Does Outward Foreign Direct Investment Reduce Domestic Investment? An Industry-Level Analysis

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Abstract:

With the rise of globalisation, countries have become more connected financially and global cross-border investment flows have become more common. FDI is an important form of cross-border flow which is responsible for the spread of technology across countries and is the main source of external finance for emerging countries. In the last two decades, FDI has increased tremendously. But this has been accompanied by fears about outward FDI taking away production activities and jobs away from the home country. I look at how outward FDI affects home country investment. One can intuitively understand that a dollar of money spent abroad means a dollar less to invest in the domestic economy. Based on the theory of the financially constrained firm, I hypothesize that outward FDI reduces domestic fixed capital investment and R&D spending. I also develop a theoretical framework to distinguish the varying effects of outward FDI on domestic investment across traditional and R&D-intensive industries.

By using industry-level panel data for 18 OECD countries covering the period 1995-2009, I regressed the shares of Gross Fixed Capital Formation (GFCF) and R&D spending separately on the share of outward FDI both for all industries as well as specifically for traditional and R&D-intensive industries. While, outward FDI had a negative effect on domestic capital investments at the aggregate level, it did not have any significant effect while looking at specific industry types. This could be because of the reduced sample size in the individual types. Outward FDI had a negative effect on domestic R&D spending at the aggregate level and for R&D-intensive industries, but it had a positive effect for traditional industries. Thus, while fears about outward FDI taking away domestic fixed capital investments are valid, outward FDI can have both a positive and negative effect on R&D expenditure, depending on the type of industry. These results can help MNCs make strategic investment decisions taking into account their effect on their home country industry. It can also help policymakers formulate tax and industrial policies to promote home country investments.

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1. Introduction:

The image of factories closing, big corporate companies offshoring production activities to low-wage countries and factory workers losing jobs is most commonly used by politicians across the spectrum to win over voters disenchanted with globalisation and internationalisation. While in the United States, this has resulted in blaming and scrapping of the free trade agreements, across Europe this has led to the rise of populist movements that want more nationalisation and to break out of the EU. Brexit is the prime example of the effect of these fears. Across the world, countries are exhibiting more protectionism, to save their domestic investments. Especially after the 2008 financial crisis, voters who were deeply hurt by the recession, mainly low and middle level workers, who lost their jobs and could not participate in the recovery are easily swayed by these notions. But are these fears based on facts? Do cross-border investment outflows deeply hurt the domestic economy, especially the domestic investment climate, which is crucial for a country's growth and recovery? These questions are more important today than ever in these changing political landscapes. They not only affect politicians and policymakers but are increasingly relevant for multinational firms (MNCs), who face risk and uncertainty and have to account for these in their decision-making.

According to the theory of perfect capital mobility, in an ideal world characterised by zero transaction costs and capital as a homogeneous good, capital would flow freely to worthy investments irrespective of geographical boundaries, and thus, there would be no need for multinational firms. But this is just a hypothetical scenario, and in the real world, there are transaction costs involved in moving capital. MNCs arise in response to imperfections in the goods or factor markets (such as variations in prices of goods or in labour/capital costs across countries). They capitalise on firm-specific advantages such as knowledge and other technical know-how which can be transported internally between one country and another through the MNC (Rugman, 1980). The rise of MNCs resulted in cross-border capital flows, in the form of Foreign Direct Investments (FDI) and Foreign Portfolio Investments (FPI). FDI is an investment made by a firm or individual in one country (home country) into business interests located in another country (host country). In FDI, investors make direct investments abroad by acquiring existing business assets of foreign companies, by starting new businesses with greenfield investments in plant and equipment, and by increasing their investments in foreign businesses that they already own (Feldstein, 1995). This is different from FPI, wherein the investor simply invests in the stocks of a foreign company, without owning it.

The rise of globalisation and a more connected and liberalised global economy have also been accompanied by the rise of FDI. Figure 1 shows how outward FDI flows as a percentage of GDP for developed countries has changed over the period from 1970 to 2016. As we can see, in the last twenty years, FDI flows have more than doubled. FDI has been predominantly responsible for the spread of technology from the developed to the developing countries. More than financial aid, portfolio investment or remittances, FDI has become the largest source of external finance in many developing countries. It has been especially crucial in helping develop infrastructure and industry in many emerging economies recovering from war, poverty and other crises. Thus, it is a key instrument for the distribution of wealth across countries. At the same time, it has also been very beneficial for MNCs in helping them achieve competitiveness and economies of scale, serve bigger markets and has resulted in the creation of the increasingly successful mega-corporations.

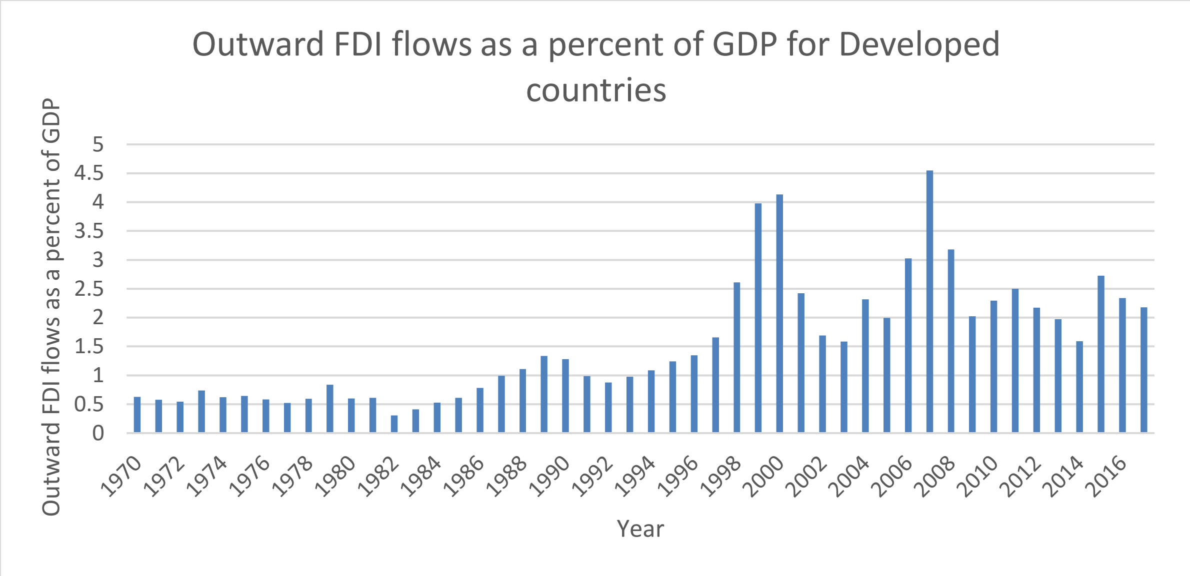

Figure 1: Outward FDI flows as a percent of GDP for Developed countries

Notes to Figure 1: The data are taken from "UNCTAD Stat Foreign Direct Investment: Inward and Outward flows and stock, annual,".

But the rise of FDI has also been accompanied by increasing concerns about the risks associated with FDI and globalisation and multinationals transferring employment and production abroad. Though FDI can increase the profitability of the individual MNC by enabling it to take advantage of its firm-specific capabilities and intangibles, there have been increasing worries over the effects of outward FDI on the home country economy as a whole. These fears have affected the world both politically and economically. The rise of protectionism and distrust of MNCs has led to a risky investment climate for companies. This can be seen from Figure 2, which shows how the Gross Fixed Capital Formation (GFCF), which is usually taken as the indicator of domestic investment, as a percentage of GDP for developed countries has declined over the same period (1970-2016). We are again confronted with the question if there is any evidence to these rising fears. Is outward FDI actually taking investment away from the home country? Intuitively, we know that a dollar spent abroad is a dollar that cannot be spent at home. So, we can understand the conception that investing abroad can divert economic activity from the home country. To answer the question, we develop the hypothesis that outward FDI reduces domestic fixed capital and R&D investment.

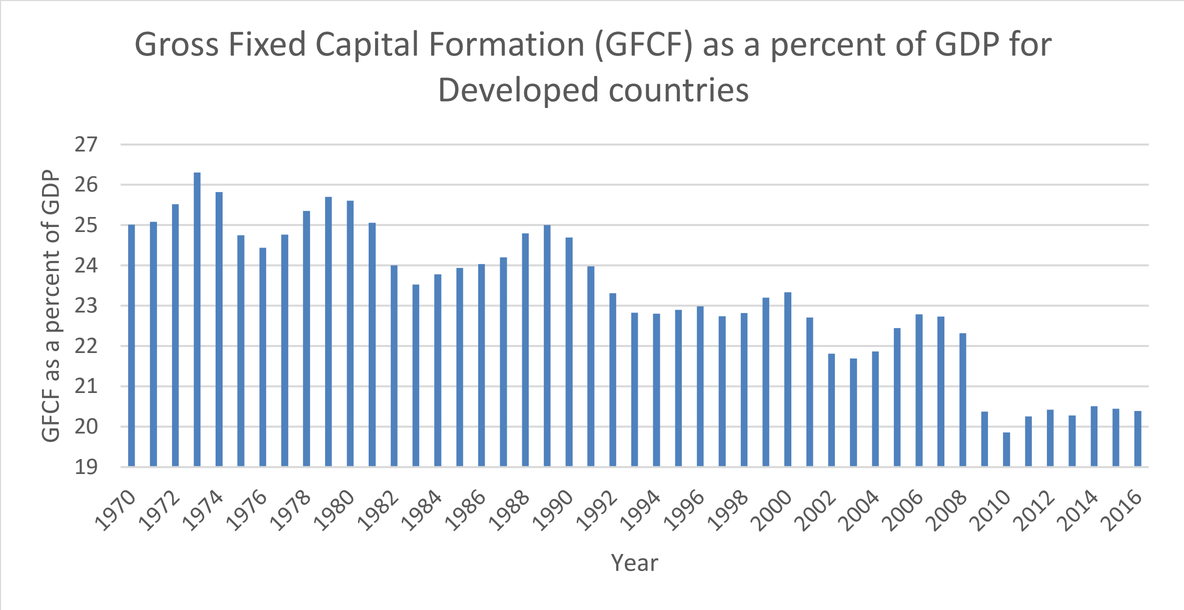

Figure 2: Gross Fixed Capital Formation (GFCF) as a percent of GDP for Developed countries

Notes to Figure 2: The data are taken from "UNCTAD STAT Gross Domestic Product: GDP by type of expenditure, VA by kind of economic activity, total and shares, annual, 1970-2016," .

This has been supported by some empirical evidence like Feldstein (1995), who found that for every dollar of outward FDI, a dollar of domestic investment is lost. But other empirical evidence supporting the concerns over the economic impact of rising FDI is limited. While there has been a lot of literature on the host country effects of FDI (Lipsey (2004), Faeth (2006), Johnson (2006)), home country effects of FDI have not been studied that extensively. Considering the home country effects, attention has focussed mainly on the effect of outward FDI on domestic exports and employment (Lipsey & Weiss (1981), Lipsey & Weiss (1984), Brainard (1997), Kokko (2006), Simpson (2012), *et cetera*), those discussing the effect on home country investments are comparatively less and produce mixed results. Among these limited studies done on home country, most are firm–level analyses for a specific country (Mansfield, Romeo, & Wagner (1979), Stevens & Lipsey (1992), Herzer & Schrooten (2008), Desai, Foley, & Hines (2009), *et cetera*), whose results cannot be generalised for a wider context. Looking at aggregate studies, we have few country-level analyses (Feldstein (1995), Desai et al. (2005)) and very few industry level analyses (Arndt et al. (2010), Goedegebuure (2006), Hejazi & Pauly (2002)). The country-level analyses may overlook considerable heterogeneities existing among industries, and how the impact of outward FDI can vary accordingly. The industry-level studies focus on a specific country, so again we encounter the problem of transferability. Thus, in this context, analysing cross-country data can produce results that could be widely applicable and doing it at the level of industry can greatly help understand if there are significant differences across different types of industries.

1.1. Problem description and research questions:

A country's current investment spending determines its future growth and capabilities as well as its productivity and employment. Domestic investment can mean both domestic fixed capital spending and R&D expenditure. Fixed capital refers to physical assets and capital investments that are used in the production of a product without being consumed in the production process. R&D refers to the work a business conducts toward the innovation, introduction and improvement of its products and procedures. While policymakers want to ensure that more money is not flowing out of the country, they also don't want to curtail the home country-based MNCs' global competitiveness and the revenue they bring in. At the same time, while companies focus on profit maximisation, they also don't want to adversely affect the domestic investment climate of their home country, which can lead to a huge reduction in domestic demand. Thus, the need to balance the two extremes depends on the specific firm or country's characteristics and priorities. But to arrive at that decision, it is important for all the relevant stakeholders to have a clear understanding of the actual effects of outward FDI, heterogeneities and underlying reasons.

We are now in the fourth industrial revolution and knowledge-capital and technology have become the backbone of every country and can in fact shape its future. Regulatory and tax policy is often formulated based on inaccurate popular theories or misunderstood empirical results about the effects of FDI on the domestic economy and can lead to counterproductive and detrimental results. Elections are won/lost and big politico-economic decisions are made based on them. With empirical results emphasizing both a positive as well as negative relationship between FDI and domestic spending, these can be highly confusing and misleading. Thus, understanding the actual relationship between outward FDI and domestic investment and R&D spending can help make better and well-informed policy decisions, that will benefit the economy in the long-run. It will also help MNCs to use their investment behaviour to influence their home country investment climate. This brings us to our research question of *'What is the effect of outward FDI flows on domestic fixed capital investment and R&D spending, while controlling for industry growth rate?'* If found that FDI affects domestic fixed capital and R&D investment adversely, it can also help policymakers counteract or compensate for this by taking other measures to promote capital investment and R&D spending.

Also, there can be a lot of heterogeneity in the relationship between outward FDI and domestic investment across different types of industry. For example, Braunerhjelm & Oxelheim (2000) found a substitutionary relationship between outward FDI and domestic investment for R&D-intensive industries, while they found outward FDI and domestic investment to be complements in traditional industries. This is in contrast to Goedegebuure (2006), who looked at the effect of outward FDI on domestic capital investment and R&D spending separately for both types of industries. He found a strong positive relationship between outward FDI and domestic R&D investment in both R&D-intensive and traditional industries. In case of domestic capital investment, he found a negative effect for R&D-intensive industries, while the positive and negative effects seemed to cancel out for traditional industries (Goedegebuure, 2006). Though there are contradicting empirical evidence as to the direction of the association, we can't discount that the relationship between outward FDI and domestic investment could be different at the aggregate level for all types of industries and at the disaggregated level of type of industry. Neglecting such differences and concluding just from the overall data for all industry types could lead to wrong policies which can be counterproductive and affect domestic investments adversely. So, this leads to the following research questions: '*How does the effect of outward FDI flows on domestic fixed capital investment and R&D spending vary across traditional and R&D-intensive industries?'*

1.2. Research objectives:

The aim of this research is to understand the nature of association between outward FDI and domestic investment, and if it is the same across both traditional and R&D-intensive industries. To do this, I use industry-level panel data merged from three different databases: OECD's ANalytical Business

Enterprise Research and Development (ANBERD) database, OECD's STAN STructural ANalysis Database and OECD FDI statistics to end-2013. It covers the period from 1995 to 2009 and 21 countries. I develop an empirical model where domestic investment indicated by the share of Gross Fixed Capital Formation (GFCF) and the share of R&D expenditure are independently regressed on the share of Outward FDI flows. The share of inward FDI and value-added growth are used as the control variables and fixed Effects Estimation method is used. Finding a positive or negative correlation will help us understand whether outward FDI flows and investment patterns are interlinked. Also, industry type-specific effects are studied for traditional and R&D-intensive industries to check for differences in the nature of the correlation across industry types.

1.3. Thesis outline:

This thesis report is structured as follows: Section 1 started with an introduction to FDI, description of the problem statement and research questions. In section 2, prior literature is reviewed providing a proper theoretical background as well as describing important prior empirical works to arrive at the research gap. In section 3, a theoretical framework is established and the primary and secondary hypotheses answering the research questions are developed. The Sections 4 and 5 contain an in-depth explanation of the methodology adopted and description of the data. In section 5, the results of the research are discussed thoroughly, and discussed with reference to other works. The last section summarizes the results, answers the research questions and reflects on the limitations and future work.

2. Literature review:

2.1. Theoretical background:

2.1.1. Theory of the financially-constrained firm:

To understand whether a firm's decision to invest abroad affects the overall domestic investment and R&D spending of the home country, we can look at it as a case of capital budgeting in a firm. As per Feldstein (1995), we imagine a theoretical ideal, wherein, a firm can borrow as much as it wants at a fixed interest rate and invest anywhere until the marginal product of capital is equal to the rate of interest. Thus, businesses should take up all projects and opportunities that enhance shareholder value without any fiscal constraints and regardless of the location of the project. However, practically, the amount of capital available for new investments is limited. A firm has a given amount of after-tax profits and dividend payout as expected by its shareholders. The firm's retained earnings (after tax profits minus the actual dividend payout) and desired level of debt to capital ratio determine how much a firm can borrow and thus, the actual capital available for investments (Feldstein, 1995).

Now the firm which is a multinational has to decide how to allocate this limited amount of capital for investments across all its subsidiaries depending on their profitability. Firms use different capital budgeting techniques such as net present value to assess the profitability of an investment. In this case, investing more abroad would mean the parent firm has less to spend in its home country. If we apply this to all multinational firms, more outward FDI by firms could adversely affect the fixed and R&D investment in their home country. But more outward FDI also increases the share of debt borrowed from and equity owned by foreign sources in a firm's financing. Feldstein (1995) speculated that this could be due to firms wanting to avoid foreign currency risk or getting access to cheaper foreign capital on availability of collateral. The latter implies that previously non-existing sources of capital might become available to firms while engaging in outward FDI, thus not affecting the funds available for domestic investment.

2.1.2. Substitutes and Complements:

An alternate way to understand firms' investment decision is to look at it as a choice of where corporate production will take place. A multinational firm's total worldwide production level might be approximately fixed, constrained by market conditions and government policies. In this case, foreign and domestic factors of production such as labour will act as conditional substitutes. When foreign production replaces domestic exports, they are referred to as substitutes; whereas, when foreign production stimulates domestic production by increasing the demand for domestic intermediates, they are referred to as complements. As the theory of internalization suggests, outward FDI substitutes for exports when there are sufficient costs to external transactions such as exporting or licensing (Blonigen, 2001). Hence any additional foreign production might reduce domestic production, and outward FDI could be negatively correlated with domestic investment levels. On the other hand, total production might not be fixed, but dependent on the expected sales and profitability. More foreign production might reduce costs and raise the return to domestic production, stimulating domestic factor demand and domestic output (Desai et al., 2009). In this case, outward FDI could have a positive effect on domestic production and investment. With outward FDI having both potential positive and negative effects on domestic investment, understanding the different types of FDI and the reason firms engage in FDI could help in predicting the effects better.

2.1.3. Types of FDI:

Horizontal FDI is investment that enables a multinational to produce the same product or service in multiple countries. The choice of horizontal FDI over exports is made when the higher fixed cost required to set up a plant in a foreign country is offset by the higher per unit cost of exporting to that country owing to tariffs and other transportation costs. The proximity-concentration hypothesis refers to the common tenet that FDI occurs when the benefits of producing in a foreign market outweigh the loss of scale economies that could be reaped if produced in only one plant (in the firm's home country) (Buckley and Casson, 1981). Thus, the firm gives up concentration of production and the associated economies of scale to take advantage of proximity to foreign market in terms of availability of foreign capital, easier access to foreign markets, better understanding of customer needs and closer working relationship with industrial customers, etc. Horizontal FDI is generally considered as a diversion of domestic investment, as domestic exports are substitutes for outputs of horizontal FDI. However, complementarity may later arise between horizontal FDI and domestic, as foreign operations make use of functions performed by parent firm and buy intermediary products from home country suppliers.

