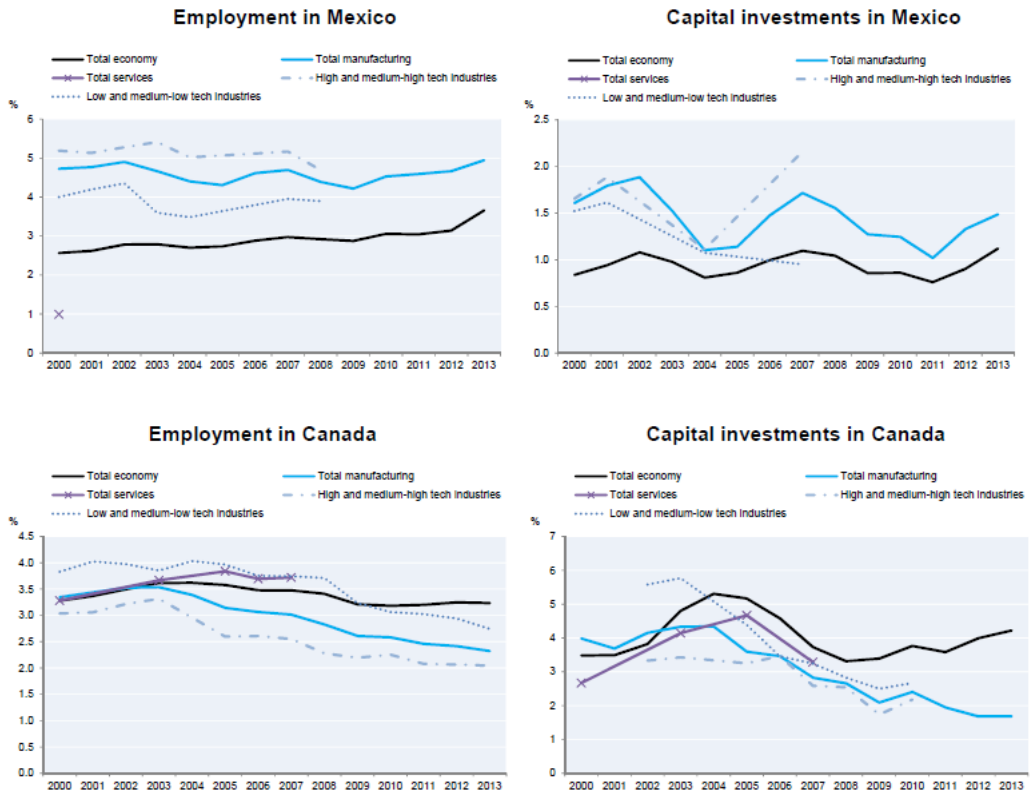


Figure 13 - Share of US MNEs' employment and capital investments in Mexico and Canada
Source: De Backer et al (2016)

Conversely, data pertaining to European MNEs is considerably more limited. It indicates that the geographic distribution of employment for French, German, Swedish, Polish, Hungarian, and Finnish MNEs is not shifting significantly towards their respective home countries. In contrast to US MNEs, the share of employment within European MNEs' home countries has remained relatively stable during the available recent years of data. This suggests that any employment reallocation due to backshoring and further offshoring tends to offset each other.

However, it's essential to emphasize that this aggregate evidence should be interpreted with caution. It offers only indirect insight into the presence of reshoring. The variations in MNEs' employment or capital investment allocations between home and abroad might be linked to factors beyond the scope of backshoring.

5.5.1 GEOGRAPHICAL DISTRIBUTION OF PRODUCTIVE RESOURCES – ECONOMETRIC ANALYSIS

To systematically explore evidence of reshoring activities by multinational enterprises (MNEs), De Backer et al (2016) conducted an econometric analysis utilizing the BvD ORBIS database (2011 edition). This dataset offers comprehensive balance sheet information, including details about employment and fixed assets, for a multitude of companies spanning numerous OECD and non-OECD member countries. It also encompasses ownership and group structure information.

While the dataset is abundant in information, it does possess certain noteworthy limitations, particularly concerning its coverage and comprehensiveness. Notably, it has been noted that the ORBIS database's coverage is comparatively less extensive for small firms. However, given that the primary focus of this analysis is on MNE-affiliated entities, this limitation should pose a lesser concern.

Across the studied period, the proportion of MNE affiliates in this dataset ranges from 1.9% to 3.2%. Less than half of the sample consists of companies located in OECD high-income countries. The remaining portion is predominantly made up of companies situated in upper middle-income countries like Brazil, China, and Russia. Additionally, around 4% of companies are based in lower middle-income or low-income countries.

Year	Freq.	% Share Group	% Share MNEs	% MNE affiliates at home	% Share high income countries
2003	697,736	27.7	3.0	1.1	53.9
2004	932,330	23.6	2.7	1.0	43.8
2005	974,124	22.4	2.8	1.1	47.3
2006	1,178,676	24.6	2.6	1.0	47.4
2007	1,397,821	21.0	2.2	0.8	59.1
2008	1,639,852	18.8	1.9	0.7	52.6
2009	1,927,132	16.2	2.2	1.0	72.1
2010	700,489	11.9	3.2	1.8	88.5

Figure 14 - Sample Composition
Source: De Backer et al (2016)

The analysis starts with the estimation of a baseline model to assess if the findings on the geographic distribution of productive resources within MNE networks are confirmed. To analyze whether employment and fixed capital investments of MNE affiliates ‘’at home’’ (i.e. headquarters and affiliates in the home country) show a distinctive trend over time as compared to MNE affiliates abroad, the following model was estimated:

$$y_{it} = YEAR_t + MNE_t + MNEHOME_t + averageemployment_{it} + FIRM\_FE_i + \varepsilon_{it}$$

The dependent variable yit is the one-year growth rate of total employment or in fixed assets. The subscript i indexes' firms and t the years. The growth rate is calculated as the year-to-year variation in employment or fixed assets over the average value over the two years:

$$Growth(y)_t = (y_t - y_{t-1})/[0.5 * (y_t + y_{t-1})]$$

The independent variables are:

- a year dummy;
- year specific MNE (equal to 1 if the company is part of a MNE group in a given year); it corresponds to the average percentage difference of employment of MNE-affiliates with respect to non-MNE affiliates in the same country-year, expressed in difference from the baseline year 2003, keeping fixed all firms' time-invariant characteristics (e.g. sector);
- MNEHOME (equal to 1 if the company is part of a MNE group in a given year and it is located in the same country as the group headquarter); it tells whether there is an additional effect specific for companies that are located in the same country as the MNE headquarter;
- the average firm employment over the full period interacted with the year dummy;
- a firm fixed effect