Vertical FDI is when the multinational firm fragments the production process internationally, locating each stage of production in the country where it can be done at the least cost (Aizenman & Marion, 2004). This can be best explained by the knowledge-capital model of the multinational enterprise, according to which, knowledge-based firm-specific intangible assets such as R&D can be geographically separated from production and supplied to production facilities at low cost. These knowledge-intensive activities are skill-intensive and can be located where skilled labour is cheap, whereas, production which is more labour-intensive can be located where unskilled labour is cheap, thus facilitating vertical fragmentation (Carr, Markunsen & Maskus, 2001). Vertical FDI can initially act as substitutes to domestic production as labour-intensive activities are outsourced. However, once the production process has been split up, foreign and domestic activities are likely to complement one another (Desai, Foley & Hines Jr., 2005a).

Most firms may engage in both vertical and horizontal FDI at the same time. But these could have varying effects on the intra-firm industrial organisation and concentration of activities and skill-levels in the firm's operations in the home country. Thus, the cumulative effect of this change in intra-firm industrial structure could greatly shape up the skill-intensity of production of the population at home. Horizontal FDI can have positive effects on home country employment in two ways. By displacing the production of low skill-intensity products abroad, which would otherwise have been produced at home and exported, the demand for low-skill labour at home reduces. So, the home population is forced to upgrade their skills to gain competitive advantage, and thus, the general skill-intensity of the home country as a whole increases. On the other hand, though production is offshored, if the host economy offered more of unskilled or low-skilled cheap labour, the more skill-intense activities like R&D and higher management and administrative activities could still be centrally located and retained at the home country. This results in expansion of high-skilled employment at the firm headquarters in the home country, and thus, the general skill levels of the home country population increase.

In the case of vertical FDI, the direction of change in home economy skill levels depends on how the production process is fragmented and what kind of activities are retained in the home country. If the more labour-intensive production activities are outsourced owing to cheap unskilled or low-skilled labour in the host country, similar to horizontal FDI, there would be concentration of high skill activities like R&D at home. But this can also be reversed, if the host country is chosen because of the availability of cheap high skilled labour. In this case, either just the skill-intensive activities or both the labour and skill-intensive activities could be outsourced thus, negatively affecting the overall employment levels in the home country. Sometimes, even if the host country has more of low to moderately skilled labour, if the labour supply is abundant and wages are cheap, firms may opt to train the moderately skilled so they can acquire the relevant skills required for the production or R&D process. In this case, the costs of training might be lower when compared to the production cost advantages arising from the low wages and flexible labour markets. Thus, depending on the skill levels and economic characteristics of the host country, vertical outward FDI can have positive or negative effects on home country employment.

2.1.4. Motivation for firms to engage in FDI:

Hejazi and Pauly (2003) identified three main motivations for firms to engage in outward FDI: gaining entry to new markets, taking advantage of differences in factor prices and access to natural resources. They also hypothesised the possible effects FDI for each of these reasons could have on domestic investment. Outward FDI to access new market would not displace existing domestic production, but instead might increase export of intermediaries, thereby having either a net zero or net positive impact on domestic investment; outward FDI to take advantage of low labour costs elsewhere would displace domestic production, which could be offset a little by export of intermediaries by multinationals to their foreign subsidiaries, thus having either a net zero or net negative impact on domestic investment. Similarly, outward FDI to access natural resources would still not displace domestic investment, but could encourage export of intermediaries, and would thus have either a net zero or net positive impact on FDI. More intra-firm (parent-subsidiary) trade would increase the offsetting effects of the intermediaries' exports, and thus increase the effect of outward FDI on domestic investment (Hejazi & Pauly, 2003).

2.1.5. Industry linkage effects:

Adding to this, Arndt, Buch &Schnitzer (2010) argued that while considering the effect of outward FDI on domestic investment, we should not only look at the industry-level effects of FDI by competing firms from the same industry, but also by FDI by input firms which deliver to this industry and by FDI by output firms which buy from this industry. Also, an industry can have multinationals as well as purely domestic firms (PDEs) which are owned by domestic owners, produce locally and serve only the domestic output market. So, when MNCs involve in vertical FDI, it can reduce their overall production costs, increase their competitiveness and thus increase their capital stock at both home and abroad. But this can adversely affect rival PDEs in the same industry who do not have the same factor price advantages and hence, may not be competitive enough to sell at the lower price of the MNCs. Thus, the overall effect of vertical FDI on the domestic capital stock of the industry under consideration depends on the competitiveness of the domestic market and on the market share of multinationals.

If the MNCs engaged in horizontal FDI to access newer markets, it might not have any adverse effect on the rival PDEs and thereby on the domestic investment. Next, looking at the effect of FDI by supplier firms, horizontal FDI for new market access might not affect the industry under consideration. Whereas, vertical FDI to take advantage of cheaper factors of production might result in lower production cost and translate to lower price for the buyer industry. Thus, it can have a positive effect on domestic investment. Finally, we consider the effect of FDI by output firms which buy from inputs the industry under consideration. Vertical FDI due to cheaper inputs abroad will substitute for domestic inputs and hence imply loss of business for the industry under consideration, negatively affecting the domestic capital stock. Whereas, horizontal FDI to access newer markets means more demand for domestic inputs and would thus have a positive impact on domestic capital stock (Arndt et al., 2010).

2.1.6. Effect of FDI on R&D spending:

Since R&D expenditure is considered a part of fixed investment, the effect of outward FDI on domestic R&D spending could also be similarly either positive or negative. If foreign investment substitutes for domestic exports, it would displace domestic production and thereby, negatively affect the R&D spending in the home country (Singh, 1977). On the other hand, there are also a number of ways through which more outward FDI could induce MNCs to spend more on R&D. But this depends on the reason why the firm is engaging in outward FDI. If a firm is investing abroad to take advantage of lower labour or capital costs or cheaper resources of production, the firm might be able to transfer this cost advantage to the consumer through competitive pricing. This, in turn would increase the total sales of the product (Cohen & Klepper, 1996a,b). Similarly, firms engaging in outward FDI to expand to newer markets would also increase their total sales. With more sales, the R&D and other fixed costs could be averaged over a wider range of output, thus unit fixed costs would reduce, giving firms an incentive to spend more on R&D (Chen & Yang, 2013).

A firm's R&D may be internal or external. Internal R&D is R&D undertaken in-house by the firm's personnel using the firm's resources to develop technological know-how or to come up with commercially viable innovations, whereas, external R&D is R&D contracted to external research organisations like universities, other firms, et cetera for the same purpose (Cuervo-Cazurra & Un, 2007). The choice of a firm's R&D expenditure depends on the external pressures, which influence the firm's return-on-investment from these R&D expenditures. In the case when firms engage in outward FDI to easily access foreign markets, they acquire an expanded customer base and foreign competitors. These newer foreign market customers may have different preferences and demands to those of domestic customers. So, firms have to focus more on innovation and R&D to come up with products that satisfy their diverse customer base (Cuervo-Cazurra & Un, 2007). Also, they have to compete with domestic as well as foreign competitors. This increased competition in product markets could greatly reduce product life cycles and induce firms to spend on internal R&D to optimize their operations (Chen & Yang, 2013). It could also lead to intense pricing wars, since unlike fixed investments, price changes can be implemented quickly and are reversible (Ghemawat, 1991). Thus, all of these product market pressures could force firms to focus on internal R&D to develop their technological capabilities, as internal development could provide them with a distinct competitive edge that is difficult to imitate by competitors (Cool, Costa, & Dierickx, 2002).

When firms engage in outward FDI, along with newer product markets, they also gain access to previously unavailable sources of raw materials, suppliers, skilled labour as well as technology. This can prove to be an advantage, especially, when the host country is more technologically advanced or has more highly skilled labour, as firms can acquire newer technology and scientific knowledge from external sources more easily. Having access to a wider range of factor markets, firms can also easily outsource this acquired technology, thus motivating them to engage in external R&D (Cuervo-Cazurra & Un, 2007). The access to foreign suppliers could enable firms to change suppliers more easily, reducing opportunism, while the threat could increase the competitiveness of domestic suppliers. Thus, all these factor market influences could increase the profitability of firms, enabling them to allocate more resources for R&D (Cuervo-Cazurra & Un, 2007). Also, as (Feldstein, 1995) speculated, with foreign investments, firms might get access to cheaper sources of foreign capital due to the availability of collateral in the host country. This could again encourage firms to invest more in R&D. Thus, the domestic and foreign factors of production along with the market size and other country-specific characteristics such as regulatory and tax regimes determine the choice between exports and outward FDI, and the consequent effect outward FDI would have on the home country.

2.2. Review of Empirical evidence:

We can categorize the literature available on the effect of outward FDI on domestic investment and R&D spending into firm-level, industry-level or country-level analyses. A brief overview is presented in the following table (*Table 1*):

Table 1: Overview of Empirical Evidence

Unit of Analysis	Literature	Variables studied	Effect
Firm-level	Mansfield et al. (1979)	Effect of foreign market sales on R&D returns (US)	Positive
	Desai et al. (2005)	Effect of foreign capital expenditures on domestic capital expenditures (US)	Positive
	Goedegebuure (2006)	Effect of outward FDI on domestic R&D spending in R&D-intensive industries (Netherlands)	Positive
	Goedegebuure (2006)	Effect of outward FDI on domestic R&D spending in traditional industries (Netherlands)	Positive
	Goedegebuure (2006)	Effect of outward FDI on domestic capital investments in R&D-intensive industries (Netherlands)	Negative
	Goedegebuure (2006)	Effect of outward FDI on domestic capital investments in traditional industries (Netherlands)	Positive
	Chen & Yang (2013)	Effect of outward FDI on domestic R&D spending (Taiwan)	Positive
Industry-level	Braunerhjelm & Oxelheim (2000)	Effect of outward FDI on domestic investment in R&D-intensive industries (Sweden)	Negative

	Braunerhjelm & Oxelheim (2000)	Effect of outward FDI on domestic investment in traditional industries (Sweden)	Positive
	Hejazi & Pauly (2002)	Effect of outward FDI on domestic capital formation (Canada)	No effect
	Goedegebuure (2006)	Effect of outward FDI on domestic R&D spending in R&D-intensive industries (Netherlands)	Positive
	Goedegebuure (2006)	Effect of outward FDI on domestic R&D spending in traditional industries (Netherlands)	Positive
	Goedegebuure (2006)	Effect of outward FDI on domestic capital investments in R&D-intensive industries (Netherlands)	No effect
	Goedegebuure (2006)	Effect of outward FDI on domestic capital investments in traditional industries (Netherlands)	Negative
	Arndt et al. (2010)	Effect of outward FDI on domestic capital stock (Germany)	Positive
Country-level	Feldstein (1995)	Effect of outward FDI on domestic investment	Negative
	Desai et al. (2005)	Effect of outward FDI on domestic capital investment	Negative

2.2.1. Firm-Level Analyses:

Looking at firm-level analyses, Mansfield et al. (1979) were one of the first to look at the effect of international trade and Foreign Direct Investment (FDI) on Research & Development (R&D). They chose a sample of 30 US multinational firms, with 20 firms representing diverse industries and the remaining 10 firms being major chemical companies. They studied how foreign market sales or foreign utilisation contributed to anticipated R&D returns for each of the 30 firms. Here, foreign utilisation could mean utilising the new technology in foreign subsidiaries, exporting goods that are based on the new technology, licensing the new technology to others who will use it abroad, or engaging in joint ventures with others to use it abroad. They found that on average, 29% of the chemical sample's R&D returns were expected to come from overseas sales or utilisation (licensing, etc.), while 34% of the 20-firm subsample's R&D returns were expected to come from foreign sales or utilisation. They also found high inter-firm variation from some firms expecting 0% to some firms expecting 50-60% of their R&D returns from foreign sales.

They attributed this variation to the extent to which a firm depended on foreign sources for its current sales. So, a firm which usually has a higher share of foreign sales would have an R&D program more tuned to suit foreign market needs, and thus would be able to get more returns for its R&D spending from foreign sales or utilisation. They also found evidence that contradicted the myth that FDI was reducing incentive to invest in domestic R&D by transferring technology abroad. They showed that in the hypothetical scenario where firms were not able to utilize any new technology abroad in their affiliates or by licensing the technology abroad or by exporting products or processes based on the technology, firms' R&D spending would fall significantly by about 26% for the 20-firm subsample, and by about 16% in the chemical sample. They also found that firms that depend more on foreign sales spend more on basic research, which can find some application in one of their heterogeneous product and business lines in the long-term. Thus, all these show a positive relationship between foreign sales and domestic R&D spending.

Chen & Yang (2013) analysed 1992-2005 firm-level panel data on Taiwanese manufacturing firms to study the link between outward FDI activity of Taiwanese MNCs in developing countries (especially China) to take advantage of low-cost labour and the MNCs' domestic R&D spending. They developed an empirical model, wherein, along with a binomial dummy variable to indicate whether a firm engaged in outward FDI, they also included demand side factors such as firm size (sales) as well as technology side factors such as firm's age as a proxy for firm's accumulated technological knowledge, firm's technology purchase expenditures and technology licensing revenues as control variables in determining a firm's profit-maximizing R&D (Lee, 2003). Chen & Yang (2013) used a difference-in-difference methodology to compare the difference between pre-FDI and post-FDI R&D spending between a control group and sample group. To account for policy changes in Taiwan which greatly affected Taiwanese outward FDI in China after 2000, Chen & Yang (2013) divided the sample data into two sub-samples 1992-1998 and 1999-2005. Since most of the firms engaged in outward FDI either in 1993 or in 2000, binomial time dummies were included to indicate 1994-1998 and 2002-2005 which were the post-FDI periods. The coefficient for the interaction term between the binomial outward FDI dummy and the time dummy would give the difference-in-difference estimate of the effect of outward FDI.

Chen & Yang (2013) found positive coefficients of 1.12 and 1.36 for the interaction terms, thus indicating that if a firm engaged in outward FDI in either 1993 or 2000, its R&D spending was likely to increase by 1.12 thousand New Taiwan Dollars (NTD) or 1.36 thousand NTD in the respective post-FDI periods. They attributed the relatively larger positive coefficient for the second sub-sample to the increase in wages in China and other South-East Asian countries during the late 1990 due to economic development, thereby, confirming their proposition that smaller the wage gap between home and host countries, more likely is the positive effect of a firm's outward FDI on its domestic R&D spending (Chen & Yang, 2013). Looking at the control variables, firm size had a positive effect on R&D in accordance with Cohen & Klepper (1996a)'s theory of cost spreading, which states that larger the firm, more output over which the firm's R&D costs can be averaged over, thus giving more incentive for firms to engage in R&D. Technology purchases were also found to have a positive effect on R&D, stressing the complementarity between external and internal R&D (Veugelers, 1997). Firm age had no significant effect on R&D spending, whereas, technology licensing revenues which were representative of the performance of the firm's R&D activity were also found to have a positive effect on R&D spending, as better returns would incentivise firms to spend more. Chen & Yang (2013) also divided the sub-samples further into high and low R&D-intensive industries and repeated the regressions. They obtained similar positive coefficients for both high and low R&D-intensive industries for both the sets of sub-samples, confirming that outward FDI in low wage countries to transfer labour-intensive activities abroad would stimulate R&D spending in the home country (Chen & Yang, 2013).

Goedegebuure (2006) was one of the very few to study the effect of outward FDI on domestic investments in capital and R&D separately. Netherlands was one of the largest sources of outward FDI. Goedegebuure (2006) looked at longitudinal firm-level data on Dutch MNCs spanning the years 1996-2000. He found positive coefficients when changes in R&D expenditures were regressed against changes in outward FDI for high-tech and medium high-tech companies. The positive effect was especially strong in high-tech companies. In the case of capital investments, in high-tech companies, outward FDI had a slightly negative effect implying that the positive effects associated with sales-increasing market-seeking outward FDI are cancelled out by the negative effects associated with production-displacing efficiency-seeking outward FDI. But counter to their hypothesis, Goedegebuure (2006) found a comparatively stronger positive association between outward FDI and capital investments in low-tech companies, dispelling misconceptions that outward FDI reallocated funds available for domestic investments. Thus, he argued that outward FDI mainly had a net positive effect on domestic investments by expanding the market available and increasing sales to recuperate the R&D costs, whereas, the negative effects associated with the decrease in capital expenditures by shifting production abroad were negligible and occurred only in high-tech companies and industries due to their highly competitive industry characteristics (Goedegebuure, 2006).

Desai et al. (2005) analysed both aggregate cross-country data as well as firm-level data on outward FDI and domestic investment. To understand firm-level behaviour, they obtained time-series data for the US and foreign capital expenditures of American multinationals from the annual Survey of US Direct Investment Abroad and the annual measures of US gross savings and US between 1982 and 1999. They regressed the ratio of aggregate annual domestic capital expenditures of American multinational firms to US GDP on the ratio of US multinational firms’ foreign capital expenditures to US GDP, while controlling for domestic savings and inward FDI flows. They found a regression coefficient of 3.50 implying that while holding domestic savings to GDP ratio and inward FDI flow to GDP ratio fixed, for every dollar a US multinational invested abroad, the multinational invested 3.50 dollars in the US, thus showing a strong complementarity between outward FDI and domestic investment (Desai et al., 2005a).

2.2.2. Industry-Level Analyses:

Braunerhjelm & Oxelheim (2000) explored how FDI and regional integration affected home country investment, and whether this effect varies across Schumpeter (R&D-intensive) and Heckscher-Ohlin (traditional) type of industries. They analysed industry-level data for Swedish Multinationals for the period 1982 to 1995. Sweden is one of the countries with the highest number of MNCs. They hypothesized that in traditional industries, which are based more on country-specific advantages and are vertically integrated, FDI mainly takes place in downstream activities, whereas the process-intensive activities are retained in the home country. So FDI will act as a complement to domestic investment. But R&D-intensive industries are horizontally integrated and the knowledge from R&D can be used by different units simultaneously, thus FDI will act as substitute for domestic production. When these hypotheses were tested empirically by regressing gross domestic investment on FDI, a statistically significant coefficient of -0.003 was obtained for Schumpeter industries thus confirming their hypothesis. Similarly, for Heckscher-Ohlin industries, a coefficient of 0.029 was obtained indicating a strong positive effect, again verifying their hypothesis.

Hejazi & Pauly (2002) analysed the impact of Canada’s FDI on its domestic capital formation. They used annual industry-level data from 1983 to 1995 and found that while decreasing levels of inward

FDI negatively affected domestic capital formation, increasing outward FDI had no net statistically significant effect on GFCF. Hejazi & Pauly also found some variations depending on the host country. Canada's outward FDI to the United States had a strong positive effect on Canada's domestic capital formation, while the effect of outward FDI to the United Kingdom was statistically insignificant. However, outward FDI to the rest of the world had strong negative impacts on Canada's domestic capital formation. Hejazi & Pauly (2003) attributed this heterogeneity among countries to the varying motivations for firms to engage in FDI in these countries. While FDI to the United States was mainly due to the free trade agreement between the two countries, which stimulated bilateral trade thus increasing the GFCF, FDI in the United Kingdom was just to bypass the high tariffs between the two countries. Thus, there wasn't much loss of domestic production or offsetting export of intermediaries from Canada, explaining the statistically insignificant effect of FDI. But outward FDI to the rest of the world could mainly be to exploit the lower labour and production costs in developing countries, which would thereby displace domestic production and reduce GFCF. Thus, Hejazi & Pauly (2003) argued that the motivation for FDI could be a major determinant of the actual effect of FDI on domestic investment.

Goedegebuure (2006) also looked at cross-sectional industry-level data taken for the latest year in their coverage period (1996-2000) for which the data were available. He similarly used OECD classification of industries to distinguish the effects of outward FDI in medium high-tech and high-tech manufacturing industries, which he considered as R&D intensive industries, and in low-tech, which he considered as traditional industries. It was found that R&D investment increased strongly with the degree of internationalisation in both R&D intensive and traditional industries, with the effect especially strong in high-tech industries. Whereas, while internationalisation had no net effect on capital investments in R&D intensive industries, it had a slightly negative effect on capital investments in traditional industries confirming their hypothesis that in case of capital investments, the negative effects of outward FDI either cancel out or outweigh the benefits of internationalisation.

Arndt et al. (2010) also studied the relationship between outward FDI and domestic capital stock using data aggregated at the industry level. They used firm-level FDI data for the period 1991-2004 from the MiDi (Micro database Direct Investment) provided by the Deutsche Bundesbank and aggregated it using standard NACE industries into 13 manufacturing and 9 service industries. They obtained the domestic capital stock data from the OECD's STAN database and from the German Statistical Office. They regressed the log of the domestic capital stock on the logs of the price of labour and the levels of employment, output, and the stock of outward FDI, and found a regression coefficient of 0.04 for the stock of outward FDI. Since all the variables were in logs (growth rates), the coefficient could be taken as the elasticity of domestic capital stock to outward FDI, thus indicating that when the growth rates of hourly wages, employment level and output level were fixed, a one unit increase in the growth rate of outward FDI would result in a positive effect of 0.04 unit increase in the growth rate of domestic capital stock (Arndt et al., 2010).

With empirical results emphasizing both a positive as well as negative relationship between FDI and domestic spending, motivations for firms to engage in FDI become the determining factors. Though, there are multinational firm-level analysis mainly for the US and a few Asian and European countries, they produce contradicting results based on the country. At the aggregate level, except for Feldstein (1995) and a few other papers ((Desai et al., 2005a)), there is no comprehensive cross-country panel data used for the study of FDI. While these indicate a negative relationship between FDI and domestic investment, analyses using data aggregated at the industry-level ((Hejazi & Pauly, 2002) and (Arndt et al., 2010)) show strong positive effects. Thus, there is a stark contrast in results when aggregated at the country and industry level. Hence, we can identify a research gap in this area. To overcome the issues, we analyse cross-country data measured at the industry level.

2.2.3. Country-Level Analyses:

At the country-level, Feldstein (1995) studied the relationship between the outward FDI to GDP ratio and the Gross Domestic Investment (GDI) to GDP ratio based on OECD and International Monetary Fund (IMF) data for 18 of the OECD countries in the 1980s and 15 of the OECD countries in the 1970s. He used Gross National Savings (GNP) to GDP ratio and inward FDI to GDP ratio as the control variables. He considered two cases: affiliate fully financed by the parent firm; and affiliate financed by multiple sources including foreign debt and equity. For the first simpler case, wherein, the foreign affiliate of the multinational is fully financed by the parent firm, he found an FDI-out coefficient of approximately -1, thus proving that while holding GNS to GDP ratio and inward FDI to GDP ratio fixed, outward FDI had a dollar-to-dollar negative effect on domestic investment. For the second more realistic case he found that for every dollar of outward FDI, domestic capital stock decreased by 20 to 38 cents (Feldstein, 1995).

Desai et al. (2005) also analysed country-level data and found some contrasting results to their firm-level analysis. They used OECD countries data for the 1980s and 1990s and regressed decade-long averages of the ratio of national gross capital formation (GCF) to GDP on the ratio of savings to GDP, ratio of outward FDI to GDP and ratio of inward FDI to GDP, and found results similar to those obtained by Feldstein (1995). They found outward FDI coefficients of -1.33 for the 1980s and -1.07 for the 1990s, that is, if savings to GDP and inward FDI to GDP ratios were held fixed, a one-point increase in outward FDI to GDP ratio would result in a 1.33 decrease in GCF to GDP ratio for the 1980s and a 1.07 decrease in the GCF to GDP ratio for the 1990s. Thus, (Desai et al., 2005a) concluded that outward FDI and domestic investment were substitutes.

Desai et al. (2005) attributed the contrasting results for the OECD data and the US multinational firm data to three likely possibilities. The first that foreign and domestic production might be complements in the US, while being substitutes in the rest of the OECD countries. The second that while the second study considered the expenditures of only the US multinationals, an increase in domestic spending by US firms could be offset by a greater reduction in inward FDI in the US by foreign multinationals, thus accounting for the substitutive behaviour evidenced by the first OECD analysis. A third explanation was that the complementarity between foreign and domestic expenditure could be dependent on a mediating variable such as the growth rate of the foreign economies. Thus, investing in a growing foreign country would mean the multinationals could make more profits and thus would more likely invest in their home country. Regression done including this mediating variable resulted in a higher outward FDI coefficient of 3.9, implying that omitted variables could significantly obscure the complementarity. Desai et al. (2005) argued that since such instrumental variables could not be found for the OECD data, the US multinational firm data was more reliable, thus supporting the positive effect of outward FDI on domestic investment.

3. Theoretical Framework and Hypothesis Development:

3.1. General Framework:

We are interested in developing a theoretical framework to study how outward FDI affects domestic investment, where domestic investment here is understood broadly: it can mean investments in fixed capital equipment and structures as well as investments in R&D.

3.1.1. Conventional model of investment:

Economic textbooks present the theory of investment at the level of the firm (e.g. Pindyck & Rubinfeld 2017). Expected future profitability and the user cost of capital are the key determinants of investment. Profit-oriented firms commit to capital investment and R&D spending in anticipation of future profits – the investments are made when they promise to yield a return above the cost of capital. The firm in the simplest textbook model faces no financial constraints: external funds perfectly substitute for internal capital and a firm can borrow as much as it wants at the going rate of interest. The assumption of profit-maximization then causes it to commit to all investment opportunities that promise to yield a return above the rate of interest, and to pass on all opportunities that promise to yield a return below the rate of interest. In this highly stylized textbook world, there is no opportunity cost to investing abroad, that is, committing funds to investment projects abroad does not subtract from funds available for domestic projects. Without financial constraints, the multinational firm carries out all profitable investment projects within its reach, without regard to the location of the underlying economic activity.

3.1.2. Capital market imperfections and Financial constraints:

The simple textbook model is not an accurate representation of actual investment decisions by multinational firms. It may be the case if complete information were available to all the participants in the capital market. But firms do face financial constraints and these constraints influence investment decisions. The economics literature attributes the existence of financial constraints to various kinds of "capital market imperfections". These imperfections mainly arise out of two types of information asymmetries between firms and their lenders in capital markets:

- Adverse selection
- Moral hazard

The first type is adverse selection, whereby, the lender does not know complete and accurate information about the quality or riskiness of the firm's investment projects. The firm may present lenders with a more favourable view of its projects and their returns. The firm could also have proprietary information that it is not willing to share. All of this means that the lender is unable to judge if the firm will be able to and/or willing to pay back the loan. To compensate for this information disadvantage, lenders increase their average price of capital. But this higher interest rate discourages safe borrowers and leaves only risky borrowers to avail the loans, thus leading to adverse selection (Fazzari & Athey, 1987). The second type is moral hazard, whereby, the firm can default on the loan post-borrowing. Both adverse selection and moral hazard require costly external evaluation and monitoring of firms' investments. All of these result in external finance such as debt and equity being costly over internal financing for the firm, and not all firms being able to access external financing. Thus, this leads to financing constraints (Hubbard, 1997).

The main hypothesis of this thesis is developed based on the theory of the financially constrained firm. According to this, a multinational firm has limited amount of capital determined by its retained earnings and desired debt-to-equity ratio (Feldstein, 1995). So, it has to carefully allocate this capital among the most profitable projects across all its subsidiaries. Given a limited capacity to raise external funds, spending more abroad leaves less to spend at home. The theory of investment applies to the level of the firm. The capital allocation by individual firms can be expected to have aggregate effects at the level of industry, which is a collection of firms. This leads to the development of our primary hypothesis as follows:

(H1): '*Domestic investments tend to be negatively correlated with outward FDI'*. This consists of two parts –

(H1a): '*Domestic fixed capital investment tends to be negatively correlated with outward FDI*'; and

(H1b): '*R&D spending tends to be negatively correlated with outward FDI'.*

The main hypothesis is that outward FDI reduces domestic investment, and the main objective of the empirical analysis is to estimate the size of this effect.

Funds that enter the industry should increase the capacity of domestically active firms to invest in the domestic economy, all else being equal. Therefore, inward FDI will be included as a control variable because it can be expected to increase capital investment and R&D spending. The type of the industry the firm is in, whether it is a growing industry or not, can also affect the amount of domestic investments made in that industry. It can be expected that investment is high in growing industries and low in shrinking industries, all else being equal. Value added is a measure of the scale of an industry; it represents the monetary value of all wages paid and all profits made in a year. An industry with a high value-added growth rate can earn more revenue and thus, can still be associated with high domestic capital and R&D investment, despite high levels of outward FDI. Hence value-added growth will be used as a second control variable.

Thus, we develop a theoretical model, where outward FDI, which is the money going out, inward FDI, which is the investment money coming in, and value-added growth, which indicates the industry's growth rate, together explain the variation in domestic investment, as shown in Fig. 3.

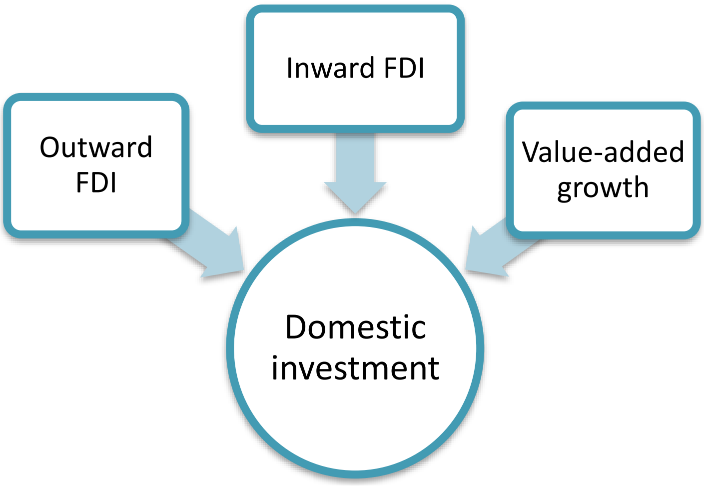

Figure 3: General Theoretical Framework

3.2. Industry effects:

As Braunerhjelm & Oxelheim (2000) argues, the effect of outward FDI on domestic investment can be significantly different for different types of industries. Thus, using data aggregated at the industry-level, we can distinguish between Schumpeterian and Heckscher-Ohlin type of industries. Heckscher-Ohlin type of industries are that where firm competitiveness depends on the access to some country-specific, relatively abundant and inexpensive natural resource or knowledge. These are analogous to the low-tech traditional industries. Schumpeterian type of industries consist of firms whose competitiveness comes from firm-specific factors, created within the firm through R&D and other knowledge enhancing activities (Braunerhjelm & Oxelheim, 1992). These are analogous to the high-tech R&D-intensive firms.

As noted from empirical evidence (Braunerhjelm & Oxelheim (2000), Goedegebuure (2006)) the relationship between outward FDI and domestic investment could be different at the aggregate level and at the disaggregated level of the types of industries. Neglecting the differences and concluding just from the overall results for all industries could lead to wrong policies which can be counterproductive and affect domestic investments adversely. To understand how outward FDI can affect domestic investment differently in traditional and R&D-intensive industries, along with our primary theory of the financially constrained firm, I also look at the following secondary theories from literature. The strength of our secondary theories and the aggregate effects of our primary and secondary theories together determine the direction of the association, as represented in Table 1.

Traditional industries with low R&D intensity depend on cheaper factors of production for their competitive advantage. Therefore, they mainly engage in efficiency-seeking outward FDI to access cheaper raw materials or low-skilled labour. Production is shifted from the home country to where the production costs are lowest, thus displacing domestic fixed capital spending. This leads to our next hypothesis:

(H2a): *'In traditional industries, domestic fixed capital investment tends to be negatively correlated with outward FDI'.*

Though traditional industries mainly engage in efficiency-seeking outward FDI, there could also be a sales-increasing effect associated with it. If a firm is investing abroad to take advantage of lower labour or capital costs or cheaper resources of production, the firm might be able to transfer this cost advantage to the consumer through competitive pricing. This, in turn would increase the total sales of the product (Cohen & Klepper, 1996a,b). With more sales, R&D expenses can be averaged over a wider range of output. This is known as cost spreading and can encourage firms to spend more on R&D (Chen & Yang, 2013). Also, with efficiency-seeking FDI as in the case of traditional industries, vertical fragmentation of the production process takes place. While the more labour-intensive production activities are outsourced owing to cheap unskilled or low-skilled labour in the host country, the more skill-intense activities like R&D and higher management and administrative activities are still centrally located and retained at the home country. At the same time, although efficiency-seeking is the main motive for outward FDI for traditional industries, this also opens up these firms to newer customer markets. They have to adapt their products to suit the preferences and demands of the customers of these newer markets. This could again incentivise firms to invest more in home-country R&D. All this leads to the following hypothesis:

(H2b): *'In traditional industries, domestic R&D spending tends to be positively correlated with outward FDI*'.

R&D-intensive industries gain their unique competitive advantage from firm-specific factors such as R&D and other knowledge-enhancing activities. R&D-intensive industries are highly skill-intensive, and thus mainly engage in horizontal outward FDI to expand to newer markets. Here production is not vertically fragmented but takes place simultaneously in different markets. Thus, the firm gives up concentration of production and the associated economies of scale to take advantage of proximity to foreign market in terms of availability of foreign capital, easier access to foreign markets, better understanding of customer needs and closer working relationship with industrial customers, et cetera. Since the outputs of horizontal FDI substitute for domestic exports, it can reduce domestic production and hence be a diversion of domestic fixed capital investment. At the same time, the access to newer markets can increase the output produced as well as the sales, leaving the firm with more money to spend more on both its domestic and foreign fixed investments. Thus, outward FDI can have both a positive and negative effect on domestic fixed capital investments, which can eventually cancel each other out. This leads to the following hypothesis:

(H3a): *'In R&D-intensive industries, domestic fixed capital investment tends to be uncorrelated with outward FDI*'.

Though market-seeking is the main motive for FDI in R&D-intensive industries, efficiency-seeking motive can also come into play if cheap and abundant highly-skilled labour is available in the host country. Also, even if the host country has more of low to moderately skilled labour, if the labour supply is abundant and wages are cheap, firms may opt to train the moderately skilled so they can acquire the relevant skills required for the R&D process. In this case, the costs of training might be lower when compared to the cost advantages arising from the relatively lower wages and more flexible labour markets available in the host country. This can displace R&D activities from the home country, thus leading to the following hypothesis:

(H3b): *'In R&D-intensive industries, domestic R&D spending tends to be negatively correlated with outward FDI*'.

Table 2: Framework for Industry effects

		Traditional industries	R&D-intensive industries
Domestic fixed capital investment	Primary theory	Negative • Financially constrained firm	Negative • Financially constrained firm
	Secondary theory	Negative • Efficiency-seeking outward FDI leads to offshoring of production activities	Positive or negative • Market-seeking outward FDI that substitutes for domestic exports • But increased sales can also mean more money for domestic capital investment
	Aggregate effect	? • Hypothesis H2a: Negatively correlated	? • Hypothesis H3a: Uncorrelated
Domestic R&D spending	Primary theory	Negative • Financially constrained firm	Negative • Financially constrained firm
	Secondary theory	Positive • Efficiency-seeking outward FDI leads to sales-increasing effect • More sales, R&D costs averaged over wider output • Vertical fragmentation: R&D activities retained at the headquarters	Negative • Market and efficiency-seeking outward FDI • Take advantage of the cheaper high-skilled labour elsewhere, and the lower costs of training cheap and abundant moderately-skilled labour elsewhere • Displaces domestic R&D activities
	Aggregate effect	? • Hypothesis H2b: Positively correlated	? • Hypothesis H3b: Negatively correlated

4. Methodology:

4.1. Empirical model:

Based on our theoretical model (General Framework:), the baseline empirical model for the population can be formulated as follows:

$$y_{ict} = \beta_{0,ic} + \beta_1 x_{1,ict} + \beta_2 x_{2,ict} + \beta_3 x_{3,ict} + \varepsilon_{ict} \quad (1)$$

Where the explanations for the symbols used are mentioned in Table 3.

Table 3: Explanation for the symbols used in the population model

Symbol	Name	Explanation	Units
y	Share of GFCF*	Dependent variable	US$/US$
	Share of R&D expenditure*	Dependent variable	US$/US$
X_1	Share of Outward FDI*	Independent variable (Main)	US$/US$
X_2	Share of Inward FDI*	Independent variable (Control)	US$/US$
X_3	Value-added growth*	Independent variable (Control)	/year
i	Industry	index	-
c	Country	index	-
t	Time-period	index	years
β_0	Time-variant Intercept	Change in y caused by variations across industry and country, *ceteris paribus*	US$/US$
β_1	Slope Coefficient	Change in y for a one unit increase in X_1, *ceteris paribus*	$\frac{US\$/US\$}{US\$/US\$}$
β_2	Slope Coefficient	Change in y for a one unit increase in X_2, *ceteris paribus*	$\frac{US\$/US\$}{US\$/US\$}$
β_3	Slope Coefficient	Change in y for a one unit increase in X_3, *ceteris paribus*	$\frac{US\$/US\$}{US\$/US\$}$
ε	Unexplained Stochastic error term		US$/US$

Notes to Table 3: The variable definitions are explained in the following Data Section (5.5).

This is an unobserved or fixed effects model as presented in standard economic textbooks (e.g. Wooldridge (2012)), whereby, the error terms, ε_{ict} for each combination of industry, country and year, are considered to be composite errors consisting of two components: time constant and time-varying unobserved effects. Thus, the population model equation can be written as:

$$y_{ict} = \beta_{0,ic} + \beta_1 x_{1,ict} + \beta_2 x_{2,ict} + \beta_3 x_{3,ict} + \alpha_{ic} + u_{ict} \quad (2)$$

where, $\alpha_{G,ic}$ and $\alpha_{R,ic}$ are the time-constant individual fixed effects, and $u_{G,ict}$ and $u_{R,ict}$ are the time-varying unobserved effects. Individual characteristics of an industry or country, which do not change over time are given by the time-constant fixed effects. For example, the degree of risk-averseness, target markets, debt-to-equity ratios, distribution of market share *et cetera* are some industry-specific characteristics that can be different for different industries and may not change over time. Similarly, country-specific factors like industry concentration, relative level of development, labour market flexibility, skill intensity of the population, *et cetera* may remain fairly constant over time.

4.1.1. Variations to the baseline model:

The variations to the baseline model are addition of a linear time trend (t):

$$y_{ict} = \beta_{0,ic} + \beta_1 x_{1,ict} + \beta_2 x_{2,ict} + \beta_3 x_{3,ict} + t + \alpha_{ic} + u_{ict} \tag{3}$$

Addition of linear and quadratic time trends (t and t^2):

$$y_{ict} = \beta_{0,ic} + \beta_1 x_{1,ict} + \beta_2 x_{2,ict} + \beta_3 x_{3,ict} + t + t^2 + \alpha_{ic} + u_{ict} \tag{4}$$

and addition of time dummies $\delta_t D_t$ with δ_t=1 at year t, and 0 elsewhere

$$y_{ict} = \beta_{0,ic} + \beta_1 x_{1,ict} + \beta_2 x_{2,ict} + \beta_3 x_{3,ict} + \delta_t D_t + \alpha_{ic} + u_{ict} \tag{5}$$

4.2. Estimation Method:

The sample consists of country-industry combinations observed over time. There are many estimation methods that can be applied to panel data sets of this type. The fixed effects estimator (also known as the within estimator) and the first difference estimator are commonly used in econometric studies (Wooldridge, 2012). The key problem was that after omitting the missing values, the number of years available for each industry-country combination was very limited. For almost one-third (55 out of 182) of the country-industry combinations, only one observation was available. Hence it was decided that first differencing was not suitable due to data limitations, and the fixed or within effects method was chosen.