Dependent variable	Growth rate fixed assets		Growth rate employment	
Sample	All countries	Hi-income	All countries	Hi-income
YEAR=2005	0.125***	0.00478	-0.00621***	-0.00399***
	(0.00211)	(0.00383)	(0.000710)	(0.00101)
YEAR=2006	-0.0557***	-0.0380***	-0.0238***	-0.00498***
	(0.00191)	(0.00330)	(0.000692)	(0.000993)
YEAR=2007	-0.0653***	-0.0509***	-0.0388***	-0.0109***
	(0.00200)	(0.00336)	(0.000688)	(0.000983)
YEAR=2008	-0.0367***	-0.0409***	-0.0589***	-0.0407***
	(0.00193)	(0.00349)	(0.000717)	(0.00100)
YEAR=2009	-0.154***	-0.106***	-0.135***	-0.0900***
	(0.00347)	(0.00348)	(0.000918)	(0.00105)
YEAR=2010	-0.00704***	-0.00667*	-0.0910***	-0.0654***
	(0.00261)	(0.00344)	(0.00139)	(0.00146)
YEAR=2005 & MNE=1	-0.120***	-0.0126*	0.00342	0.00436
	(0.00596)	(0.00695)	(0.00411)	(0.00419)
YEAR=2006 & MNE=1	0.0334***	0.0195***	0.0150***	-0.000644
	(0.00610)	(0.00694)	(0.00396)	(0.00418)
YEAR=2007 & MNE=1	0.00890	8.93e-05	0.0253***	0.00751*
	(0.00622)	(0.00708)	(0.00396)	(0.00415)
YEAR=2008 & MNE=1	-0.0567***	-0.0444***	0.0211***	0.0177***
	(0.00655)	(0.00748)	(0.00396)	(0.00410)
YEAR=2009 & MNE=1	0.0256***	-0.0106	0.0369***	0.00307
	(0.00709)	(0.00738)	(0.00414)	(0.00423)
YEAR=2010 & MNE=1	-0.0513***	-0.0462***	0.0302***	0.0128**
	(0.0126)	(0.0130)	(0.00621)	(0.00630)
YEAR=2005 & MNEHOME=1	0.0163*	0.0279***	0.00871	-0.00125
	(0.00880)	(0.00901)	(0.00622)	(0.00609)
YEAR=2006 & MNEHOME=1	0.0215**	0.0214**	0.00975	0.00323
	(0.00911)	(0.00938)	(0.00619)	(0.00620)
YEAR=2007 & MNEHOME=1	0.0417***	0.0385***	0.0145**	0.00218
	(0.00921)	(0.00948)	(0.00616)	(0.00618)
YEAR=2008 & MNEHOME=1	0.0918***	0.0944***	0.0223***	0.00325
	(0.00972)	(0.0101)	(0.00618)	(0.00616)
YEAR=2009 & MNEHOME=1	0.0630***	0.0554***	0.0303***	0.0121*
	(0.00961)	(0.00984)	(0.00634)	(0.00633)
YEAR=2010 & MNEHOME=1	0.00827	0.00677	-0.00270	-0.0151
	(0.0208)	(0.0210)	(0.00946)	(0.00949)
Constant	0.106***	0.0826***	0.0525***	0.0338***
	(0.00137)	(0.00245)	(0.000525)	(0.000693)
Firm fixed effect	YES	YES	YES	YES
R-square	0.011	0.003	0.022	0.016
N	2,349,106	1,038,147	2,735,035	1,289,889

Note: Panel fixed effect estimation; the dependent variable is the one-year growth rate of employment (col 1-2) and fixed assets (3-4). Robust standard errors in parenthesis. Panel random effect estimation gave the same results

Figure 15 - Econometric results baseline model
Source: De Backer et al (2016)

The obtained results highlight that over the 2005-2010 period, MNE affiliates experienced employment growth. Furthermore, when interacting with the MNEHOME dummy variable, affiliates located in the home country exhibited an additional growth advantage from 2007 to 2009 (as seen in column 3). However, when narrowing the estimation to firms located in high-income countries, these MNEHOME dummy variables were generally insignificant (column 4), suggesting that the growth premium for home-based affiliates is not particularly prevalent in those nations.

Turning to fixed assets as the dependent variable (columns 1 and 2), a similar overall pattern emerges, though with interesting deviations. Year dummies interacting with the MNEHOME dummy are mostly significant, and their point estimates in absolute value are larger than in the model where employment growth rate is the dependent variable. This phenomenon is more pronounced in high-income countries.

This initial set of results aligns with the aggregate evidence on MNE reshoring discussed earlier: MNE affiliates located in their home countries (both headquarters and affiliates) grow relatively faster compared to other MNE affiliates. The higher growth trajectory of productive resources in home countries compared to those abroad contributes to a rising concentration of productive resources within MNE networks, observed in both employment and investments. The effect is more pronounced for investments, particularly among MNE affiliates located in high-income countries. This phenomenon appears to intensify in the later years of the sample.

However, these findings do not unambiguously indicate that backshoring is indeed taking place, as they are consistent with several alternative interpretations. For instance, these results could also suggest that MNE groups that have refrained from offshoring in the past are outperforming those who recently engaged in offshoring.

Consequently, a subsequent analysis directly links the change in employment or capital investments of affiliates abroad to the corresponding change at home. This model reveals a positive effect between employment changes at home and abroad. This econometric model examines the connection between the growth rate of employment or fixed assets of MNE affiliates at home (located in the same country as the group head) and the aggregate value of the same variable for MNE group affiliates abroad.

$$growth\_home_{git} = growth\_abroad_{pos}{}_{gt} + growth\_abroad_{neg}{}_{gt} + groupgrowth_{gt} + NACE_{it} + \varepsilon_{it}$$

Dependent variable	Yearly growth rate Fixed assets		Yearly growth rate Employment	
Growth abroad positive	-0.000741	-0.00358	-0.000934	-0.00577
	(0.00498)	(0.0113)	(0.00279)	(0.00935)
Growth abroad negative	-0.0329***	-0.0552	-0.0148	-0.0157
	(0.00901)	(0.0364)	(0.0100)	(0.0263)
Av. growth group 2003-9	0.986***	0.989***	0.962***	0.965***
	(0.0328)	(0.0330)	(0.0340)	(0.0342)
YEAR=2005 & Growth abroad pos.		0.0216		0.00742
		(0.0179)		(0.00992)
YEAR=2006 & Growth abroad pos.		-0.00406		0.00515
		(0.0155)		(0.0116)
YEAR=2007 & Growth abroad pos.		-0.00873		-0.00153
		(0.0166)		(0.0124)
YEAR=2008 & Growth abroad pos.		-0.0173		-0.00284
		(0.0170)		(0.0118)
YEAR=2009 & Growth abroad pos.		0.0297		0.0167
		(0.0200)		(0.0118)
YEAR=2005 & Growth abroad neg.		0.0184		0.0129
		(0.0431)		(0.0303)
YEAR=2006 & Growth abroad neg.		0.0478		0.0309
		(0.0427)		(0.0342)
YEAR=2007 & Growth abroad neg.		-0.00693		0.0116
		(0.0434)		(0.0328)
YEAR=2008 & Growth abroad neg.		0.0112		-0.0317
		(0.0416)		(0.0319)
YEAR=2009 & Growth abroad neg.		0.0461		0.000612
		(0.0398)		(0.0318)
Constant	-0.0182	-0.0206	-0.00361	-0.00189
	(0.0235)	(0.0224)	(0.0158)	(0.0171)
nace2-year FE	YES	YES	YES	YES
country FE	YES	YES	YES	YES
R-square	0.074	0.074	0.064	0.065
N	21,380	21,380	29,256	29,256

Note: Ordinary least-squares estimation; the dependent variable is the one-year growth rate of fixed assets (col. 1-2) and employment (col. 3-4) at home. Likewise, the independent variables are the one-year growth rates of fixed assets (col. 1-2) and employment (col. 3-4) abroad. The sample is limited to the MNE affiliates located in the same country as the group head. Robust standard errors clustered at group level in parenthesis.