In the fixed effects method, the dependent and independent variables and the time-varying error component are first time-demeaned for each individual 'id'. First, by taking the averages across time for each individual id, we get:

$$\overline{y_{\iota c}} = \beta_0 + \beta_1 \overline{x_{1,\iota c}} + \beta_2 \overline{x_{2,\iota c}} + \beta_{3G} \overline{x_{3,\iota c}} + \overline{u_{\iota c}} \tag{6}$$

Next, by subtracting these from the original equations (2) and denoting the resulting time-demeaned variables as $\ddot{x}$ (with an accent on top), we get:

$$\ddot{y_{ic}} = \beta_1 \ddot{x_{1,ic}} + \beta_2 \ddot{x_{2,ic}} + \beta_3 \ddot{x_{3,ic}} + \ddot{u_{,ic}} \tag{7}$$

Where,

$\ddot{y_{ic}} = y_{ict} - \overline{y_{ic}}$

$\ddot{x_{1,ic}} = x_{1,ict} - \overline{x_{1,ic}}$

$\ddot{x_{2,ic}} = x_{2,ict} - \overline{x_{2,ic}}$

$\ddot{x_{3,ic}} = x_{3,ict} - \overline{x_{3,ic}}$

$\ddot{u_{ic}} = u_{ict} - \overline{u_{ic}}$ are the time-demeaned variables.

The time-constant independent variables and error terms are eliminated. Now, pooled OLS is applied on the resulting equation (7). A pooled OLS estimator that is based on the time-demeaned variables is called the fixed effects estimator or the within estimator. It is called within estimator because OLS uses the time variation in *y* and *x* within each cross-sectional observation (Wooldridge, 2012). The method eliminates time-constant variables and exploits only the time variation within each unit of analysis, which explains the name within estimator. The main assumption required for unbiased estimation of the regression coefficients is strict exogeneity, that is, the independent variables must not be correlated with the error terms. Similarly, the time-demeaning and subsequent OLS can be applied to all the other original model equations (equations (3), (4) and (5))

5. Data description:

To analyse the effect of FDI on domestic investment and domestic R&D spending, I merged three different databases to construct the final estimation sample:

- OECD's ANalytical Business Enterprise Research and Development (ANBERD) database[1]
- OECD's STAN STructural ANalysis Database[2]
- OECD FDI statistics to end-2013[3]

The International Standard Industrial Classification (ISIC) is a United Nations industry classification system. There are different versions available. For our analysis, ISIC Revision 3.1 (ISIC Rev. 3.1) versions of all the three databases have been used. All three databases provide annual data at the industry level for the OECD countries and a few other non-member countries. Thus, the unit of analysis is the industry.

5.1. Data on Research and Development (R&D):

R&D data used for the analysis are taken from the OECD ANalytical Business Enterprise Research and Development (ANBERD) database. This database presents OECD countries' and selected non-member economies' annual business expenditure on R&D since 1987, broken down across 100 manufacturing and service industry groups. The data are expressed in national currencies as well as in Purchasing Power Parities (PPP) US dollars, both at current and constant prices ("ANBERD (ANalytical Business Enterprise Research and Development)," n.d.). I use the variable R&D expenditure from this database.

5.2. Data on Value Added and Domestic Investment:

The domestic investment, value added and production data are taken from the OECD's STAN STructural ANalysis Database. The STAN database is a comprehensive tool for analysing industrial performance at a relatively detailed level of activity across countries. It includes annual measures of output, value added and its components, labour input, investment and capital stock, from 1970 onwards ("STAN STructural ANalysis Database," n.d.). The data are available in the national currencies at current prices. I use the variables value added (VALU, current prices) and Gross Fixed Capital Formation (GFCF, current prices) from this database.

5.3. Data on Foreign Direct Investment (FDI):

FDI data are taken from the OECD FDI statistics. This database gathers detailed historical statistics on international direct investment to and from the OECD area till 2013. Data are broken down by geographical zone and industrial sector for direct investment flows and stocks ("Historic time series: OECD FDI statistics to end-2013," n.d.). The data are available in US dollars as well as in reported national currencies at current prices. I use the variables outward FDI flows (fdi_out) and inward FDI flows (fdi_in) from this database.

[1] http://oe.cd/anberd ("ANBERD (ANalytical Business Enterprise Research and Development)," n.d.)
[2] http://www.oecd.org/sti/ind/stanstructuralanalysisdatabase.htm ("STAN STructural ANalysis Database," n.d.)
[3] http://www.oecd.org/daf/inv/investment-policy/fdi-statistics-according-to-bmd3.htm ("Historic time series: OECD FDI statistics to end-2013," n.d.)

5.4. Final Merged Data:

The data are merged and formatted to include the variables of interest from all the three databases for each combination of industry, country and year. STAN data are available from 1970 onwards, the OECD FDI Statistics start in 1985, and ANBERD R&D data start in 1987. But not all countries report on all the metrics for all the years. Thus, there is a problem of missing values that is larger than anticipated at the beginning of this study.

The final estimation sample is an unbalanced panel that covers the period from 1995 to 2009. No observation for any country-industry combination is available for the years 2004 and 2008. Countries covered include 21 of the 36 OECD member countries (Austria, Belgium, the Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Korea, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, the United Kingdom and the United States).

5.5. Variable Definitions:

The main variables of interest along with the transformations performed are listed in the following tables:

Table 4: Original Variables

Original Variable Name	Symbol	Unit	Original Database
R&D expenditure, current prices	rd_natcur	National currencies	OECD ANalytical Business Enterprise Research and Development (ANBERD) database
Gross Fixed Capital Formation, current prices	GFCF	National currencies	OECD's STAN STructural ANalysis Database
Outward FDI	fdi_out	US dollars	OECD FDI Statistics
Inward FDI	fdi_in	US dollars	OECD FDI Statistics
Value added, current prices	VALU	National currencies	OECD's STAN STructural ANalysis Database

Table 5: Transformations performed

Original Variable Name	Transformation 1 performed	Transformation 2 performed	Final Variable Name
R&D expenditure	converted to US dollars by using the OECD market exchange rates*	divided by value added**	Share of R&D expenditure
Gross Fixed Capital Formation, current prices	converted to US dollars by using the OECD market exchange rates*	divided by value added**	Share of GFCF
Outward FDI	None	divided by value added**	Share of Outward FDI
Inward FDI	None	divided by value added**	Share of Inward FDI

Value added, current prices	converted to US dollars by using the OECD market exchange rates*	ratio of the difference between the value at year t and year t-1 to the value at year t-1	Value added growth

Notes to Table 5*: *Exchange rates are defined as the price of one country's currency in relation to another. Exchange rates may be expressed as the average rate for a period of time or as the rate at the end of the period ("OECD Exchange rates (indicator)," 2018). **The explanatory variables are scaled by Value added to eliminate the size effects of individual countries and industries.*

Table 6: Final Variables

Original Variable Name	Final Variable Name	Type of variable	Final Variable Unit
R&D expenditure	Share of R&D expenditure	Dependent variable	US dollar/US dollar
Gross Fixed Capital Formation, current prices	Share of GFCF	Dependent variable	US dollar/US dollar
Outward FDI	Share of Outward FDI	Independent variable	US dollar/US dollar
Inward FDI	Share of Inward FDI	Independent variable	US dollar/US dollar
Value added, current prices	Value added growth	Independent variable	$Year^{-1}$

5.5.1. FDI Flows:

Foreign direct investment (FDI) is when a company invests in a business that it owns in a different country. This contrasts with an investment in stocks by foreign investors, known as foreign portfolio investment, whereby the investor doesn't exert significant control over the business. For example, Amazon opening a new headquarters in Vancouver, Canada, McDonalds opening restaurants in Japan, Apple investing in its R&D facilities in China, Ford purchasing manufacturing plants in Ireland are all FDI flowing from the US to other countries; while US investors purchasing securities of the Philippine Stock Exchange-listed companies or the London Stock Exchange-listed companies are examples of foreign portfolio investment. FDI can be in the form of greenfield investments, which means setting up a new plant or subsidiary in a foreign country from scratch, or in the form of mergers and acquisitions of existing foreign companies.

According to the OECD Benchmark definition of foreign direct investment: fourth edition, "a foreign direct investor is an entity (an institutional unit) resident in one economy that has acquired, either directly or indirectly, at least 10% of the voting power of a corporation (enterprise), or equivalent for an unincorporated enterprise, resident in another economy. A direct investor could be classified to any sector of the economy and could be any of the following: i) an individual; ii) a group of related individuals; iii) an incorporated or unincorporated enterprise; iv) a public or private enterprise; v) a group of related enterprises; vi) a government body; vii) an estate, trust or other societal organisation; or viii) any combination of the above" (OECD, 2008, p8-9). Foreign Direct Investment (FDI) flows record the value of cross-border transactions related to direct investment during a given period of time, usually a quarter or a year. Financial flows consist of equity transactions, reinvestment of earnings, and intercompany debt transactions (“OECD FDI flows (indicator),” 2018).

5.5.2. R&D expenditure:

R&D refers to activities though which companies develop innovations that lead to new products and services or help improve their existing products and services. For example, a pharmaceutical company developing a new drug, a sauce manufacturer developing new sauce recipes, a CPU-manufacturing company working on improving its processor speed, a social media company developing artificial intelligence tools to display more relevant advertisements are all examples of R&D. OECD’s definition of R&D is “Research and experimental development (R&D) expenditure comprise creative work undertaken on a systematic basis to increase the stock of knowledge and the use of this knowledge to devise new applications. R&D covers three activities: basic research, applied research, and experimental development” (*Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*, 2015, p44).

For an activity to qualify as R&D, it must satisfy the following criteria: the activity must be aimed at arriving at novel solutions using creative approaches, outcomes must be uncertain at the beginning, the activity should be planned and conducted in a systematic way and produce results that are transferable or reproducible. Thus, while most innovation activities qualify as R&D, some do not. For example, while activities such as new product or process design, initial phases of a clinical trial, development of new methods and standards, experimental development of new software, research to identify new risks, development of mathematical models for new applications, prototype construction and testing, setting up of a pilot plant, R&D following product feedback, et cetera are all considered as R&D; activities such as market research, patent application, licensing, production process design, pre-production development, manufacturing start-up, tooling up and redesign for the manufacturing process, routine tests, regular data collection, creation of websites or software using existing tools, customisation of a product for a particular use, after-sales service and troubleshooting, routine compliance with public regulations, et cetera are not included under R&D . R&D expenditure consists of labour costs of personnel involved in above-mentioned R&D activities, costs of equipment and materials purchased exclusively for R&D without any alternate use, software purchased solely for R&D and other administrative costs related to R&D (*Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development, The Measurement of Scientific, Technological and Innovation Activities*, 2015, p60).

5.5.3. Gross fixed capital formation (GFCF):

Gross fixed capital formation (GFCF) is the net investment in physical assets during a given period. It is not the total investment, but only the change in investment for that period. It does not account for the consumption (depreciation) of fixed capital. According to the OECD, GFCF consists of acquisitions, minus disposals, of tangible assets (such as machinery and equipment, transport equipment, livestock, constructions) and new intangible assets (such as mineral exploration and computer software) to be used for more than one year. The assets purchased may be new or may be used bought from second-hand markets. The investments can also be in the form of improvements to existing fixed assets, such as buildings or computer software, that increase their productive capacity and/or extend their service lives. In this case, GFCF does not measure the value as that of the creation of a new asset, but instead measures it as the increase in the value of an existing asset. While acquisitions of land, mineral deposits, timber tract etc are excluded, their improvement and development are included. GFCF measures improvements to land as the creation of a new fixed asset and not as value addition to the existing natural resource. Government outlays primarily for military purpose are also excluded (*The OECD STAN Database for Industrial Analysis*, 2005).

5.5.4. Value added:

Gross Value added for a particular industry is an economic productivity measure that represents its contribution to national GDP. It is sometimes referred to as GDP by industry, adjusting for the impact of subsidies and taxes on products. It is not directly measured. In general, it is calculated as the difference between production and intermediate inputs. It provides a dollar value for the amount of goods and services that have been produced in an industry, minus the cost of all inputs and raw materials that are directly attributable to that production (Kenton, 2019). Value added comprises labour costs, consumption of fixed capital, taxes less subsidies and net operating surplus and mixed income *(The OECD STAN Database for Industrial Analysis, 2005)*.

5.6. Data availability:

To understand the pattern of missing observations, we look at the number of observations available by year, country and industry[4]. Figure 4 gives an overview. It shows the overall availability of observations by year, country and industry:

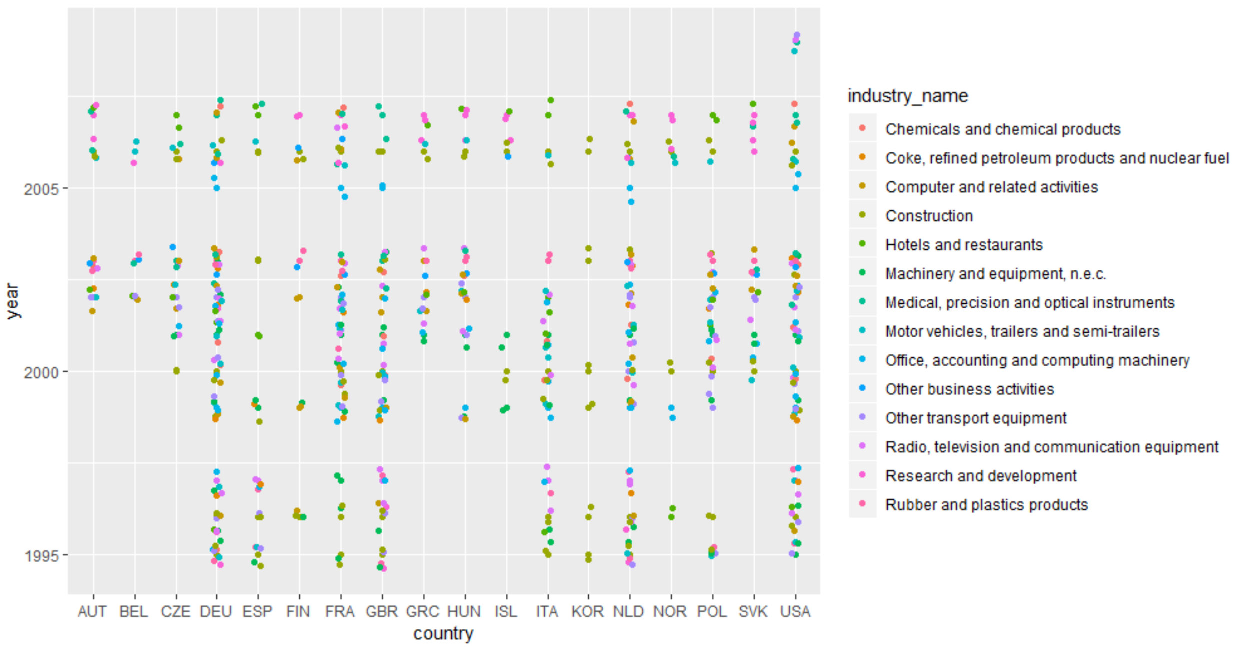

Figure 4: Data points for each combination of year, country and industry

Notes to Figure 4*: The number of non-missing observations are shown for each combination of year and country. Different colours are used to distinguish across industries.*

As we can see from Figure 4, not all countries report data uniformly throughout all the years. Many countries (Austria, Belgium, Czech Republic, Greece, Hungary, Iceland, Slovak Republic) report data only for the later years. Also, some countries (such as Finland, Korea, Norway) only report data

[4] Some countries have very few observations (less than five), and these countries (Estonia, Portugal and Slovenia) were omitted from the analysis.

intermittently every few years. All of this results in a highly unbalanced panel, with many countries missing data for a lot of years. This can greatly affect the results that can be achieved with this data. To understand this in-depth, I report the number of non-missing observations by year, country and industry separately in the following tables (Table 7, Table 8 and Table 9).

Table 7: Number of non-missing observations by year

#	Year	Number of non-missing observations
1	1995	38
2	1996	40
3	1997	27
4	1999	52
5	2000	51
6	2001	58
7	2002	73
8	2003	75
9	2005	5
10	2006	61
11	2007	38
12	2009	4

Notes to Table 7*: The non-missing observations are grouped by year and the count displayed. It can be seen that the time periods are not continuous, and that there are three discontinuities: years 1998, 2004 and 2008 for which there are no non-missing observations.*

Table 8: Number of non-missing observations by country

#	Country name	Code	Number of non-missing observations
1	Austria	AUT	17
2	Belgium	BEL	8
3	Czech Republic	CZE	18
4	Germany	DEU	71
5	Spain	ESP	21
6	Estonia	EST	2
7	Finland	FIN	12
8	France	FRA	55
9	United Kingdom	GBR	45
10	Greece	GRC	17
11	Hungary	HUN	24
12	Iceland	ISL	8
13	Italy	ITA	32
14	Korea	KOR	6
15	Netherlands	NLD	59
16	Norway	NOR	8

17	Poland	POL	34
18	Portugal	PRT	1
19	Slovak Republic	SVK	18
20	Slovenia	SVN	3
21	United States	USA	63

Notes to Table 8*: The non-missing observations are grouped by country and the count displayed along with country name and code. Estonia, Portugal and Slovenia have very few non-missing observations (less than 5), which might not be an accurate representative sample for the countries. So, these countries are excluded from the analysis, which brings our number of countries covered to 18.*

As can be seen from Table 8, the number of non-missing observations reported is not uniform across countries. Of the 18 countries included, Germany has the highest number of reported observations at 71, while Korea has the least number of reported observations at 6. This high variability in the number of reported observations implies that our data could be more representative of those countries with more reported observations (Germany, United States, Netherlands, France, United Kingdom) and so could our results.

Table 9: Number of non-missing observations by industry

#	Industry name	Code	Number of non-missing observations
1	Coke, refined petroleum products and nuclear fuel	2300	22
2	Chemicals and chemical products	2400	26
3	Rubber and plastics products	2500	25
4	Machinery and equipment, n.e.c.	2900	48
5	Office, accounting and computing machinery	3000	45
6	Radio, television and communication equipment	3200	49
7	Medical, precision and optical instruments	3300	30
8	Motor vehicles, trailers and semi-trailers	3400	50
9	Other transport equipment	3500	42
10	Construction	4500	64
11	Hotels and restaurants	5500	27
12	Computer and related activities	7200	49
13	Research and development	7300	27
14	Other business activities	7400	18

Notes to Table 9*: The non-missing observations are grouped by industry and the count displayed along with industry name and code. The industry codes are based on the industry classification ISIC Rev. 3.1, and the '00' in the last 2 digits of the codes indicate that data has been reported at a reasonably higher level of industrial classification (two-digit level) called the 'division'.*

As can be seen from Table 9, the distribution of the number of non-missing observations is comparatively more uniform across countries. Construction reported the highest number of non-missing observations at 64, while Other business activities reported the least number of non-missing observations at 18. This implies that our data is reasonably representative of all industries and thus, our results could be more accurately applicable across industries.

5.7. Data quality and Limitations:

5.7.1. Tax Havens and FDI Flows:

One of the main problems in using accounting FDI flows recorded for country-level boundaries is that not all of these accounting numbers might reflect real investments in financial assets. This is because of the existence of global tax havens. IMF's Coordinated Direct Investment Survey found that 12 trillion USD - almost 40 percent of global FDI positions are artificial. Companies invest in empty corporate shells popularly called Special Purpose Entities (SPEs) which are registered in tax haven countries with low tax regimes, to significantly reduce their domestic tax burdens. So, while money passing through these SPEs is registered as outward/inward FDI flows in the respective country accounts, they do reflect any real economic activity ("Piercing the Veil," 2018). This could affect the reliability of our underlying data. But this is not a limitation that could be currently rectified, as almost all macroeconomic data, currently use national boundaries to classify and aggregate data.

5.7.2. Sample bias due to data availability:

From Table 8, we can already see that our data is biased to more adequately represent some countries, while others have very limited representation. This is mainly because not all countries report data uniformly for consecutive years or for all the industries. Since this is a main issue usually faced when trying to use even cross-country data, and we are trying to analyse at the level of industry across countries, this issue is difficult to overcome. But this has to be understood as a main limitation of this work.

Table 10: Sample size by Industry type

Industry Type	**Number on Non-missing Observations**
Traditional Industries	85
R&D-intensive Industries	249

Notes to Table 10: The non-missing observations are grouped by industry type and the count displayed along with the name of the industry type. Industries are divided into high, medium-high, medium-low and low-tech industries based on the OECD technology classification for ISIC 3 as well as the OECD taxonomy of economic activities based on R&D intensity for ISIC 4. Further the high and medium-high tech industries can be considered as R&D intensive industries, while the medium-low and low-tech industries can be considered as traditional industries (Galindo-rueda & Verger, 2016).

Also, from Table 10, we can see that the data available in our sample for the two industry types is also not uniform. Our sample is biased towards R&D-intensive industries, and this might affect our results. The effect observed at the aggregate level is the sum of the effects observed for each industry type (hypotheses H1a = H2a + H3a and H1b = H2b + H3b). Thus, the effects observed for R&D-intensive industries might greatly influence the effects observed at the aggregate level.

6. Results and Discussions:

6.1. Descriptive Statistics:

Removing observations with missing values results in an unbalanced panel, for which the overall summary statistics are obtained as follows (Table 11). The summary statistics help understand the range and units of the data.

Table 11: Overall Summary Statistics

Variables	Number of Observations	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Standard deviation
Share of R&D expenditure	516	0.0000	0.0074	0.0464	0.1343	0.1417	4.0233	0.3700
Share of GFCF	516	0.0026	0.0985	0.1439	0.1982	0.2194	2.0109	0.2018
Share of Outward FDI	516	-7.0295	0.0002	0.0091	0.0995	0.0534	9.0120	0.7117
Share of Inward FDI	516	-7.6912	-0.0006	0.0079	0.1308	0.0653	18.5151	1.1048
Value-added growth	334	-0.5098	-0.0320	0.0936	0.1777	0.2795	2.4617	0.3703

Notes to Table 11*: The shares of R&D expenditure, outward FDI, Inward FDI and Gross Fixed Capital Formation (GFCF) are defined as the ratios of the particular component by Gross Value Added (GVA). Value-added growth is defined as the increase in GVA from the previous year to the current year divided by the previous year's GVA. Outward FDI and Inward FDI data are from the OECD FDI Statistics Database, R&D expenditure data are from the OECD ANalytical Business Enterprise Research and Development (ANBERD) database, while the GFCF and GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

As can be seen, for each of the variables, the mean appears largely greater than the median, indicating that the data is skewed to the right or positively skewed. Looking at the mean values, we can understand that on average, R&D expenditure is around 13.5% of value added, fixed capital investment is around 20% of value added, outward FDI is around 10% of value added, inward FDI is around 13% of value added, and value added has an average growth rate of around 18. This indicates that on average, inward FDI is slightly higher than outward FDI, and domestic fixed capital investment is higher than R&D investment. The large standard deviation values when compared to the mean values imply that the data is spread over a wide range of values and potentially contains extreme values. The distribution of data for each of these variables is discussed in-depth in the following sub-section.

6.1.1. Distribution over time

We first look at the main trends and patterns in the distribution of our key variables over time.

6.1.1.1. Share of Outward FDI

First, looking at the share of outward FDI, which is the key independent variable of interest, Figure 5 shows the distribution of the share of outward FDI added over time, with the red line indicating the mean points for each year. It is evident that there are quite a few extreme values, most of them on the higher side, which can explain the higher standard deviation observed in the summary statistics. Though the mean line seems to show very small variation, this is because of the higher spread caused by the extreme values. So, if we look only at the mean points, the variation could be interpreted in a better way. Figure 6 shows the distribution of only the mean shares of outward FDI over time. We can see that a distinct pattern is observed for each of the sub-periods.

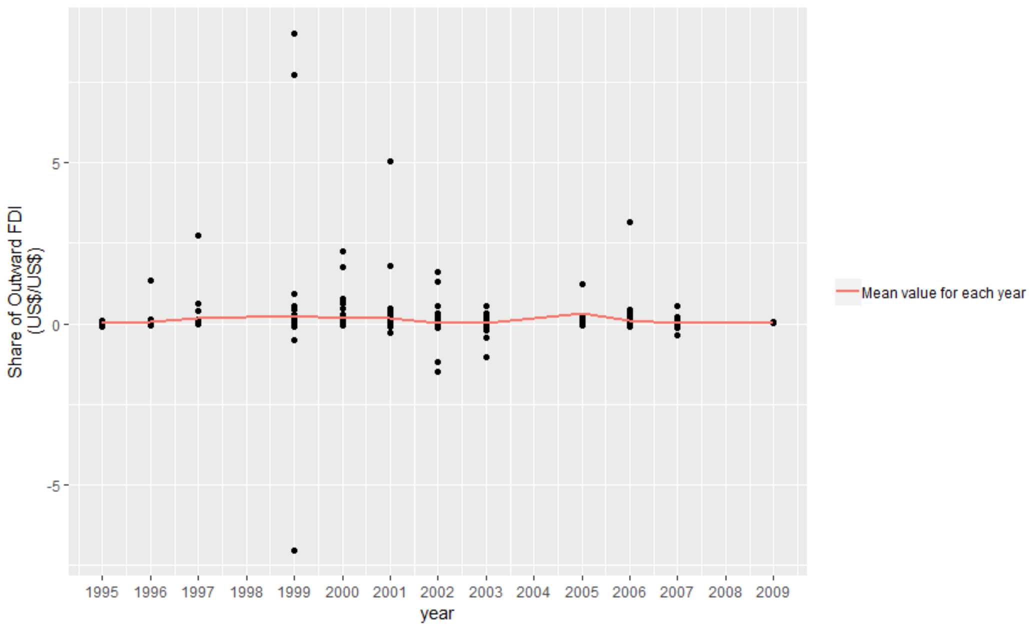

Figure 5: Distribution of the Share of Outward FDI over time

Notes to Figure 5*: The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). The black dots indicate all the observations during each year, while the red line connects the mean value for each year. Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

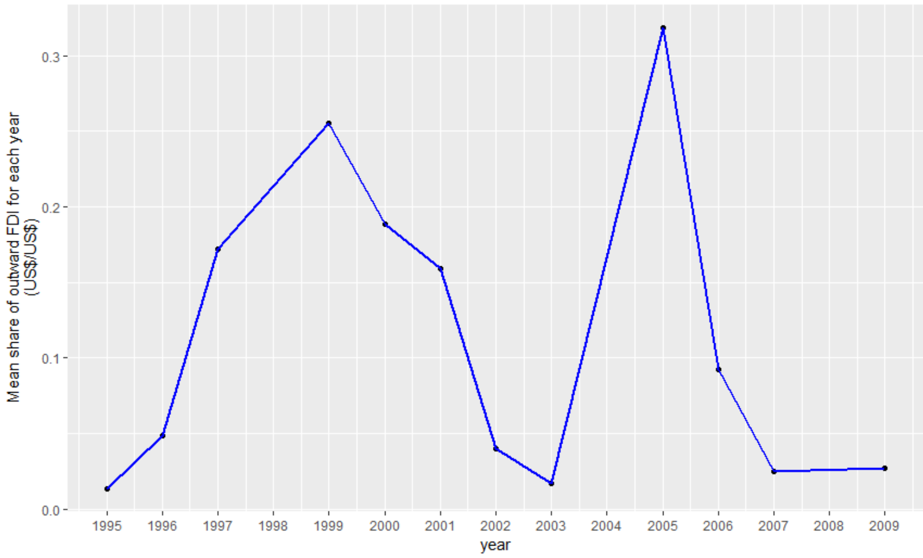

Figure 6: Distribution of the Mean Share of Outward FDI over time

Notes to Figure 6*: The average share of outward FDI across all industry-country combinations are calculated for each year and are plotted against time. The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

6.1.1.2. Share of Inward FDI

The share of inward FDI is the other key independent variable. Figure 7 shows the distribution of the share of inward FDI over time, with the red line indicating the mean points for each year. It is evident that there are quite a few extreme values, most of them on the higher side, which can explain the higher standard deviation observed in the summary statistics. Though the mean line seems to show very small variation, this is because of the higher spread caused by the extreme values. So, if we look only at the mean points, the variation could be interpreted in a better way. Thus, Fig. 8 shows the distribution of only the mean share of inward FDI values over time.

Figure 7: Distribution of the Share of Inward FDI over time

Notes to Figure 7*: The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). The black dots indicate all the observations during each year, while the red line connects the mean value for each year. Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

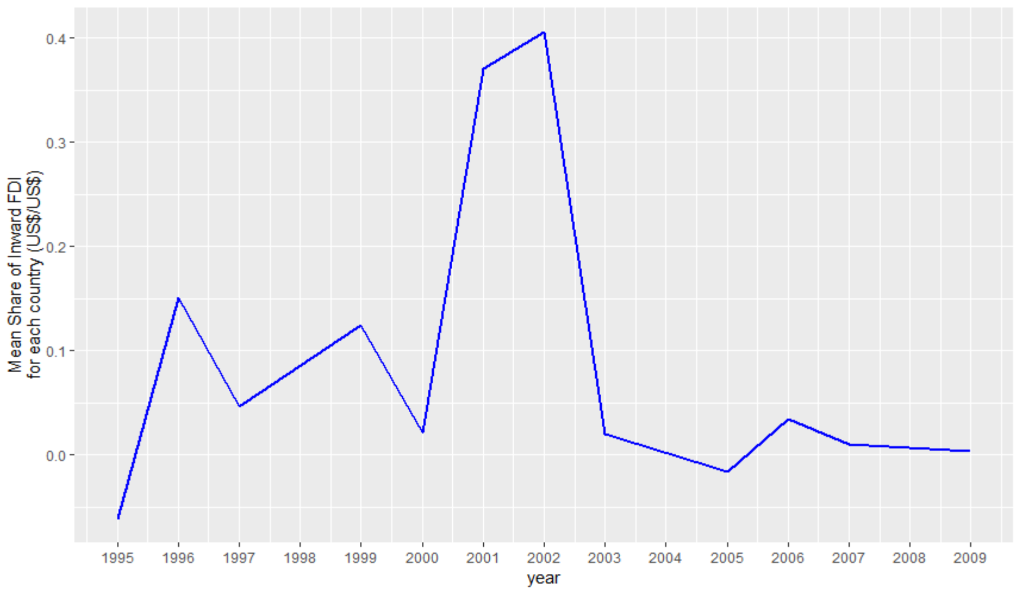

Figure 8: Distribution of the Mean Share of Inward FDI over time

Notes to Figure 8*: The average share of inward FDI across all industry-country combinations are calculated for each year and are plotted against time. The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

6.1.1.3. Interpreting the variation in the share of FDI flows over time:

To interpret the trends and changes in the share of FDI flows against the backdrop of the broader global economic events, I divide the period covered into four sub-periods:

- Period upto the East Asian economic crisis (1995 to 1999)
- Period following the crisis and the dotcom bubble burst (2000 to 2003)
- Period of recovery and growth during the mid-2000s (2004 to 2006)
- Period just before and after the 2007 financial crisis (2007 to 2009)

Period upto the East Asian economic crisis (1995 to 1999):

The period up to 1999 can be characterised as the years immediately preceding and during the 1998 Asian financial crisis. The 1990s were predominantly characterised by enormous FDI inflows into the emerging markets (mainly developing East Asian economies), which were undergoing rapid economic growth during this period (Athukorala, 2003). The emerging Asian economies were highly favourable to foreign investors because of their unique strengths suitable for long-term growth, such as high domestic savings rate, flexible government policies towards FDI as well as skilled and cheaper human resource availability ("World Investment Report 1998 - Trends and Determinants," 1998). This might explain the exponential increase in the share of outward FDI, which reached its peak in 1997, right before the financial crisis. The large inflow of development money in the form of both FDI and portfolio investment into the emerging Asian countries had created an asset price bubble, which eventually burst and resulted in the crisis. While portfolio investment decreased significantly, FDI inflow into the crisis-hit countries only declined modestly in 1998 and managed to recover in 1999 (Robert E Lipsey, 2001).

One reason that FDI did not decrease significantly and even began to increase following the crisis might be because FDI flows, unlike other capital flows are associated with long-term economic development and are not that volatile. But the main factor that might have contributed to this increase in FDI flows into crisis-hit countries is a phenomenon known as fire-sale FDI. According to this, during crisis years, portfolio investments are negatively correlated with FDI inflows (Acharya, Shin, & Yorulmazer, 2011). That is, the distressed nature of crisis-hit firms results in fire sales of these firms at prices attractive to less financially constrained foreign buyers (Krugman, 2000). This was accompanied by strong macroeconomic growth and FDI inflows in the developed countries, which were unaffected by the crisis ("World Investment Report 1998 - Trends and Determinants," 1998).

Similar to the share of outward FDI, the share of inward FDI also had a slight decrease during the 1997 crisis, but recovered quickly following the crisis. While there was a huge change in the share of outward FDI during the initial years probably due to the investment in emerging Asian economies, such significant patterns could not be found for the share of inward FDI. This is understandable as the Asian crisis mainly affected the emerging Asian economies which were not that big sources of FDI inflows into the OECD. This was also the period of the dotcom boom, wherein, there was widespread adoption and usage of the internet. This led to a lot of speculation and over-investment in internet companies and technology start-ups in the United States. This might have contributed to both increase in outward FDI as well as inward FDI. The raising share of outward FDI might also be the money being invested in these companies, leading to the inflation and creation of the dotcom bubble (Ofek & Richardson, 2003).

Period following the crisis and the dotcom bubble burst (2000 to 2003)

After the Asian financial crisis from 1997-1999, the following second sub-period from 2000 to 2003 can explain the after-effects of the crisis as well as that of the burst of the dotcom bubble. Also, the European Union was going through an economic recession during 2000 and 2001. Thus, this might be why the share of outward FDI started decreasing during this period. The dotcom bubble, that had been built up from 1995, was characterised by the overvaluation of technology companies, and reached the peak around early 2000 before crashing. This crash lasted till late 2002 and resulted in the shutting down of many internet companies. Also, the September 11 terrorist attacks on the US in 2001 also led to a stock market downturn, leading to an eventual recession in the US during 2002 and 2003 (Ofek & Richardson, 2003). All of this together might explain the decreasing trend in share of outward FDI during this sub-period. But this is in contrast to the pattern followed by the share of inward FDI, which reached its peak in 2001, just after the dotcom crash, continued to remain high in 2002, and declined only in 2003. This may again be explained by the phenomenon of fire-sale FDI. Many of the crisis-hit tech companies were selling at very low prices, which made them attractive to foreign buyers (Acharya et al., 2011; Mcaleer, Suen, & Wong, 2016), thus probably increasing the FDI inflows coming into the OECD countries.

Period of recovery and growth during the mid-2000s (2004 to 2006)

After the dotcom crash and the ensuing recession, the US economy started recovering from 2004. The European Union also began to recover from its earlier economic recessions. The growth cycle in international investment which began in 2004 characterised by a strong expansion may explain the huge increase in the share of outward FDI during this sub-period ("Assessing the Impact of the Current Financial and Economic Crisis on Global FDI Flows," 2009). At the same time, following the high levels reached by the share of inward FDI following the dotcom crash, probably mainly due to fire-sale FDI, the share of inward FDI declined and returned back to stable levels, where it remained during 2004 and 2005. But the share of FDI inflows into the developed world, especially the US started rising again in 2006, as the asset price bubble preceding the 2007 global financial crisis began to take shape (Poulsen & Hufbauer, 2011).

Period just before and after the 2007 financial crisis (2007 to 2009)

The fourth sub-period from 2007 to 2009 is again characterised by a downward trend in the share of outward FDI. Following the strong expansion in 2004, world economic growth slowed noticeably in 2006, and reached an all-time low following the 2007 financial crisis. This could have greatly affected the share of outward FDI, which reduced exponentially and came to a standstill during the crisis. The share of inward FDI which had increased during the 2006 build-up to the crisis, also came down following the crisis ("Assessing the Impact of the Current Financial and Economic Crisis on Global FDI Flows," 2009). This is different from the increase the capital inflows observed following the 1997 and the 2001 crises, attributed to the phenomenon of fire-sale FDI. But this is because the 2007 crisis was larger in scale than the preceding crises, becoming the biggest crisis the world had seen since world war II. Also, the previous crises did not affect all the countries at the same time. They were mainly concentrated either in developing or developed countries. But the trend of globalisation and the liberal FDI policies followed by countries in response to the previous crises resulted in a world increasingly coupled to the United States economy. So, when the crisis hit the US, globalisation amplified it and the global economy came crashing down. This probably explains the declining shares of inward and outward FDI flows during this period (Poulsen & Hufbauer, 2011).

6.1.2.4. Variation in FDI flows over time across industry types:

Rather than just looking at the distribution of the share of the overall FDI flows over time, it can be more insightful to plot the variation across industry groupings. Industries can be divided into high, medium-high, medium-low and low-tech industries based on the OECD technology classification for ISIC 3 as well as the OECD taxonomy of economic activities based on R&D intensity for ISIC 4. Further the high and medium-high tech industries can be considered as R&D intensive industries, while the medium-low and low-tech industries can be considered as traditional industries (Galindo-rueda & Verger, 2016). The year-wise mean share of outward FDI values can be plotted against time for both traditional and R&D intensive industries, as in Figure 9. Looking at Figure 9, the trend followed by R&D intensive industries appears almost counter to the pattern followed by traditional industries during any given period. This could be due to the differences in the reasons for engaging in outward FDI between the two types of industries.

Traditional industries require more unskilled or low-skilled labour and therefore, engage in efficiency-seeking outward FDI to take advantage of cheaper labour elsewhere. R&D intensive industries are more skill-intensive and mainly engage in market-expanding outward FDI to increase sales to spread the costs of R&D over more output (Goedegebuure, 2006). If, for example, we look at the period from 1995, initially traditional industries probably engaged in more outward FDI in the emerging Asian countries for the cheaper labour and production costs there. This may explain the huge spike in share of outward FDI for traditional industries till 1999 ("World Investment Report 1999 - Foreign Direct Investment and the Challenge of Development," 1999). Following the Asian financial crisis of 1999, there is a downward trend, which lasts till 2001. Though there is a slight increase in 2002, the global recession during that time could have again caused the share of outward FDI for traditional industries to drop in 2003 ("World Investment Report 2003 - FDI Policies for Development: National and International Perspectives," 2003). From 2003 onwards, the share of outward FDI increases gradually as the asset price bubble in the US boosts traditional industries like construction and coke and petroleum products. This lasts till 2006, following which the asset price bubble bursts and the financial crisis of 2007 occurs. Thus, the share of outward FDI value for traditional industries starts decreasing from 2006 ("Assessing the Impact of the Current Financial and Economic Crisis on Global FDI Flows," 2009).