Figure 16 – Econometric results, model on backshoring
Source: De Backer et al (2016)

When observing the growth rate of fixed assets abroad, the results indicate a significant negative association with the growth rate at home (column 1). These estimations show that within individual groups, a decrease in investments abroad corresponds to an increase in investments at home. When interacting the same variable with year dummies, all coefficients are significant (column 2), suggesting that the intensity of this association remains consistent over time. Surprisingly, the coefficient for positive growth rate abroad is not significantly

different from zero on average over the period. This is unexpected, as one would anticipate that during a period of rapid expansion, investments in fixed assets both at home and abroad would increase, hence being positively correlated.

Results concerning the growth rate of employment yield less conclusive findings (columns 3 and 4). Coefficients for both positive and negative growth rates are not significant. The model thus struggles to establish a statistically significant association between changes in employment at home and abroad within the same group. It's important to emphasize that the employment variable might be measured less accurately than fixed assets. Employee characteristics like skills, productivity, hours worked, etc., which significantly impact their contribution to production, are not accounted for, with only headcount available. In contrast, fixed assets are valued based on book value, better reflecting their actual contribution to the production process.

In summary, there are discernible nearshoring and backshoring trends underway, yet they are not as substantial and convincing as survey results and anecdotal cases may suggest. Additionally, it's noteworthy that reshoring is more pronounced in terms of capital investments than in employment. Ultimately, the presented evidence doesn't substantiate claims that backshoring will result in a substantial increase in domestic employment.

5.6 BROADER ANALYSIS: DATABASE CREATION AND BREAKDOWN BY DIFFERENT INDICATORS

Fratocchi et al (2013) have collaboratively developed an inter-University dataset known as Uni-CLUB MoRe Backshoring to have a more extensive dataset encompassing a greater number of countries. Data has been sourced from various outlets, including international economics newspapers and magazines, whitepapers from major consulting firms, internet search engines, and existing academic studies. The collected data was then scrutinized for specific variables: the country of origin of the headquarters, industry, year of implementing backshoring and offshoring strategies, abandoned country, corporate size (in terms of sales and/or employee count), stated reasons for backshoring, and the mode of entry (greenfield vs. merger and acquisition).

While the collected data is acknowledged to be neither exhaustive nor fully representative of the studied phenomenon, it still holds value in providing an initial understanding of the key attributes of backshoring operations.

The database comprises 230 instances stemming from 192 distinct companies. The variation in numbers (230 vs. 192) arises due to 25 companies (13% of the total) executing multiple backshoring activities. The researchers propose that in situations where companies prioritize acquisition-led expansion, backshoring endeavors could result from intricate post-merger reorganization of the group's strategic and organizational framework, rather than stemming from the perception of initial offshoring as a mistake.

Home Country	Host Country							
	China	Eastern Europe	Asia (other than China)	Western Europe	Central & South America	North America	Total	%
USA	80	1	17	4	3	1	106	46,1%
Italy	22	14	3	9		2	50	21,7%
Germany	9	10	6	9	5	1	40	17,4%
France	9	5	1				15	6,5%
UK	8	1					9	3,9%
Japan	2						2	0,9%
Norway	2						2	0,9%
Canada	1						1	0,4%
Finland				1			1	0,4%
Slovenia				1			1	0,4%
South Korea	1						1	0,4%
Spain	1						1	0,4%
Sweden	1						1	0,4%
Total	136	31	27	24	8	4	230	100,0%
%	59,1%	13,5%	11,7%	10,4%	3,5%	1,7%	100,0%	

Figure 17 - Breakdown by home and host countries
Source: Fratocchi et al (2013)

Data classification based on the home country reveals that American companies hold the most substantial representation, accounting for 46% of the share, trailed by Italy at 21% and Germany at 17%. This alignment seems coherent with the significant economic weight of manufacturing industries in these countries (the USA leads global manufacturing, while Germany and Italy hold the largest and second-largest manufacturing economies in the European Union).

	Host Country							
Year	China	Eastern Europe	Asia (other than China)	Western Europe	Central & South America	North America	Total	%
'80s			4		4		8	3,5%
'90s	1						1	0,4%
2000-2005	7	2	4	4	1	2	20	8,7%
2006	4			2			6	2,6%
2007	4	6	1	3			14	6,1%
2008	12	7		3	1	1	24	10,4%
2009	28	7	5	6			46	20,0%
2010	14	5	5	3		1	28	12,2%
2011	30		3	2	2		37	16,1%
2012	36	4	5	1			46	20,0%
Total	136	31	27	24	8	4	230	100,0%
%	59,1%	13,5%	11,7%	10,4%	3,5%	1,7%	100,0%	

Figure 18 - Breakdown by host countries and time of back-shoring
Source: Fratocchi et al (2013)

As the host country where backshoring took place, 72% of attestations regarded China (59%) and Eastern Europe (13%). However, while attestations regarding China are almost equally distributed between US and EU companies, those regarding Eastern Europe derive exclusively from European companies. It is interesting to note that attestations regarding Central and South American are notably limited (8), despite the substantial relocation of US companies to said area.

A chronological breakdown of Uni-CLUB MoRe Backshoring data highlights a sharp upswing in the last five years, with roughly 50% of cases occurring within the past 3 years, and 80% originating from the period starting with the onset of the financial crisis in 2012.

Categorization of data by industry indicates that backshoring activities span across nearly all manufacturing sectors, although traditional ones dominate. Notably, Mechanical non-automotive (21%), Home furnishing (18%), and Clothing and footwear (17%) are prominent.

Industry	Home Country														
	USA	I	D	F	UK	J	N	C	FIN	SLO	ROK	E	S	#	%
Mechanical	18	10	17	4	1									50	21,7
Home furnishing	28	4	1	4	3					1			1	42	18,3
Clothing & footwear	9	22		4			2	1				1		39	17,0
Electronic	16	2	8			1			1					28	12,2
Appliances	10	4	3		1									18	7,8
Electric	5	2	5		1									13	5,7
Food & beverage	5	1	3											9	3,9
Biomedical	4	4												8	3,5
Toys	2		3	2	1									8	3,5
Biomedical	4				1									5	2,2
Health & beauty care	2			1										3	1,3
Aerospace	1				1									2	0,9
Automotive	1	1												2	0,9
Jewellery	1										1			2	0,9
Materials						1								1	0,4
Total	106	50	40	15	9	2	2	1	1	1	1	1	1	230	100

Figure 19 - Breakdown by industry and home country
Source: Fratocchi et al (2013)

It's worth mentioning that while data from US companies reflect engagement across a wide array of industries, those from Germany and Italy showcase a more concentrated focus on their respective specialized sectors.