R&D intensive industries follow a different pattern. Initially till 1999, R&D intensive industries did not engage in much outward FDI and the share of outward FDIs show a declining trend ("World Investment Report 1999 - Foreign Direct Investment and the Challenge of Development," 1999). But from 1999, there is an exponential increase which could be due to the dotcom bubble. High tech industries were experiencing a lot of growth and were investing in a lot of internet technologies and companies. This continues till 2000-2001 during which the dotcom crash happens. Following the crash, many high-tech companies lost a lot of money, and the share of outward FDI decreases till 2003 ("World Investment Report 2003 - FDI Policies for Development: National and International Perspectives," 2003). From 2003, the recovery begins, and surprisingly, along with traditional industries, R&D intensive industries also engage in a lot of outward FDI during this period ("World Investment Report 2004 - The Shift Towards Services," 2004). This could be due to the strong recovery and expansion during this period, fuelled by the asset price bubble, which could promote both market-seeking and efficiency-seeking FDI at the same time. But for R&D intensive industries, the share of outward FDI starts decreasing even before the 2007 financial crisis happens, from 2005 onwards, reaching almost a standstill following the crisis ("Assessing the Impact of the Current Financial and Economic Crisis on Global FDI Flows," 2009).

Figure 9: Distribution of the Share of Outward FDI over time across different industry groups

Notes to Figure 9*: The average share of outward FDI across all industry-country combinations are calculated for each year for both traditional and R&D-intensive industries and are plotted against time. The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. Based on the OECD industry technology classification for ISIC Rev. 3.1 and the OECD R&D intensity-based industry classification for ISIC Rev. 4, those industries which are classified as medium-low tech and low tech are taken as traditional industries, while those that are classified as medium-high tech and high tech are considered as R&D-intensive industries. All the data have been converted to US dollars, current prices.*

Similarly, the year-wise mean shares of inward FDI can be plotted against time for both traditional and R&D intensive industries, as in Figure 10. By comparing this plot with the overall plot against time (Figure 8), it can be seen that, distribution of share of inward FDI for R&D intensive industries follows the same pattern as that for overall industries, implying that R&D intensive industries contribute to most of the trend variations in share of inward FDI. Traditional industries also follow an almost similar direction of variation, although the magnitude of variation is relatively less.

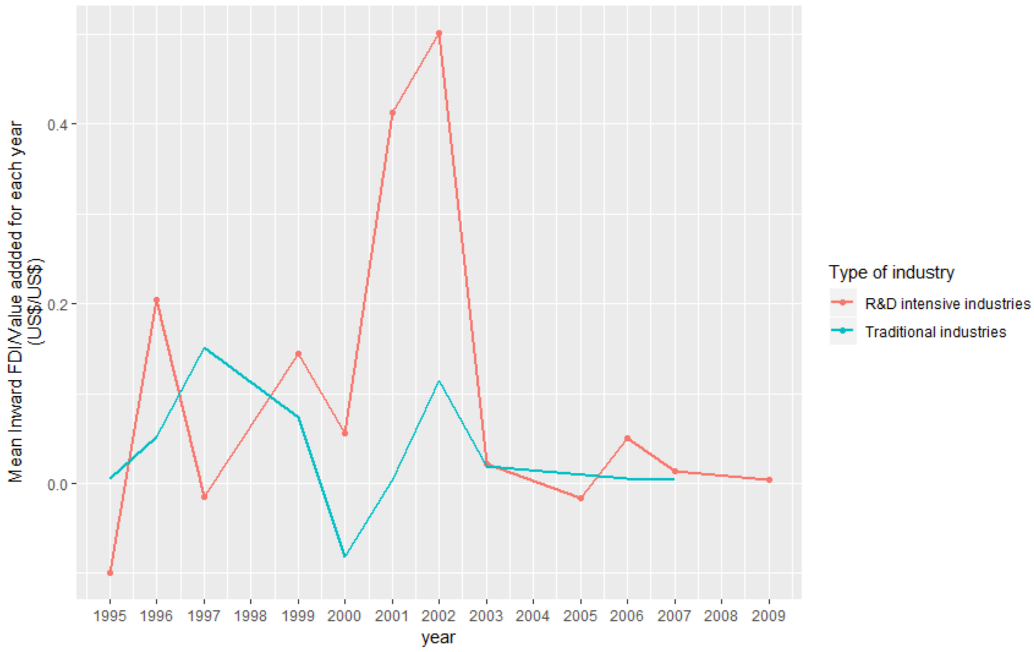

Figure 10: Distribution of the Share of Inward FDI over time across different industry groups

Notes to Figure 10*: The average share of inward FDI across all industry-country combinations are calculated for each year for both traditional and R&D-intensive industries and are plotted against time. The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. Based on the OECD industry technology classification for ISIC Rev. 3.1 and the OECD R&D intensity-based industry classification for ISIC Rev. 4, those industries which are classified as medium-low tech and low tech are taken as traditional industries, while those that are classified as medium-high tech and high tech are considered as R&D-intensive industries. All the data have been converted to US dollars, current prices.*

6.1.2. Distribution across countries:

6.1.2.1. Share of Outward FDI

Next, looking at the distribution of the share of outward FDI across countries (Figure 11), it can be seen that there are extreme values, with Spain, Netherlands and Iceland showing a few exceptionally high values for the shares of outward FDI, while Italy showing a really low value in 1999. The red dots represent the mean values for each country, and as evident, most of the countries for most of the time engage in outward FDI between -1 and 1 US dollar for every US dollar of value added. Only four countries have a few observations falling outside this range.

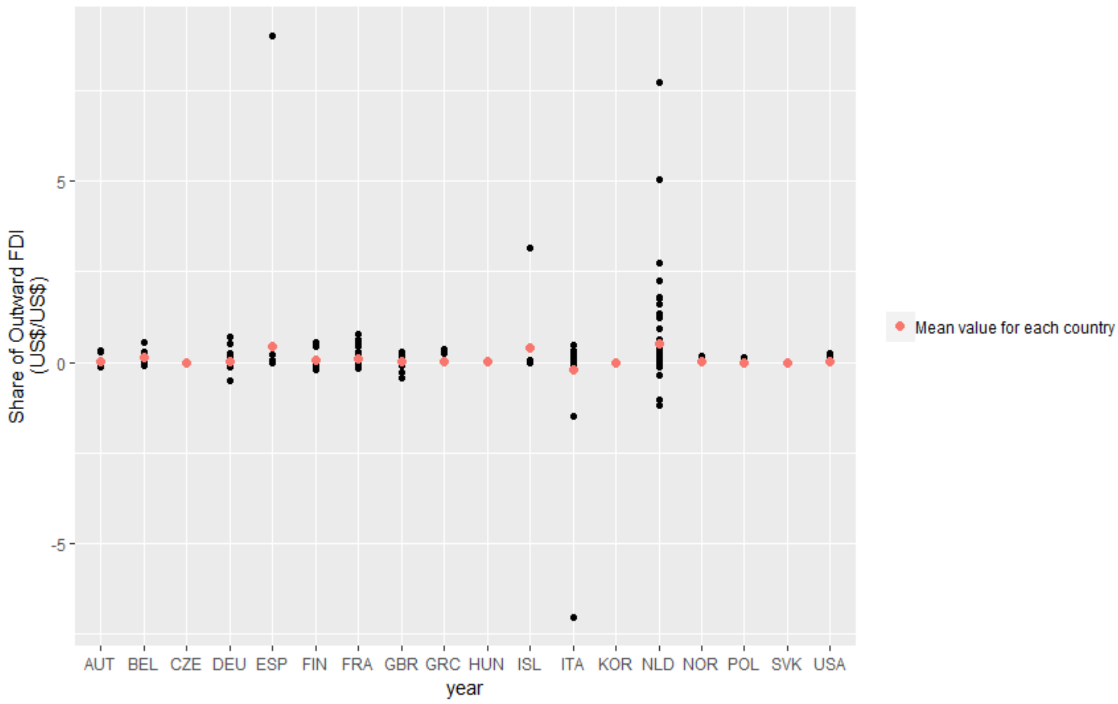

Figure 11: Distribution of the Share of Outward FDI across countries

Notes to Figure 11*: The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). The black dots indicate all the observations for each country, while the red dots represent the mean share of outward FDI for each country. Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

To understand the variation among countries, only the mean values are plotted separately against the countries in Figure 12. As can be seen, Netherlands has one of the highest outward FDI as a fraction of its value added, followed by Spain and Iceland, while Italy has the lowest. But these exceptionally high and low mean values could be caused by the extreme values as most of the other countries exhibit a share of outward FDI value between 0 and 0.2. This small range implies that there is not much variation in share of outward FDI across countries.

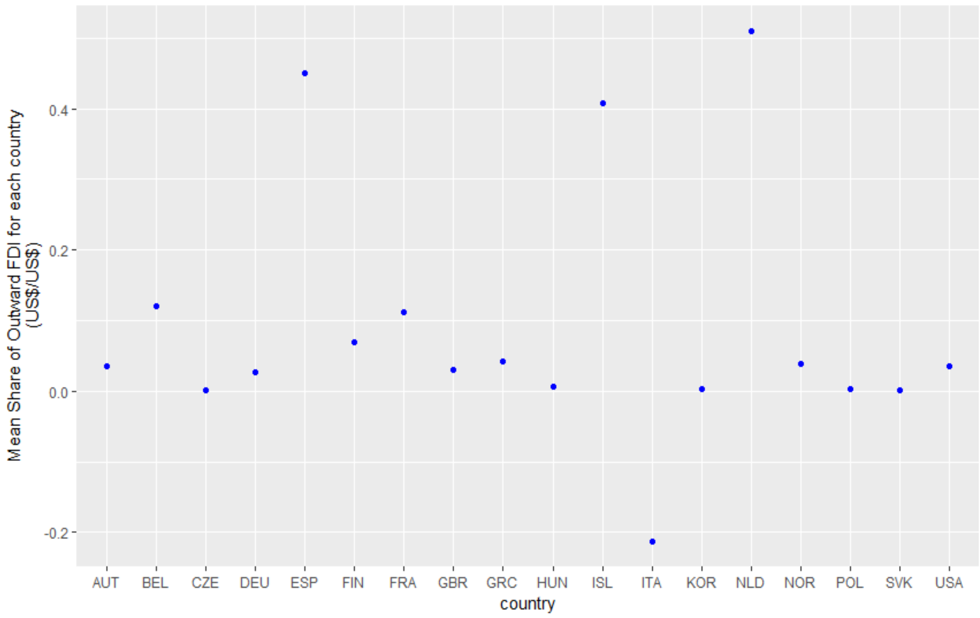

Figure 12: Distribution of the Mean Share of Outward FDI across countries

Notes to Figure 12*: The average shares of outward FDI across all industry-year combinations are calculated for each country and are plotted against the countries. The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

6.1.2.2. Share of Inward FDI

Next, looking at the distribution of the share of inward FDI across countries (Figure 13), it can be seen that there are extreme values, with the Slovak Republic and Hungary showing a few exceptionally high shares of inward FDI values, while Greece showing a really low value in 2001. The red points indicate the mean values for each country, and as evident, most of the countries on average enjoy inward FDI between -0.5 and 0.5 US dollar for every US dollar of value added.

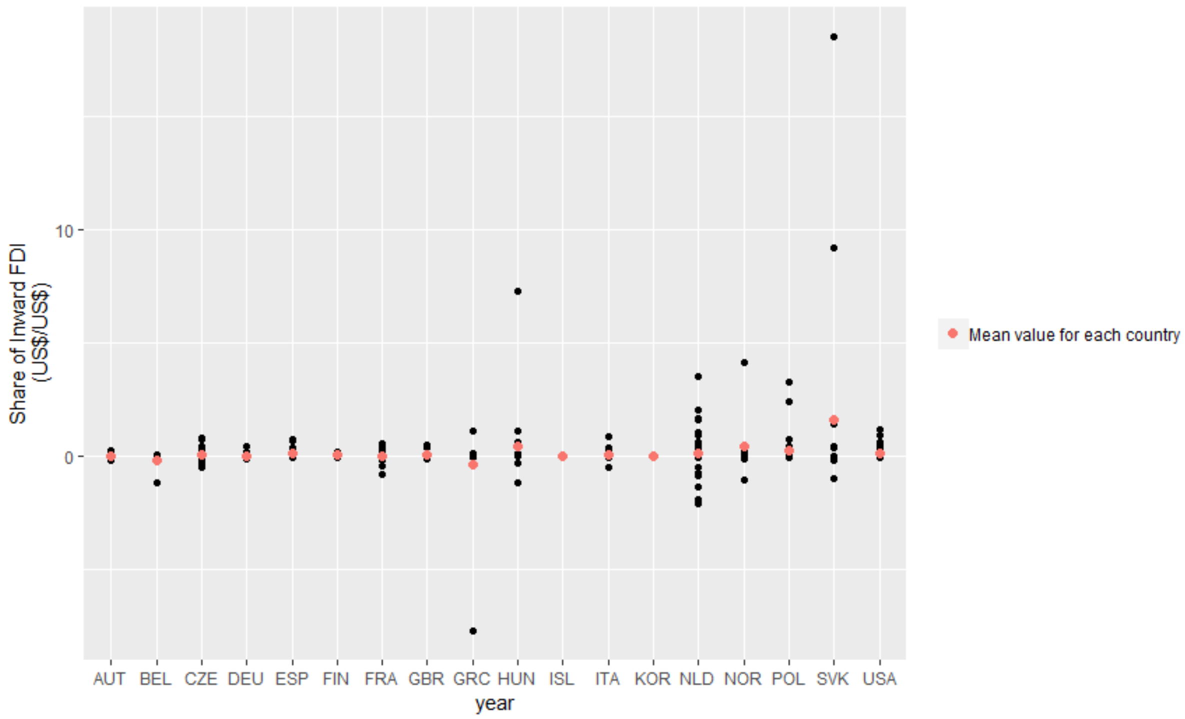

Figure 13: Distribution of the Share of Inward FDI across countries

Notes to Figure 13*: The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). The black dots indicate all the observations for each country, while the red dots represent the mean share of inward FDI for each country. Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

To understand the variation among countries, only the mean values are plotted separately against the countries in Figure 14. As can be seen, the Slovak Republic has one of the highest inward FDI as a fraction of its value added, followed by Hungary and Norway, while Greece has the lowest. But the exceptionally high mean value for the Slovak Republic could be caused by the presence of the outlier, as all other countries exhibit a share of inward FDI value between -0.5 and 0.5. This small range implies that there is not much variation in the share of inward FDI across countries.

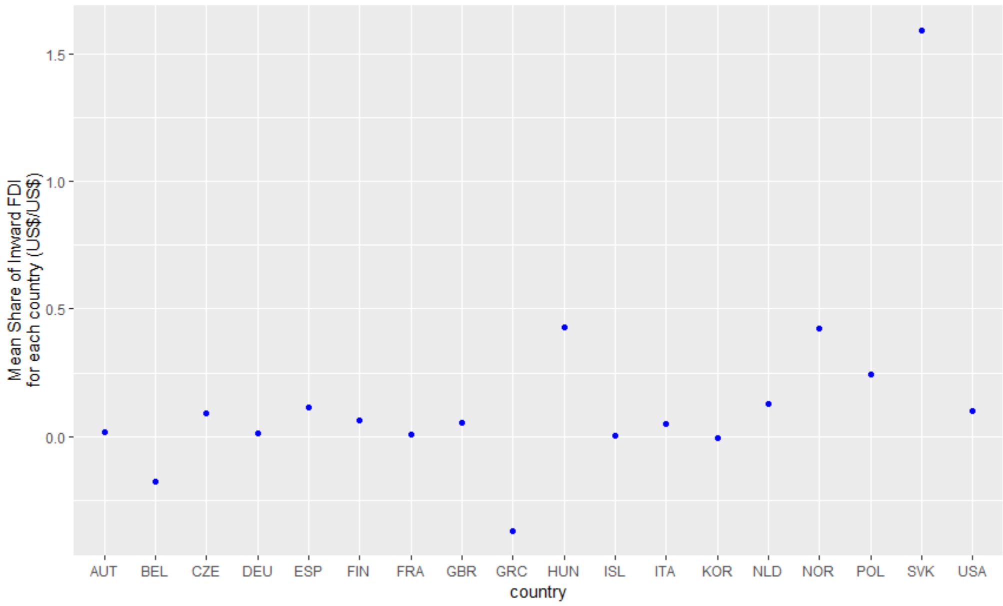

Figure 14: Distribution of the Mean Share of Inward FDI across countries

Notes to Figure 14*: The average shares of inward FDI across all industry-year combinations are calculated for each country and are plotted against the countries. The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

6.1.3. Distribution across industries:

6.1.3.1. Share of outward FDI:

Lastly, Figure 15 shows the distribution of the share of outward FDI across industries. It can again be seen that there are extreme values, and these extreme values previously observed in the 'across countries' and 'over time' plots are exhibited mainly by two industries: the 'Coke, refined petroleum products and nuclear fuel' industry and the 'Office, accounting and computing machinery' industry. These two industries also have values spread over a wider range, contributing to a higher standard deviation. The mean value for each industry is represented by the red dot. Though the variation among the mean values seems minimal, they can be plotted separately to better interpret the small changes.

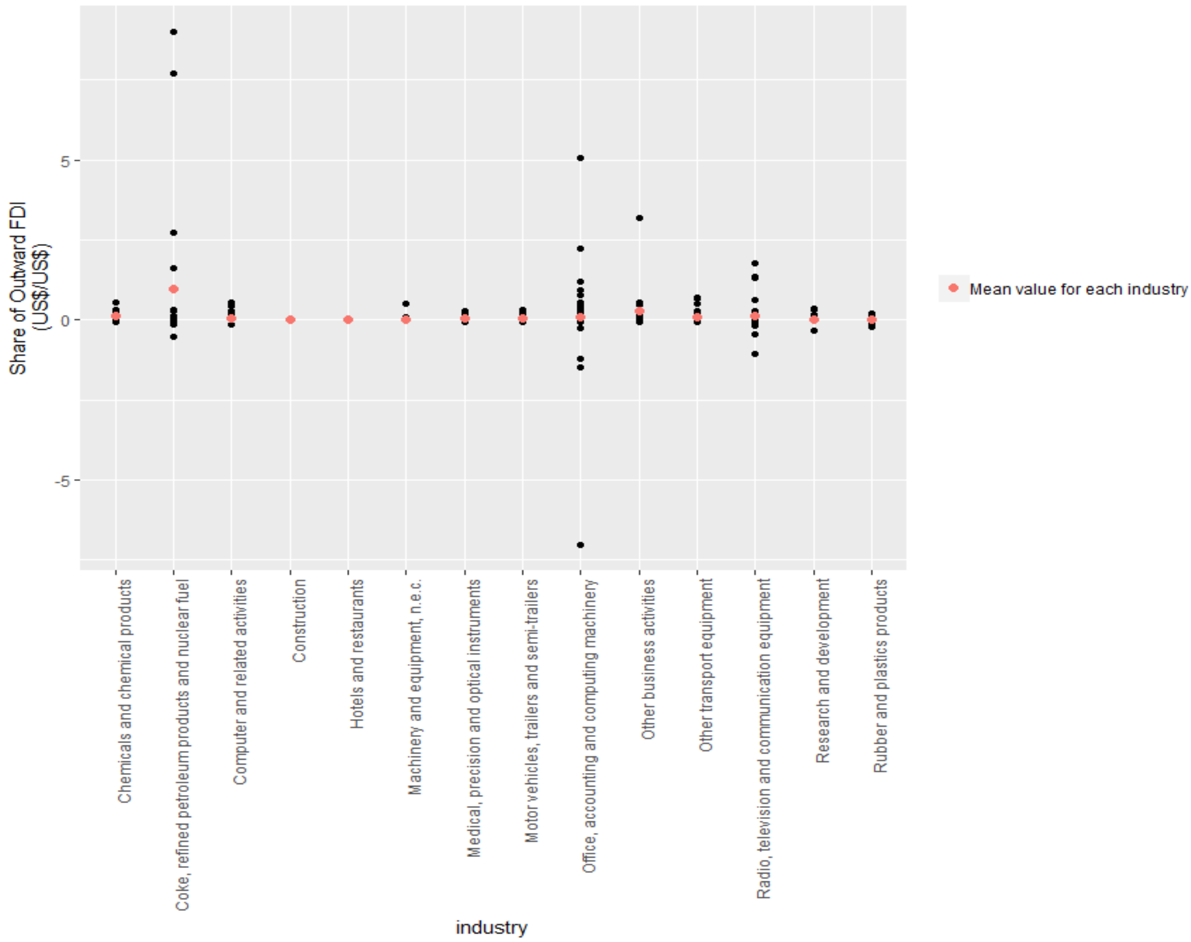

Figure 15: Distribution of the Share of Outward FDI across industries

Notes to Figure 15*: The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). The black dots indicate all the observations for each industry, while the red dots represent the mean share of outward FDI for each industry. Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

Figure 16 shows the plot of the mean share of outward FDI for each industry against the industry. The Coke, refined petroleum products and nuclear fuel industry spends the highest outward FDI on average (almost 1 US dollar) for every US dollar of its value added. This is followed by the industry Other business activities, which spends just over a quarter of a US dollar on average in outward FDI for every US dollar of its value added. But all the other industries spend less than half of this in outward FDI for every US dollar of their value added. The industries Construction and Hotels and restaurants have a share of outward FDI value close to zero, which is justified as they are mainly service industries.

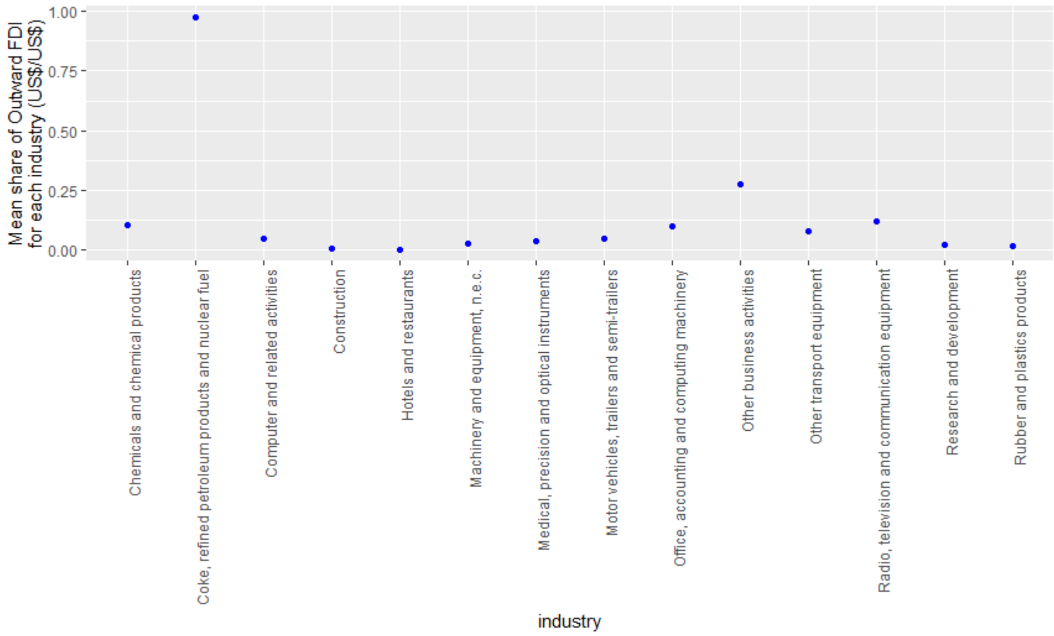

Figure 16: Distribution of the Mean Share of Outward FDI across industries

Notes to Figure 16*: The average shares of outward FDI across all country-year combinations are calculated for each industry and are plotted against the industries. The share of outward FDI is defined as the ratio of outward FDI by Gross Value Added (GVA). Outward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

6.1.3.2. Share of Inward FDI:

Figure 17 shows the distribution of share of inward FDI across industries. It can again be seen that there are extreme values, and these extreme values previously observed in the 'across countries' and 'over time' plots are exhibited mainly by two industries: the 'Office, accounting and computing machinery' industry and the 'Other transport equipment' industry. These two industries also have values spread over a wider range, contributing to a higher standard deviation. The mean value for each industry is represented by the red dot. Though the variation among the mean values seems minimal, they can be plotted separately to better interpret the small changes.

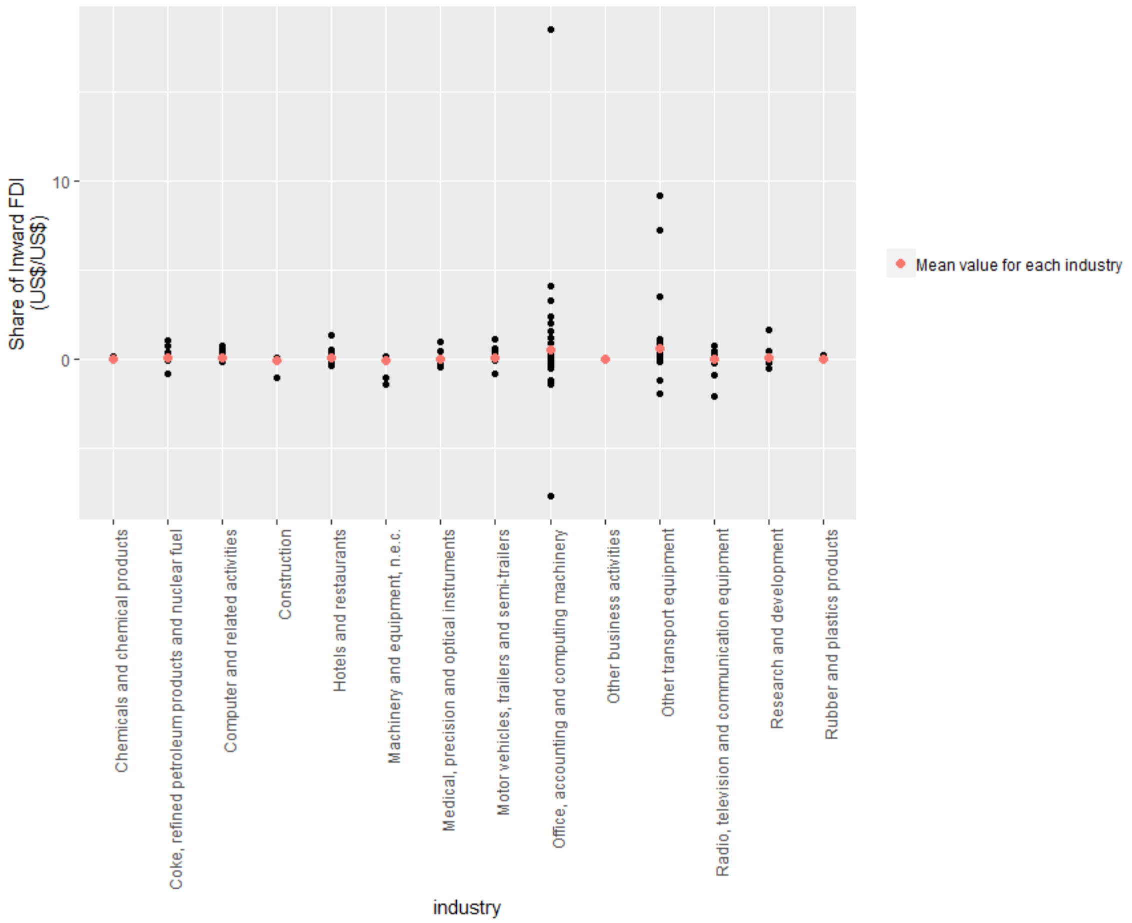

Figure 17: Distribution of the Share of Inward FDI across industries

Notes to Figure 17: The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). The black dots indicate all the observations for each industry, while the red dots represent the mean share of inward FDI for each industry. Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.

Figure 18 shows the plot of the mean share of inward FDI for each industry against the industry. Both the Office, accounting and computing machinery industry and the Other transport equipment industry enjoy on average 0.6 US dollars of share of inward FDI for every US dollar of its value added. By referring to the previous plot (Figure 17), it can be seen that while Office, accounting & computing machinery has a high mean value because of the high outlier point, the Other transport equipment industry has a high mean by having more higher values of inward FDI. All the other industries enjoy less than 0.1 US dollars of inward FDI for every US dollar of their value added. The industry 'Other business activities' has an almost zero value of share of inward FDI, whereas, the industries 'Construction' and 'Machinery and equipment n.e.c.' have negative values of inward FDI.

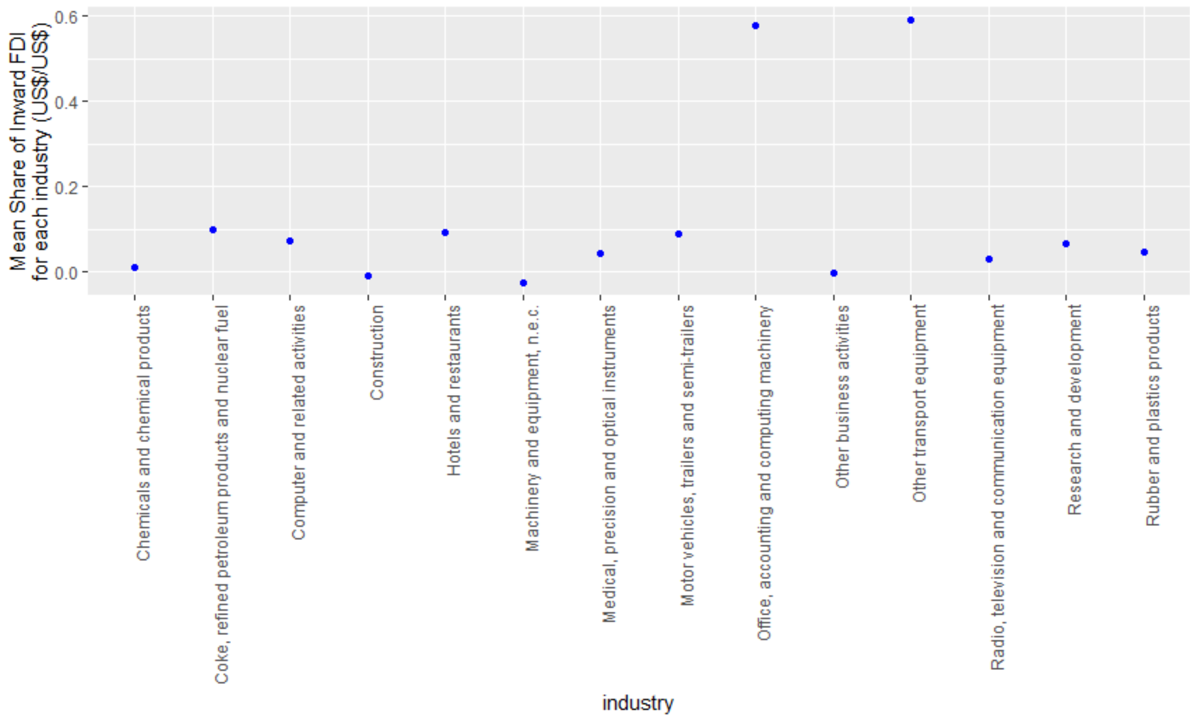

Figure 18: Distribution of the Mean Share of Inward FDI across industries

Notes to Figure 18*: The average shares of inward FDI across all country-year combinations are calculated for each industry and are plotted against the industries. The share of inward FDI is defined as the ratio of inward FDI by Gross Value Added (GVA). Inward FDI data are from the OECD FDI Statistics Database, while the GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices.*

To summarise the main outliers across time, countries and industries:

Table 12: Outliers

Unit of Analysis	**Variable**	**Outliers**
Year	Share of Outward FDI	1999
Year	Share of Inward FDI	2001
Industry	Share of Outward FDI	Coke, refined petroleum products & nuclear fuel industry; Office, accounting & computing machinery industry
Industry	Share of Inward FDI	Office, accounting & computing machinery industry
Country	Share of Outward FDI	Netherlands Spain Iceland
Country	Share of Inward FDI	Slovak Republic Greece Hungary

6.2. Regression results using aggregate flows:

We first look at the regression results for the aggregate data to assess our primary hypothesis H1, which states that outward FDI flows reduce domestic capital and R&D investments.

Table 13: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic Fixed capital Investment

	Dependent variable:			
	(Share of GFCF)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	-0.013**	-0.013**	-0.013**	-0.015**
	(0.006)	(0.006)	(0.006)	(0.006)
Share of Inward FDI	0.014	0.014	0.014	0.012
	(0.009)	(0.009)	(0.009)	(0.009)
Value-added growth	-0.080***	-0.077***	-0.076***	-0.070***
	(0.014)	(0.016)	(0.016)	(0.017)
Linear time trend		-0.001	0.001	
		(0.001)	(0.005)	
Quadratic time trend			-0.0001	
			(0.0003)	
Time dummies?	No	No	No	Yes
Observations	334	334	334	334
R^2	0.149	0.150	0.151	0.209
F Statistic	11.920*** (df = 3; 204)	8.953*** (df = 4; 203)	7.162*** (df = 5; 202)	3.938*** (df = 13; 194)

*Notes to Table 13: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and Gross Fixed Capital Formation (GFCF) are defined as the ratios of the particular component by Gross Value Added (GVA). Outward FDI and Inward FDI data are from the OECD FDI Statistics Database, while the GFCF and GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model, Column 2 gives the estimates for the model with a linear time trend, Column 3 give the estimates for the model with a linear and quadratic time trend, while Column 4 gives the estimates for the model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 2Table 13 adds evidence to support the first part of our primary hypothesis 'H1a', which is '*Domestic fixed capital investment tends to be negatively correlated with outward FDI*'. We find that there appears a negative correlation in our sample between the share of domestic fixed capital investment and our key regressor of interest, the share of outward FDI, indicated by the coefficient of -0.013, which has a p-value less than 0.05. I choose a significance level of 5%, which is the probability of rejecting the null hypothesis based on sample data, when in fact, the null hypothesis is true for the population. Thus, our main coefficient is statistically significant at the 5% level. This means that in random samples drawn from a population in which there is either no effect or a positive effect of the share of outward FDI on the share of domestic fixed capital investment, there is a 5% probability that for every 10 percentage point increase in the share of outward FDI, there will be a 0.13 percentage point decrease in the share of domestic fixed investments, *ceteris paribus*. Since 5% is the desired significance level, we reject our null hypothesis and support our alternate hypothesis that there is a negative effect.

Table 13 also shows that our model explains little of the variation in the share of domestic capital investment across industries, countries and years as implied by the low R-squared values. But the results of the overall F-statistic test are significant at the 5% level indicating that our model is better than the null model with just the mean values in explaining the data. Thus, high variability in our dependent variable could cause the low R-squared values, whereas, the significant F-statistic reveals a significant relationship between our regressand and one or more of the regressors in our sample. Looking at the other regressors, while the coefficient for the share of inward FDI is not statistically significant, the regressor value-added growth has a negative coefficient of around -0.08, that is statistically significant at the 1 percent level. This means that in random samples drawn from a population in which there is either no effect or a positive effect of value-added growth on the share of domestic fixed capital investment, there is a 1% probability that for every 10 percentage point increase in value-added growth, we can expect the share of domestic fixed capital investment to decrease by around 0.8 percentage point, while all else remains constant. This is counterintuitive as we had earlier expected an industry with a high growth rate to spend more on fixed investments domestically. This could be because a high growth rate can increase the dividends expected by shareholders or the wages expected by employees, causing firms to cut down on fixed investments. Similar values are obtained for the regressions with the linear time trend, linear and quadratic time trends and time dummies as shown in Columns 2, 3 and 4, confirming the robustness of our results.

Our results are similar to those obtained in country-level analyses by Feldstein (1995) and Desai, Foley, & Hines Jr. (2005), though the coefficients are way smaller (they found that domestic investments decrease on a dollar-to-dollar basis with outward FDI). The sign of the coefficient for our key regressor supports our primary theory of the financially constrained firm and how it contributes to aggregate investment patterns. Firms face financial constraints due to capital market imperfections and have limited access to capital. Capital investments at home and abroad compete for the same limited amount of funds that the firm has access to. So, capital investments abroad have a small negative effect on the capital investments at home. This allocation by individual firms contributes to the investment pattern of the industry as a whole. So, an industry which invests more abroad might invest less in the home country. But the magnitude of the coefficient is very small. This could be because there were competing positive effects produced by outward FDI. For example, though outward FDI offshores production activities and substitutes for exports, it can also have complementary effects by increasing the foreign demand for domestic intermediary goods (Hejazi & Pauly, 2003). So, the low coefficient values can be interpreted to reflect the aggregate of both positive and negative effects, whereby the negative effects associated with outward FDI are more dominant.

Table 14: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic R&D Expenditure

	Dependent variable:			
	(Share of R&D expenditure)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	-0.025**	-0.025**	-0.025**	-0.024**
	(0.010)	(0.010)	(0.010)	(0.010)
Share of Inward FDI	0.020	0.021	0.022	0.027*
	(0.015)	(0.015)	(0.015)	(0.015)
Value-added growth	-0.010	-0.034	-0.040	-0.051*
	(0.025)	(0.027)	(0.027)	(0.028)
Linear time trend		0.006**	-0.004	
		(0.002)	(0.009)	
Quadratic time trend			0.001	
			(0.001)	
Time dummies?	No	No	No	Yes
Observations	334	334	334	334
R^2	0.034	0.059	0.065	0.153
F Statistic	2.420* (df = 3; 204)	3.164** (df = 4; 203)	2.796** (df = 5; 202)	2.686*** (df = 13; 194)

*Notes to Table 14: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and R&D expenditure are defined as the ratios of the particular component by Gross Value Added (GVA). Inward and Outward FDI data are from the OECD FDI Statistics Database, R&D expenditure data are from the OECD ANalytical Business Enterprise Research and Development (ANBERD) database, while the GVA data are from OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model, Column 2 gives the estimates for the model with a linear time trend, Column 3 give the estimates for the model with a linear and quadratic time trend, while Column 4 gives the estimates for the model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 14 adds evidence to support the second part of our primary hypothesis H1b that 'Domestic *R&D spending tends to be negatively correlated with outward FDI'.* We get a negative coefficient of -0.025 for the share of outward FDI, which is statistically significant at the 1 percent level. This means that in random samples drawn from a population in which there is either no effect or a positive effect of the share of outward FDI on the share of domestic R&D spending, there is a 1% probability that for every 10 percentage point increase in the share of outward FDI, there will be a 0.25 percentage point decrease in the share of domestic fixed investments, *ceteris paribus*. Since this is within our desired significance level of 5%, we reject the null hypothesis that there is no effect or a positive effect and support the alternate hypothesis that there is a negative association between the share of outward FDI and the share of domestic R&D spending.

Here, again, the R-squared values for the regressions are low, implying that our model does not explain much of the variability in the dependent variable. While the results of the overall F-statistic test for the main regression (Column 1) are not significant at the desired 5% level, the significance level increases and reaches the 5% level when a linear time trend, linear and quadratic time trends and time dummies are added (Columns 2, 3 and 4). This suggests that when additional terms to account for the time variation are added, our model shows a strong relationship between the regressand and one or more of the regressors in our sample. Looking at the other regressors, both the share of inward FDI and value-added growth do not have coefficients that are statistically significant, implying that they do not have considerable effect on domestic R&D investment. Similar values are obtained for the regressions with the linear time trend, linear and quadratic time trends and time dummies as shown in Columns 2, 3 and 4, confirming the robustness of our results.