Industry	Host Country							
	China	Eastern Europe	Asia (other than China)	Western Europe	Central & South America	North America	#	%
Mechanical	15	13	8	9	4	1	50	21,7%
Home furnishing	33	3	2	4			42	18,3%
Clothing & footwear	26	9	4				39	17,0%
Electronic	15	2	6	2	3		28	12,2%
Appliances	13		3	1	1		18	7,8%
Electric	7	2	2	2			13	5,7%
Food & beverage	3	1		4		1	9	3,9%
Biomedical	4		1	1		2	8	3,5%
Toys	8						8	3,5%
Biomedical	4		1				5	2,2%
Health and beauty care	3						3	1,3%
Aerospace	1	1					2	0,9%
Automotive	1			1			2	0,9%
Jewellery	2						2	0,9%
Materials	1						1	0,4%
Total	135	31	27	24	8	4	230	100,0%
%	58,7%	13,5%	11,7%	10,4%	3,5%	1,7%	100,0%	

Figure 20 - Breakdown by industry and host country
Source: Fratocchi et al (2013)

Analyzing data by industry and host country reveals that backshoring activities impacting China and other Asian nations encompass a broader spectrum of industries compared to Eastern Europe.

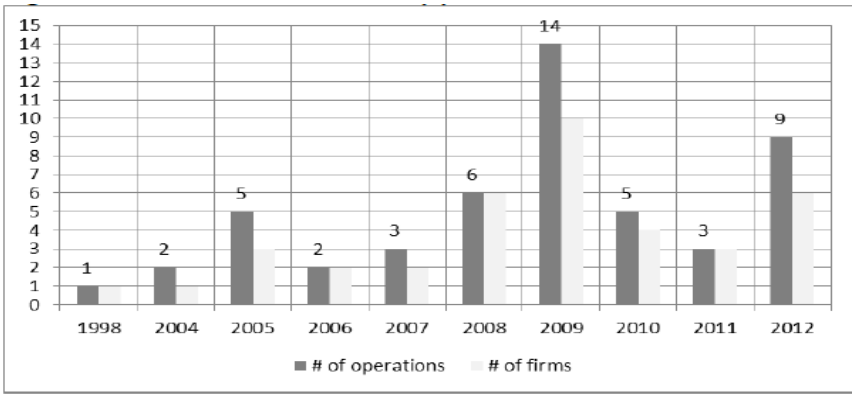


Figure 21 - Italian evidence: breakdown by year
Source: Fratocchi et al (2013)

Italian firms' 50 backshoring operations encompass 38 countries, with 7 companies executing multiple backshoring activities each. Notables are two major companies conducting 4 operations within a single year (2009 and 2012). Among the 38, twenty-one are categorized as large according to the 2003/361/EC Commission Recommendation, while the remaining three are considered small.

Time distribution analysis unveils two peak years (2009 and 2012) coinciding with the most profound effects of the global financial crisis on the Italian economy.

Industry	China	Eastern Europe	Western Europe	Asia (other than China)	North America	Total
Clothing & footwear	12	8		2		22
Mechanical	2	3	4	1		10
Home furnishing	2	1	1			4
Biomedical	1		1		2	4
Appliances	3		1			4
Electric		2				2
Electronic	1		1			2
Food			1			1
Automotive	1					1
Total	22	14	9	3	2	50

Industry	1998	2004	2005	2006	2007	2008	2009	2010	2011	2012	# of evidences	# of firms
Clothing & footwear	1	2		2	3	2		4	1	7	22	16
Mechanical						1	8	1			10	6
Home furnishing			1			2			1		4	4
Biomedical			4								4	2
Appliances							4				4	4
Electric							1			1	2	2
Electronic							1		1		2	2
Food						1					1	1
Automotive										1	1	1
Total	1	2	5	2	3	6	14	5	3	9	50	38

Figure 22 - Italian evidence: breakdown by industry and host country; breakdown by year and industry
Source: Fratocchi et al (2013)

Breaking down the data by industry underscores the dominance of traditional Italian sectors, particularly Clothing and Footwear. The sector's susceptibility to global competition prompted numerous Italian companies to offshore manufacturing to low-cost regions, primarily Eastern Europe and China. Intriguingly, a substantial portion (10 out of 22) of backshoring instances in this sector occurred even before the global financial crisis commenced.

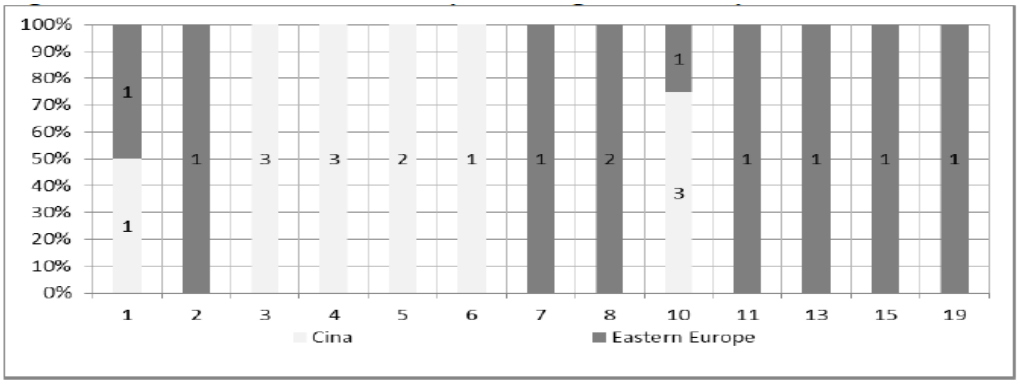


Figure 23 - Italian evidence: breakdown by time range and country
Source: Fratocchi et al (2013)

Examining the time span between offshoring and subsequent backshoring decisions yields insightful outcomes. Among the 34 cases with calculable time spans, the range extends from 1 to 19 years. This diverges from German company data. Notably, when focusing on Chinese and Eastern European operations (34 out of 50), Chinese operations mostly (10 out of 13) fall within a 1 to 6-year time span, while Eastern European operations span 7 to 19 years. This finding counters the common notion of backshoring as an "error correction mechanism."

To delve into these results, researchers analyzed time span data relative to the year of backshoring implementation. Operations preceding 2000 exhibited time spans of at least 6 years, with 8 out of 10 cases spanning a minimum of 10 years. In contrast, more recent operations typically feature spans of 2-4 years, akin to German companies.

For Italian entrepreneurs and managers, the most notable reason (42%) for reshoring was the positive "made-in effect" linked to Italian-manufactured goods. Interestingly, this diverges from German firms. The second significant reason (24%) was the subpar quality of offshore production, while the third (21%) was the need for heightened customer focus.

5.7 BACKSHORING AND INDUSTRY 4.0

Emerging technologies are one of the contributing factors for the backshoring phenomenon. Dach et al (2017) developed a compelling study where they highlighted that the future of backshoring production activities is expected to be increasingly bolstered by digital manufacturing technologies, often referred to as Industry 4.0. Their empirical investigations drew from an extensive dataset comprising over 2000 manufacturing companies from Germany, Austria, and Switzerland.

Guided by International Business theory, it's established that Information and Communication Technologies (ICTs) serve as tools that expand a firm's geographical scope. ICTs play a vital role in extending control and curbing coordination costs within extensive networks of geographically dispersed subsidiaries, suppliers, and customers. Consequently, ICTs foster the global expansion of firms and the establishment of extensive global value chains.

Nonetheless, these novel technologies can also trigger the opposite effect, permitting firms to consolidate manufacturing activities and giving rise to a process of deglobalization. Consider a hypothetical metal parts manufacturing company that initially offshored certain core production processes, like smoothening and polishing, to regions with lower labour costs. By subsequently automating these processes with robotics, the company enhances speed and productivity, leading to the repatriation of production to its home country. This shift yields heightened responsiveness, flexibility, and an ability to handle increased orders, given the elimination of cross-country transportation requirements.

In the broader context, numerous experts concur that we're currently in the midst of the fourth industrial revolution, following the eras of mechanization, electrification, and automation. Novel technologies, encompassing sensors, advanced robotics, actuators, and networked production systems, seamlessly communicate and coordinate actions across factories and global value chains. Cyber-Physical Systems integrate the physical production process with the digital realm via the Internet, creating a seamless exchange of information between these domains.

The advantages introduced by these innovative technologies encompass:
- Increased productivity, enhanced capacity utilization, and more competitive production costs. Capital investment gains precedence over labour, reducing the appeal of low-wage countries and emphasizing economies of scale in developed nations;

- Augmented flexibility in manufacturing processes, facilitating tailored production in smaller batches with minimal marginal expenses. This fusion combines the cost benefits of mass production with the adaptability of small-scale producers, potentially opening doors to new markets. However, this hinges on a swift time-to-market and underscores the importance of proximity to regional markets.

Industry 4.0, through its productivity and flexibility enhancements, can influence the trade-offs (offsetting labour cost advantages, shortened lead times, improved market orientation, broader client reach) in favour of backshoring. This provides incentives for firms to relocate production back to their home countries. The significance of proximity to customers increasingly competes with the traditionally dominant Global Value Chains (GVCs), introducing complexities and flexibility disadvantages, particularly in the context of immediate and personalized customer demands.

ICTs wield a more potent influence on economic geography compared to any prior technology, as they facilitate remote coordination, rendering local clustering less crucial. These emerging technologies empower companies to precisely position value-adding activities in optimal locations, as they enable effective coordination and control over extensive supply chains, even without direct ownership.

Nevertheless, local concentrations and clusters of corporate activities persist. While ICTs cannot entirely substitute face-to-face interaction in fostering competence creation, they effectively complement it. As the adoption of Industry 4.0 technologies in manufacturing operations constitutes a competency-building endeavour, the role of local communication and coordination becomes evident as a vital precondition for innovative manufacturing processes.

5.7.1 DATASET AND ANALYSIS – I4.0 READINESS AND BACKSHORING - CENTRAL EUROPE

Dach et al (2017) investigated whether a positive relationship exists between backshoring activities and the adoption of Industry 4.0 technologies. They rely on data from the European Manufacturing Survey (EMS) conducted in 2015. This survey is conducted by a consortium led by the Fraunhofer Institute for Systems and Innovation Research (ISI) and focuses on exploring innovations in product, process, service, and organizational aspects within European manufacturing firms.

The dataset employed in the study constitutes a subset of the EMS 2015 survey and encompasses 2120 manufacturing companies from Austria, Germany, and Switzerland, each having a workforce of at least 20 employees. These three countries were chosen due to their comparability across multiple indicators, including their manufacturing sector's share of GDP.

Among the included firms, 1236 are based in Germany, while an additional 749 are situated in Switzerland. The most prevalent sectors in the sample encompass manufacturers of fabricated metal products, the machinery industry, producers of electrical equipment, electronic and optical products, and the food industry.

The EMS assesses backshoring activities by inquiring whether a firm relocated production operations from their own affiliates or suppliers back to their home country during the years 2013 and 2014. This definition implies that backshoring is not exclusively limited to divesting assets abroad, but it also involves activities that had been outsourced to third parties. It's important to note that firms engaged in backshoring may not necessarily have overseas affiliates or production activities.

To construct an index reflecting Industry 4.0 readiness (referred to as "iready"), the researchers employ information on the adoption of individual technologies. This index is developed in two stages.

In the first step, the researchers define three distinct technology fields associated with Industry 4.0:

Digital Management Systems
Product-Lifecycle-Management Systems
Enterprise resource planning software (ERP) for production planning and scheduling
Wireless Human-Machine-Communication
Mobile/wireless devices
Digital Visualisation
Cyber-Physical-systems (CPS)
Digital Exchange of data with suppliers / customers
Systems for automation and management of internal logistics
Near real-time production control systems

Figure 24 - Technology fields used to construct an index of I4.0 readiness
Source: Dachs et al (2017)

In the second step, values are assigned to the "iready" index, which can take six different values:

- 0: No adoption of any technology from the three fields;
- 1: Adoption of at least one technology;
- 2: Adoption of at least two technologies;
- 3: Adoption of all three technologies from different fields;
- 4: Adoption of all three technologies and at least two from the CPS field;
- 5: Adoption of all three technologies and at least three from the CPS field (i.e., all Industry 4.0 technologies).

This index places greater emphasis on the more advanced CPS technologies.

In the subsequent analysis, the dependent variable of interest is "backshoring," which is a binary variable taking the value 1 if a firm has relocated production activities to its home country during 2013 and 2014, and 0 otherwise. Independent variables encompass firm characteristics such as size (measured by employee count), the "iready" index, the share of exports in turnover, and a dummy variable indicating whether the firm has production activities abroad.

Additional independent variables include sectoral characteristics, which are categorized based on a taxonomy of technological regimes developed by Marsili and Verspagen (2002). This taxonomy identifies five regimes: Continuous Process, Fundamental Process, Complex System, Science Based, and Product Engineering.

Furthermore, dummy variables account for whether the firm is a supplier, whether it produces single pieces or complex products, and whether it uses additive manufacturing (3D printing).

Variable Label	Definition	Variable Type
back	Backshoring; the variable is one if the firm has backshored production in in 2013 or 2014, zero otherwise.	Dummy
lemp	Logarithm of the number of employees in 2014	Metric
iready	I4.0 readiness index described in section 3	Ordinal
exp	Share of exports on turnover of the firm	Metric
aprod	Production activities abroad; the variable is one if the firm has production abroad, zero otherwise.	Dummy
reg_cp, reg_fp, reg_sb, reg_cs, reg_pe	Sectoral variables that describe the technological regime the firm operates following the taxonomy of Marsili & Verspagen (2002). Base case is the continuous process regime (reg_cp).	Dummy
supp	Position in the value chain; the variable is one if the firm is a supplier to other firms, or zero if the firm is a producer of final products.	Dummy
AT, CH, DE	Location of the firm; AT for Austria and CH for Switzerland, with Germany (DE) as the base case.	Dummy
batch	Batch size; the variable is one if the firm produces single pieces and zero if it produces in larger batches .	Dummy
complex	Degree of complexity of the main product; this variable is one if the firm produces predominantly products consisting of many parts, and zero if the products consist of only a few parts or single parts.	Dummy
3Dprint	3D printing or additive manufacturing; the variable is one if the firm utilized 3D printing, zero otherwise.	Dummy

Figure 25 - Definitions of variables
Source: Dachs et al (2017)

To test the hypothesis of a positive relationship between Industry 4.0 technologies and backshoring, the researchers utilize descriptive statistics and a probit regression model. The model can be expressed as: $Y^* = X' * \beta + \varepsilon$

Here, Y^* represents the latent variable indicating the probability of backshoring, X' is the vector of explanatory variables, β denotes the parameter reflecting the marginal effect of a discrete change in the probability of backshoring, and ε represents the error term.

The analysis reveals several key findings:
- a small percentage of manufacturing firms engage in backshoring (3.8% of all firms in the sample), which increases to around 10% when considering firms with overseas production activities;
- both backshoring and Industry 4.0 readiness are positively associated with firm size, peaking among firms with 250-499 employees (figure 26);

Sector	No. of firms	I4.0 readiness	Backshoring (% of firms)
Food, beverages	203	1.193	1.2%
Textiles, clothing	57	1.462	4.0%
Wood, paper, print	217	1.617	2.0%
Pharma, chemicals	134	1.813	9.4%
plastic	145	1.986	4.4%
Mineral products	107	1.540	3.0%
Metal, metal products	491	1.772	2.4%
Electrical, electronics	309	2.124	4.9%
Machinery	358	1.868	3.3%
Vehicles	70	1.985	10.8%
Other manufacturing	125	1.748	4.4%
Total	**2,216**	**1.775**	**3.8%**

Figure 26 – I4.0 readiness and backshoring in different firm size classes
Source: Dachs et al (2017)

- the likelihood of finding a backshoring firm is highest in the automotive industry, and I4.0 readiness correlates with sectoral technology levels (figure 27);

Size class	No. of firms	I4.0 readiness (mean)	Backshoring (% of firms)
< 30	338	1.139	1.3%
30-49	524	1.339	2.4%
50-99	501	1.641	3.3%
100-249	459	2.282	5.0%
250-499	180	2.525	9.2%
500-999	72	2.819	5.6%
1000	46	2.933	7.1%
Total	2,122	1.775	3.8%

Figure 27 - I4.0 readiness and backshoring in different sectors
Source: Dachs et al (2017)

- common reasons for backshoring include inflexibility at offshoring locations and low product quality. These issues align with the advantages offered by Industry 4.0 in terms of flexibility and enhanced production control (figure 28);

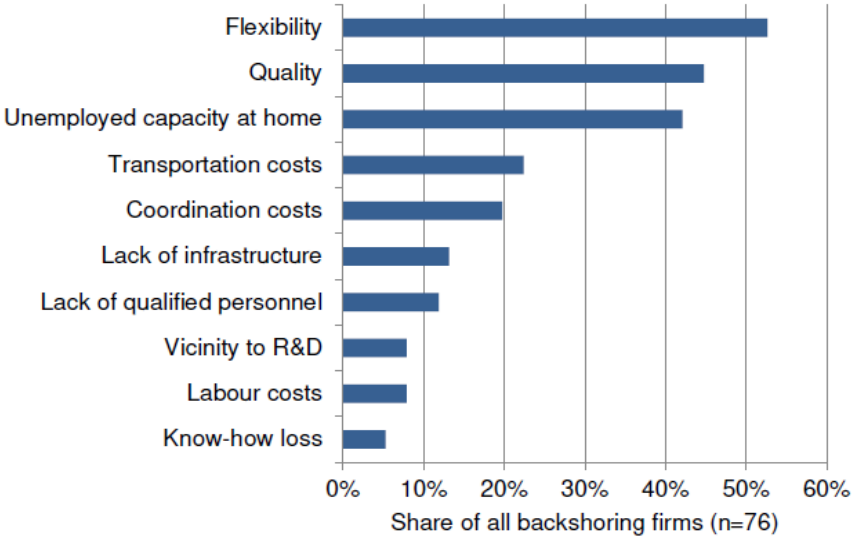


Figure 28 - I4.0 readiness and backshoring in different firm size classes
Source: Dachs et al (2017)

A t-test of the means confirms that firms engaging in backshoring exhibit significantly higher I4.0 readiness compared to those that do not.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
no backshoring	1,958	1.737	0.032	1.411	1.675	1.800
backshoring	77	2.519	0.171	1.501	2.179	2.860
combined	2,035	1.767	0.032	1.422	1.705	1.829
diff		-0.782	0.164		-1.104	-0.460
diff = mean(no) - mean(yes)			t = -4.7593			
Ho: diff = 0		degrees of freedom = 2033				
Ha: diff < 0			**Ha: diff != 0**		**Ha: diff > 0**	
Pr(T < t) = 0.0000			**Pr(|T| > |t|) = 0.0000**		**Pr(T > t) = 1.0000**	

Figure 29 - Two sample t test with equal variances
Source: Dachs et al (2017)

5.7.2 RESULTS FROM THE MULTIVARIATE REGRESSION

The following table provides the results for the probit model regression above mentioned. Dachs et al (2017) employed five different variants of the regression (columns 1-5).

	(1)	(2)	(3)	(4)	(5)
lemp	0.006	0.031	0.017	0.058	-0.172**
	(0.057)	(0.057)	(0.058)	(0.054)	(0.083)
iready	0.121***	0.109***	0.107**		0.129**
	(0.042)	(0.042)	(0.042)		(0.065)
exp	0.004*	0.005**	0.004**	0.004**	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)
aprod	0.626***	0.604***	0.579***	0.579***	
	(0.130)	(0.129)	(0.132)	(0.132)	
reg_fp	0.259		0.253	0.267	0.455
	(0.264)		(0.265)	(0.262)	(0.379)
reg_cs	0.778***		0.808***	0.768***	0.976**
	(0.265)		(0.267)	(0.268)	(0.407)
reg_sb	0.342*		0.355*	0.359*	0.569*
	(0.185)		(0.188)	(0.187)	(0.319)
reg_pe	0.129		0.150	0.143	0.176
	(0.159)		(0.163)	(0.164)	(0.288)
supp	-0.430***	-0.421***	-0.471***	-0.439***	-0.543***
	(0.138)	(0.137)	(0.141)	(0.139)	(0.205)
at	0.183	0.120	0.188	0.188	0.267
	(0.184)	(0.181)	(0.186)	(0.185)	(0.296)
ch	0.106	0.064	0.109	0.119	-0.089
	(0.133)	(0.130)	(0.134)	(0.133)	(0.223)
batch		0.173	0.152	0.162	
		(0.149)	(0.154)	(0.154)	
complex		-0.046	-0.079	-0.089	
		(0.127)	(0.130)	(0.130)	
3Dprint				0.163	
				(0.136)	
Constant	-2.538***	-2.580***	-2.662***	-2.675***	-0.815*
	(0.280)	(0.274)	(0.305)	(0.300)	(0.476)
Pseudo R2	0.1391	0.1239	0.1403	0.1324	0.0785
Observations	1,875	1,843	1,843	1,843	376

Figure 30 - Linking backshoring and Industry 4.0: regression results
Source: Dachs et al (2017)

The regression results across columns 1, 2, 3, and 5 consistently demonstrate that the coefficient for the I4.0 readiness index is statistically significant and positively associated with backshoring. This reaffirms the findings from the descriptive analysis, indicating that a higher adoption of Industry 4.0 technologies corresponds with an increased likelihood of engaging in backshoring.

The equation in column 4 focuses on the impact of 3D printing or additive manufacturing on backshoring. In this equation, the "iready" index is replaced with a dummy variable (3Dprint) that identifies firms employing additive manufacturing. The coefficient for 3Dprint does not show a significant relationship with backshoring. This outcome could be attributed to the fact that additive manufacturing is still in its early stages and is primarily used for development and prototyping, rather than full-scale production. Consequently, the effects of additive

manufacturing on backshoring may only become evident in subsequent studies as this technology evolves.

The size of the firm (lemp) loses its significance in explaining backshoring when other variables are controlled for. In column 5, when the sample size is reduced, the coefficient for lemp even becomes significant with a negative sign. This suggests that backshoring tends to increase with decreasing firm size, with all other factors held constant. The initially observed positive correlation between firm size and backshoring in the descriptive statistics can be explained by the parallel increase in both I4.0 readiness and backshoring as firm size grows. Larger companies often possess more foreign production locations and greater integration in Global Value Chains (GVCs), providing more opportunities for backshoring compared to smaller firms. Moreover, smaller companies might lack the necessary resources, experience, management expertise, and financial capacity to make offshoring decisions as meticulously as larger multinational corporations. This could result in a higher prevalence of backshoring decisions among smaller firms. Additionally, smaller companies may have a strategic imperative to serve their niche markets swiftly and flexibly, making proximity to customers crucial. Conversely, larger companies may emphasize price competitiveness and brand image.

The analysis also unveils sectoral disparities. Companies operating in a complex system regime exhibit a higher propensity for backshoring when controlling for independent variables, as opposed to firms in continuous processes. This could be attributed to the higher technological intensity of complex system industries, making them more open to adopting advanced manufacturing technologies like those encompassed by Industry 4.0. Moreover, industries characterized by higher technological intensity often entail higher asset specificity, making cross-border coordination more intricate. This could favour local integration and backshoring over global value chains and offshoring strategies.

The variable indicating whether a firm is a supplier (supp) consistently diminishes the likelihood of engaging in backshoring across all regression specifications. This outcome can be elucidated by the fact that numerous suppliers have offshored production to align with their clients' locations. For these suppliers, maintaining a presence at their clients' foreign locations is essential, particularly when compared to manufacturers of final products.

6.0 POLICY INITIATIVES AND ACTIONS AIMED AT SUPPORTING RESHORING

Governments worldwide have taken steps to encourage domestic sourcing of inputs, diversification of suppliers, and "nearshoring" of production in response to evolving economic conditions and shocks. This approach aims to balance global production efficiency and risk, choosing optimal locations and suppliers while also introducing diversification to mitigate disruptions. Reshoring, or bringing production back to domestic markets, can reduce exposure to foreign shocks while potentially increasing vulnerability to domestic ones.

Effective policy measures should focus on two main aspects:
- internalizing systematic risk: policies should help firms internalize the broader social costs of their decisions, emphasizing multilateral diversification strategies and enhancing firms' resilience. This could involve policies that encourage outward-oriented diversification, strategies for improving firms' ability to handle shocks (such as stockpiling and enhancing liquidity), and mechanisms that promote responsible decision-making;
- enhancing attractiveness of locations: policies need to address the structural factors that make certain locations appealing for reshoring. This includes considerations such as business environment, regulatory frameworks, logistics capabilities, labour costs, and productivity levels.

In Europe, the reshoring discussion has been less prominent due to a relatively lower impact of offshoring on manufacturing, especially in comparison to regions like China. However, reshoring has gained attention in various countries for different reasons:
- the UK sees reshoring as a means to rebalance its economy;
- Germany considers reshoring essential for shaping its future manufacturing sector;
- Italy aims to reintroduce the concept of "100% Made in Italy."

In the United States, reshoring discussions gained traction during the Obama administration. Initiatives like the "Blueprint for an America Built to Last" proposed specific measures to support backshoring, such as financial assistance for companies (tax deductions, credits, and incentives), trade enforcement measures, and investments in logistics infrastructure. Not all proposals were enacted into law, but there was an increase in national R&D spending. Moreover, manufacturing-focused universities received incentives to revamp engineering programs related to targeted manufacturing sectors.

The topic of reshoring has also been highlighted in various communications from European Union institutions, and individual countries are making efforts to promote this trend in the coming decades.

In terms of policy, there can be both general measures to attract investment (subsidies, tax incentives) and specific policies, such as trade provisions. However, collecting information on these policies can be challenging due to factors like the multi-level governance structure of many countries, where support for reshoring may come from national, regional, or local levels of government, leading to potential ambiguity in the actual support granted to reshoring companies.

7.0 MANAGING EXPECTATIONS

Predicting the future is indeed challenging, and while there has been some positive news about reshoring, it's important to approach the phenomenon with realistic expectations. The enthusiasm surrounding reshoring initiatives can sometimes lead to overly high and unrealistic hopes. Policymakers may view reshoring as a potential solution to structural competitiveness issues in OECD manufacturing while simultaneously addressing unemployment problems in these countries.

However, several key points should be considered:

- gap between intentions and actions: publicly announced reshoring initiatives don't always translate into tangible outcomes. Surveys often reveal a difference between the number of companies that actually reshore and those that merely plan to do so;
- coexistence of reshoring and offshoring: Reshoring does not signify the complete cessation of offshoring. Empirical evidence shows that while reshoring may be on the rise, offshoring continues to occur simultaneously, both at the national/regional economy level and within industries and companies. Businesses might bring back certain activities to serve local markets but continue to move other activities abroad to cater to different markets. Proximity to markets serves as a rationale for both reshoring and offshoring decisions;
- ongoing importance of offshoring: The current evidence suggests that offshoring remains more significant than reshoring. Emerging countries like China retain their appeal, particularly due to the growth of middle-class consumers in regions like Asia. The rising middle class in emerging economies contributes to the attractiveness of those markets;
- limited scope of reshoring: It's unrealistic to expect reshoring to encompass all activities that were previously offshored. Some manufacturing processes, especially those with high labour content intended for Asian markets, are unlikely to return due to various factors such as cost differentials and market dynamics;
- employment impact: estimations of significant employment gains from reshoring might be overly optimistic. Many OECD economies have been witnessing a long-term decline in manufacturing jobs due to productivity advancements. While reshoring is still in its early stages, it's unlikely to bring back large-scale manufacturing employment. The narrowing wage gap between developed and emerging economies may not be sufficient to drive labour-intensive activities back home. Reshoring tends to be more observable in terms of capital investments rather than substantial employment growth.

In conclusion, while reshoring is an important trend, it's crucial to manage expectations and recognize that it's not a one-size-fits-all solution to complex economic challenges. The global economic landscape is characterized by the coexistence of reshoring and ongoing offshoring, and the outcomes are influenced by a multitude of factors including market dynamics, labour costs, productivity, and regional trends.

8.0 MEASURING RESHORING

The final chapter of this thesis aims at shedding some light on how to measure the impact of reshoring in economics terms. To do so, we consider the case of a single company, which can then be extended to the case of a sample of companies and/or countries.

The attempt to measure the effects of such phenomenon begins with the analysis of the company's operations and performance before and after the decision to bring production or business operations back to the home country. The following is an exhaustive list of the KPIs to consider while performing such analysis:

1) Financial Metrics and Costs

Compare the Total Cost of Ownership (TCO) and the Return On Investment (ROI) of offshored and reshored production, including direct and indirect costs, savings, and profits. There are numerous sources available for collecting the necessary data to perform the previously mentioned analysis for a company, an industry, or a nation.

- SEC EDGAR Database (U.S. Companies): the U.S. Securities and Exchange Commission's Electronic Data Gathering, Analysis, and Retrieval (EDGAR) database is a comprehensive source for financial reports and filings of publicly traded U.S. companies (SEC EDGAR Database: https://www.sec.gov/edgar.shtml)

- Company websites: many publicly traded companies provide their financial reports and annual reports on their official websites (investor relations or financial information sections on the company's website).

- Financial news and data providers: financial news websites like Bloomberg, Reuters, and Yahoo Finance often provide access to financial statements, earnings reports, and other financial data for publicly traded companies (Bloomberg: https://www.bloomberg.com/), (Reuters: https://www.reuters.com/), (Yahoo Finance: https://finance.yahoo.com/)

- Stock Exchanges, such as the New York Stock Exchange (NYSE) and NASDAQ, typically provide access to financial statements and filings for companies listed on their exchanges (NYSE: https://www.nyse.com/), (NASDAQ: https://www.nasdaq.com/)

- Financial data providers: data providers like FactSet, S&P Capital IQ, and Morningstar offer financial data and reports for a wide range of publicly traded companies (FactSet: https://www.factset.com/), (S&P Capital IQ:

https://www.spglobal.com/marketintelligence/en/), (Morningstar: https://www.morningstar.com/)

- Government regulators (International): depending on the country, government regulatory agencies may provide access to financial filings for publicly traded companies. Examples include the UK's Companies House and Canada's SEDAR.

2) Quality and Performance

Evaluate changes in defect rates or product recalls, evaluate whether the quality of products has improved or not before and after reshoring. Also, assess whether lead times have improved, allowing for faster delivery to customers.

- Government agencies and open data portals: some government agencies provide open data portals that offer access to various datasets, including those related to product quality and performance (Data.gov: https://www.data.gov/, U.S. government's open data portal).

- Industry-specific associations and publications: Industry associations may publish reports and studies on product quality and performance, industry-specific websites, publications, and reports for data and insights (Consumer Reports: https://www.consumerreports.org/ for consumer product quality reviews and ratings).

- Market research firms and data providers: market research firms often offer datasets and reports related to product quality, customer feedback, and industry benchmarks (Statista: https://www.statista.com/ provides access to various industry reports and statistics).

- Academic research databases: academic databases may contain research papers and datasets related to product quality, performance, and customer feedback (Google Scholar: https://scholar.google.com/ or JSTOR: https://www.jstor.org/).

- Customer review websites: platforms like Yelp, TripAdvisor, and Trustpilot may offer access to customer reviews and ratings, which can provide insights into product performance and quality (Yelp Dataset: https://www.yelp.com/dataset, data provided for academic research).

- Social media data: they may provide access to user-generated content, including customer feedback and sentiment analysis. Some platforms offer APIs for data retrieval and analysis.

- Industry-specific data providers: some companies specialize in collecting and selling industry-specific data, including product quality and customer feedback (JD Power: https://www.jdpower.com/ for automotive industry data).

- Government consumer protection agencies: agencies like the U.S. Consumer Product Safety Commission (CPSC) may provide data on product recalls and safety incidents (CPSC Recall Data: https://www.cpsc.gov/Recalls for product recalls in the U.S.).

3) Supply Chain Metrics

Measure changes in inventory levels and the associated costs.

- Government and Economic Research Institutions: Many government agencies and economic research institutions collect and publish data related to international trade, including offshoring and reshoring trends. Examples include the United States Census Bureau, the Bureau of Economic Analysis (BEA: https://www.bea.gov/data/special-topics/global-value-chains), and the World Bank.

- Academic research repositories: university websites and academic research repositories often host datasets used in research papers. You can search for relevant research papers and then look for associated datasets (Google Scholar: https://scholar.google.com/ or (JSTOR: https://www.jstor.org/).

- Data Marketplaces: Some data marketplaces, such as Kaggle, Data.gov, and DataHub, offer datasets on various topics, including supply chain and trade-related data (Data.gov: https://www.data.gov/)

4) Customer Satisfaction and Sales

Collect customer feedback to understand their level of satisfaction with products made after reshoring. Analyze changes in sales volume or market share after reshoring. This is very company specific and often not disclosed to the public, but every company that is reshoring previously offshored activities is somehow conducting analysis on their customers to understand their level of satisfaction with a lower lead team, faster market time, and better quality of products. These analysis are often conducted with Customer Relationships Management software (Salesforce, HubSpot, Zoho CRM, etc).

5) Employee Metrics

Assess changes in workforce productivity and efficiency. Measure employee morale and satisfaction, which can impact performance. This typology of analysis is often internally conducted and not disclosed to the public.

6) Environmental and Sustainability Impact

Evaluate whether reshoring has had an impact on reducing the company's carbon footprint or improving sustainability practices.

- Government Agencies: Government environmental agencies often publish reports and studies on the environmental impact of various industries, including reshoring (Environmental Protection Agency in the United States: https://www.epa.gov/data)

- Sustainability Research Organizations: Organizations dedicated to sustainability research conduct studies on the impact of reshoring on carbon emissions and sustainability practices (World Resources Institute: https://datasets.wri.org/, Sustainability Accounting Standards Board: https://sasb.org/)

- Consulting Firms and Think Tanks: Consulting firms and think tanks often conduct research on sustainability and reshoring (McKinsey & Company, Deloitte, Brookings Institution, etc).

- Environmental Nonprofits: Environmental organizations like the Environmental Defense Fund (EDF) or the Natural Resources Defense Council (NRDC) may provide resources and reports on reshoring and sustainability.

9.0 ACKNOWLEDGMENTS

I would like to express my deep gratitude to all the individuals and institutions that have made the completion of this master's thesis possible. My academic journey would not have been complete without their invaluable support and contributions.

First and foremost, I wish to thank my thesis academic tutor, the professor Anna D'Ambrosio, for her guidance and patience in guiding me through this research journey. Without her constant support and expertise, this thesis would never have been completed.

Special thanks are also due to all the professors at the Engineering and Management for their dedication to teaching and guidance. Their lectures and commitment to my academic growth significantly contributed to my success.

I would like to extend my gratitude to my parents and family for their love, unwavering support, and constant encouragement. Without your affection and emotional support, this milestone would have been much harder to achieve.

Special thanks also go to my friends and classmates who made my academic journey a fun and memorable experience. Thank you for the stimulating discussions, shared laughter, and genuine friendship.

This thesis work represents the culmination of years of hard work and dedication by many individuals and institutions. I am deeply thankful for all the support received along my academic path.

Thanks to everyone who made this achievement possible.

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