The negative sign of the estimates of the coefficient for our key regressor, the share of outward FDI makes sense as it aligns with our intuitive understanding that money spent abroad implies less money to spend on R&D investments at home. This is in line with the theory of the financially constrained firm which has only a limited amount of investment funding to spend on R&D (Fazzari & Athey, 1987). The firm has to choose between the competing demands of the firm's domestic and foreign R&D projects. Thus, outward FDI reduces domestic R&D spending at the firm level and this translates to similar trends at the industry level. But similar to the outward FDI coefficient for the effect on domestic capital investment, the outward FDI coefficient here again is very small, implying competing positive and negative effects. While manufacturing activities are offshored, the skill-intensive R&D activities might be retained in the home country, stimulating domestic R&D spending. Thus, we can interpret the small but statistically significant negative coefficient for the share of outward FDI to suggest that there may be both positive and negative effects associated with outward FDI on domestic R&D spending, but the net effect is negative.

6.3. Regression results using future value-added growth

Instead of using the contemporaneous value-added growth as a control variable, we can also use future value-added growth. Value added is a measure of the scale of an industry; it represents the monetary value of all the goods and services produced in an industry after deducting the costs of the inputs and raw materials that have gone into the production of those goods and services. It includes all the wages paid and the profits earned. Expectations of future growth in an industry can trigger fixed capital investment and R&D spending to increase in that industry. We assume expectations of future value-added growth to be approximately correct and reflected in the actual future value-added growth values. This can explain a lot of the variability in GFCF and R&D expenditure in the current year. Thus, it can be a valuable control variable. The same set of regression are repeated, but with future value-added growth as the control variable.

Table 15: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic Fixed capital Investment using Future Value-added growth

	Dependent variable:			
	(Share of GFCF)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	0.011	0.012	0.012	0.005
	(0.024)	(0.024)	(0.024)	(0.024)
Share of Inward FDI	0.009	0.017	0.016	-0.001
	(0.035)	(0.035)	(0.036)	(0.036)
Future Value-added growth	0.004	0.032	0.034	0.135
	(0.102)	(0.103)	(0.105)	(0.119)
Linear time trend		-0.010	-0.008	
		(0.007)	(0.021)	
Quadratic time trend			-0.0001	
			(0.002)	
Time dummies?	No	No	No	Yes
Observations	180	180	180	180
R^2	0.004	0.022	0.022	0.133
F Statistic	0.107 (df = 3; 91)	0.515 (df = 4; 90)	0.409 (df = 5; 89)	1.155 (df = 11; 83)

Notes to *Table 15: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and Gross Fixed Capital Formation (GFCF) are defined as the ratios of the particular component by Gross Value Added (GVA). Outward FDI and Inward FDI data are from the OECD FDI Statistics Database, while the GFCF and GVA data are from the OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model altered by including the future value-added growth, Column 2 gives the estimates for the altered model with a linear time trend, Column 3 give the estimates for the altered model with a linear and quadratic time trend, while Column 4 gives the estimates for the altered model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 15 shows that using future value-added growth as the control variable greatly affects the model fit, resulting in very low R-squared values and overall F-statistic test results that are not statistically significant at the 5% level. This could be because using future value-added growth greatly reduces the sample size, as many observations may not have non-missing data for the following year. This is evident if we compare the results in

Table 15 with those in Table 13, especially the number of observations in the two tables. While the number of data points available is 334 for the original model, the model altered by including future value-added growth has only 180 observations. This could explain the poor fit of the overall model, as well as the statistical non-significance of the individual coefficients. It could also be because our assumption that expectations of future growth are accurately reflected in the actual future value-added growth values might be wrong. Thus, we conclude that future value-added growth is a poor predictor of the share of domestic fixed capital investment.

Table 16: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic R&D Expenditure using Future Value-added growth

	Dependent variable:			
	(Share of R&D expenditure)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	0.017*	0.017*	0.018*	0.015
	(0.009)	(0.009)	(0.009)	(0.010)
Share of Inward FDI	0.014	0.015	0.018	0.015
	(0.017)	(0.018)	(0.019)	(0.020)
Future Value-added growth	-0.003	-0.001	0.005	0.013
	(0.060)	(0.064)	(0.065)	(0.071)
Linear time trend		-0.001	0.027	
		(0.008)	(0.042)	
Quadratic time trend			-0.003	
			(0.004)	
Time dummies?	No	No	No	Yes
Observations	180	180	180	180
R^2	0.164	0.165	0.177	0.211
F Statistic	2.099 (df = 3; 32)	1.530 (df = 4; 31)	1.293 (df = 5; 30)	0.903 (df = 8; 27)

*Notes to Table 16: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and R&D expenditure are defined as the ratios of the particular component by Gross Value Added (GVA). Inward and Outward FDI data are from the OECD FDI Statistics Database, R&D expenditure data are from the OECD ANalytical Business Enterprise Research and Development (ANBERD) database, while the GVA data are from OECD's STAN STructural ANalysis Database. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model altered by including the future value-added growth, Column 2 gives the estimates for the altered model with a linear time trend, Column 3 give the estimates for the altered model with a linear and quadratic time trend, while Column 4 gives the estimates for the altered model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 16 shows that using future value-added growth as the control variable again results in poor model fit, evident from the low R-squared values and F-statistic test results that are not statistically significant at the 5% level. This could again be explained by the reduction in sample size when using future value-added growth, as many observations may not have non-missing data for the following year. The number of data points are reduced from 334 for the original model (Table 14) to 63 for the model altered by including future value-added growth (Table 16). It could also be because our assumption that expectations of future growth are accurately reflected in the actual future value-added growth values might be wrong. Thus, we conclude that future value-added growth is a poor predictor of the share of domestic R&D expenditure as well.

6.2. Regression results with the industry effects:

Next to test the hypotheses H2 and H3 regarding the industry effects, we first distinguish the industries into R&D intensive and traditional industries. The OECD industry technology classification for ISIC Rev. 3.1 as well as the OECD R&D intensity-based industry classification for ISIC Rev. 4 can be used to divide the industries into four groups:

- High tech industries
- Medium-high tech industries
- Medium-low tech industries
- Low tech industries

The high and medium-high R&D intensity industries are considered as R&D-intensive or Schumpeterian industries, whereas, medium-low and low R&D intensity industries are considered as traditional or Heckscher-Ohlin type of industries.

Now, the initial set of regressions are repeated for the two types of industries separately to study the distinct effects of outward FDI on domestic investment and test our hypotheses H2 and H3.

6.3.1. Traditional Industries:

Table 17: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic Fixed capital Investment for Traditional Industries

	Dependent variable:			
	(Share of GFCF)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	-0.002	-0.002	-0.003	-0.006
	(0.005)	(0.005)	(0.005)	(0.006)
Share of Inward FDI	-0.127*	-0.127*	-0.123	-0.042
	(0.074)	(0.075)	(0.076)	(0.099)
Value-added growth	-0.026**	-0.027*	-0.030*	-0.033*
	(0.011)	(0.014)	(0.015)	(0.016)
Linear time trend		0.0001	-0.003	
		(0.001)	(0.005)	
Quadratic time trend			0.0002	
			(0.0003)	

Time dummies?	No	No	No	Yes
Observations	85	85	85	85
R^2	0.153	0.153	0.160	0.303
F Statistic	2.591* (df = 3; 43)	1.900 (df = 4; 42)	1.563 (df = 5; 41)	1.386 (df = 11; 35)

*Notes to Table 17: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and Gross Fixed Capital Formation (GFCF) are defined as the ratios of the particular component by Gross Value Added (GVA). Outward FDI and Inward FDI data are from the OECD FDI Statistics Database, while the GFCF and GVA data are from the OECD's STAN STructural ANalysis Database. Data have been included only for those industries which are classified as medium-low tech and low tech according to the OECD industry technology classification for ISIC Rev. 3.1 and the OECD R&D intensity-based industry classification for ISIC Rev. 4. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model, Column 2 gives the estimates for the model with a linear time trend, Column 3 give the estimates for the model with a linear and quadratic time trend, while Column 4 gives the estimates for the model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 17 shows that our model explains very little of the variation in domestic capital investment across industries, countries and years for traditional industries as demonstrated by the low R-squared values and the overall F-statistic test results which are not significant at the 5% level. Looking at the coefficients for the individual regressors, we are not able to find any significant correlation between the share of domestic fixed capital investment and our key regressor of interest, the share of outward FDI in our sample. The hypothesis that we wanted to assess 'H2a' is 'In traditional industries, d*omestic fixed capital investment tends to be negatively correlated with outward FDI'*. While a negative coefficient is obtained for the share of outward FDI, it is not statistically significant, and thus we fail to reject the null hypothesis.

Looking at the other regressors, while the coefficient for the share of inward FDI is not statistically significant, the regressor value-added growth has a negative coefficient of -0.026, which is statistically significant at the 5% level. This means that in random samples drawn from a population of traditional industries, in which there is either no effect or a positive effect of value-added growth on the share of domestic fixed capital investment, there is a 5% probability that for every 10 percentage point increase in value-added growth, we can expect the share of domestic fixed capital investment to decrease by around 0.3 percentage point, while all else remains constant. This is counterintuitive as we had earlier expected traditional industries with high growth rates to spend more on fixed investments domestically. This could be because a high growth rate can increase the dividends expected by shareholders or the wages expected by employees, causing firms to cut down on fixed investments. Similar negative coefficients were obtained for value-added growth when looking at aggregate data for all industry types. Similar coefficient values are obtained for the regressions with the linear time trend, linear and quadratic time trends and time dummies as shown in Columns 2, 3 and 4, confirming the robustness of our results.

Our results are different from Braunerhjelm & Oxelheim (1992) who find a complementary relationship between domestic investments and outward FDI. The statistically insignificant coefficient values could be because in addition to the negative effects associated with outward FDI as hypothesized by our primary and secondary theories, there could also be unexpected positive effects which compensate for the negative effects. While on one hand, our main theory is that a financially constrained firm in a traditional industry will try to allocate capital more effectively, and thus engages in efficiency-seeking outward FDI. This leads to vertical fragmentation and offshoring of production activities, to take advantage of cheaper labour and raw materials elsewhere. This will divert capital investments from the home country. But there might be additional benefits to this vertical fragmentation and optimisation of production process in the form of lower production costs. This lower cost if translated to a lower price for the customer will lead to an increase in sales, known as the sales-increasing effect of FDI (Cohen & Klepper, 1996b). Also, efficiency-seeking my not be the only motive for firms in traditional industries. Firms may also engage in strategic asset-seeking FDI, wherein, the they make use of assets in foreign countries to increase their competitiveness in the home country. In this case domestic sales also increases. The additional sales could mean the firm will have more funds to invest in fixed capital in the home country. Thus, the positive and negative effects could have equal weightage, resulting in no net effect.

Table 18: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic R&D Expenditure for Traditional Industries

	Dependent variable:			
	(Share of R&D expenditure)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	0.005***	0.005***	0.005***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Share of Inward FDI	0.004	0.004	0.004	0.008
	(0.008)	(0.009)	(0.009)	(0.012)
Value-added growth	-0.002	-0.002	-0.002	-0.002
	(0.001)	(0.002)	(0.002)	(0.002)
Linear time trend		0.00004	-0.0001	
		(0.0002)	(0.001)	
Quadratic time trend			0.00001	
			(0.00004)	
Time dummies?	No	No	No	Yes
Observations	85	85	85	85
R^2	0.753	0.754	0.754	0.769
F Statistic	43.729*** (df = 3; 43)	32.120*** (df = 4; 42)	25.132*** (df = 5; 41)	10.603*** (df = 11; 35)

Notes to Table 18: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and R&D expenditure are defined as the ratios of the particular component by Gross Value Added (GVA). Inward and Outward FDI data are from the OECD FDI Statistics Database, R&D expenditure data are from the

*OECD ANalytical Business Enterprise Research and Development (ANBERD) database, while the GVA data are from OECD's STAN STructural ANalysis Database. Data have been included only for those industries which are classified as medium-low tech and low tech according to the OECD industry technology classification for ISIC Rev. 3.1 and the OECD R&D intensity-based industry classification for ISIC Rev. 4. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model, Column 2 gives the estimates for the model with a linear time trend, Column 3 give the estimates for the model with a linear and quadratic time trend, while Column 4 gives the estimates for the model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 18 shows that our model provides very good fit for the data and is successful in explaining about 75% of the variability in the dependent variable, the share of domestic R&D investment, as demonstrated by the high R-squared values. Also, the overall F-statistic values are significant at the 1% level suggesting a strong relationship between our regressand and one or more of the regressors. Looking at the individual coefficients, we can see that the share of outward FDI has a positive effect on the share of domestic R&D spending in our sample, which supports the second part of our second hypothesis H2b that 'In traditional industries, *R&D spending tends to be positively correlated with outward FDI'.* We get a positive coefficient of 0.005 for the share of outward FDI, which is statistically significant at the 1 percent level. This implies that in random samples drawn from a population of traditional industries, in which there is either no effect or a negative effect of the share of outward FDI on the share of domestic R&D investment, there is a 1% probability that for every 10 percentage point increase in the share of outward FDI, there will be a 0.05 percentage point increase in the share of domestic R&D spending.

Looking at the other regressors, both the share of inward FDI and value-added growth do not show statistically significant coefficients. Our results are further verified when robustness checks are performed by repeating the regressions by adding a linear time trend (Column 2), linear and quadratic time trend (Column 3) and time dummies (Column 4), and similar coefficients are obtained. Though the coefficient estimates for our key regressor, the share of outward FDI, might not be economically significant because of the small value, it still supports the existence of a positive association in traditional industries. This positive effect should be interpreted as the aggregate of the effects suggested by our primary and secondary theories. Our primary theory of the financially constrained firm and the existence of competition between R&D activities at home and abroad for the limited funds available suggests a negative correlation between the share of outward FDI and the share of domestic R&D spending. But according to our secondary theory, firms in traditional industries mainly engage in FDI to increase the efficiency of the production process and achieve economies of scale. The production activities are fragmented vertically, with the labour-intensive production activities transferred abroad to take advantage of lower labour costs or raw material costs elsewhere. But the skill-intensive R&D activities are centralised and retained in the home country. Thus, this leads to more money spent for domestic R&D. Also, the sales-increasing effect of FDI can lead to cost spreading, wherein, the per unit R&D costs can be reduced by averaging it over a wider range of output. From the positive coefficient obtained, we can understand that these positive effects suggested by our secondary theory are more dominant. This is similar to the positive correlation observed by Goedegebuure (2006) in both firm and industry-level analyses of Dutch MNC data in traditional industries.

6.3.2. R&D-Intensive Industries:

Table 19: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic Fixed capital Investment for R&D-intensive Industries

	Dependent variable:			
	(Share of GFCF)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	-0.014*	-0.014*	-0.014*	-0.015*
	(0.008)	(0.008)	(0.008)	(0.008)
Share of Inward FDI	0.016*	0.016*	0.016	0.015
	(0.009)	(0.009)	(0.010)	(0.010)
Value-added growth	-0.114***	-0.109***	-0.108***	-0.107***
	(0.019)	(0.020)	(0.020)	(0.023)
Linear time trend		-0.002	-0.001	
		(0.002)	(0.007)	
Quadratic time trend			-0.0001	
			(0.0004)	
Time dummies?	no	No	No	Yes
Observations	249	249	249	249
R^2	0.196	0.202	0.202	0.261
F Statistic	12.848*** (df = 3; 158)	9.922*** (df = 4; 157)	7.893*** (df = 5; 156)	4.018*** (df = 13; 148)

*Notes to Table 19: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and Gross Fixed Capital Formation (GFCF) are defined as the ratios of the particular component by Gross Value Added (GVA). Outward FDI and Inward FDI data are from the OECD FDI Statistics Database, while the GFCF and GVA data are from the OECD's STAN STructural ANalysis Database. Data have been included only for those industries which are classified as high and medium-high tech according to the OECD industry technology classification for ISIC Rev. 3.1 and the OECD R&D intensity-based industry classification for ISIC Rev. 4. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model, Column 2 gives the estimates for the model with a linear time trend, Column 3 give the estimates for the model with a linear and quadratic time trend, while Column 4 gives the estimates for the model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 19 shows that though our model explains only 20% of the variation in domestic capital investment across industries, countries and years for R&D-intensive industries as demonstrated by the low R-squared values, the significant overall F-statistic values suggest that our model is better than the null model with just the mean values in explaining the data. Thus, high variability in our dependent variable could cause the low R-squared values, whereas, F-statistic results could reveal a significant relationship between our regressand and one or more of the regressors for our sample. But we are not able to find any significant correlation between the share of domestic fixed capital investment and our key regressor of interest, the share of outward FDI, thus adding support to the hypothesis 'H3a' that 'In R&D-intensive industries, *domestic R&D spending tends to be uncorrelated with outward FDI'*. This conclusion is strengthened when similar results are obtained for the linear and quadratic time trend regressions and time dummies regression in Columns 2, 3 and 4.

While the coefficient for the share of inward FDI is also not statistically significant, the regressor value-added growth has a negative coefficient of around -0.11, that is statistically significant at the 1 percent level. This means that in random samples drawn from a population of R&D-intensive industries, in which there is either no effect or a positive effect of value-added growth on the share of domestic fixed capital investment, there is a 1% probability that for every 10 percentage point increase in value-added growth, we can expect the share of domestic fixed capital investment to decrease by around 1.1 percentage point, while all else remains constant. This coefficient is slightly higher than the coefficient for value-added growth obtained from the regressions for the overall data, signalling that the pattern of association observed between value-added growth and the share of domestic fixed capital investment is the same for both aggregate level of industries and R&D-intensive industries. This counterintuitive association can be because a high growth rate can increase the dividends expected by shareholders or the wages expected by employees, causing firms to cut down on fixed investments.

The main difference in R&D-intensive industries is that since these are highly skill-intensive, firms mainly engage in FDI to expand to newer markets (market-seeking FDI). So, production takes place simultaneously in the host country to serve the new market without displacing domestic production activities which serve the domestic market. Our results are similar to those obtained by Goedegebuure (2006) who argued that the positive and negative effects cancelled out each other. Thus, our results suggest that domestic fixed capital investment is uncorrelated with outward FDI, thus adding support to our hypothesis.

Table 20: Fixed Effect Estimates of the Effect of the Share of Outward FDI on the Share of Domestic R&D Expenditure for R&D-intensive Industries

	Dependent variable:			
	(Share of R&D expenditure)			
	(1)	(2)	(3)	(4)
Share of Outward FDI	-0.039^{***}	-0.038^{***}	-0.039^{***}	-0.038^{***}
	(0.014)	(0.014)	(0.014)	(0.014)
Share of Inward FDI	0.020		0.022	0.026

	(0.017)		(0.017)	(0.017)
Value-added growth	-0.010	-0.029	-0.037	-0.056
	(0.035)	(0.036)	(0.036)	(0.040)
Linear time trend		0.008**	-0.001	
		(0.003)	(0.012)	
Quadratic time trend			0.001	
			(0.001)	
Time dummies?	No	No	No	Yes
Observations	249	249	249	249
R^2	0.052	0.076	0.088	0.173
F Statistic	2.899** (df = 3; 158)	4.319*** (df = 3; 158)	2.998** (df = 5; 156)	2.386*** (df = 13; 148)

Notes to Table 20*: Standard errors are in parantheses. The shares of outward FDI, Inward FDI and R&D expenditure are defined as the ratios of the particular component by Gross Value Added (GVA). Inward and Outward FDI data are from the OECD FDI Statistics Database, R&D expenditure data are from the OECD ANalytical Business Enterprise Research and Development (ANBERD) database, while the GVA data are from OECD's STAN STructural ANalysis Database. Data have been included only for those industries which are classified as high and medium-high tech according to the OECD industry technology classification for ISIC Rev. 3.1 and the OECD R&D intensity-based industry classification for ISIC Rev. 4. All the data have been converted to US dollars, current prices. Column 1 gives the estimates for the original model, Column 2 gives the estimates for the model with a linear time trend, Column 3 give the estimates for the model with a linear and quadratic time trend, while Column 4 gives the estimates for the model with time dummies. *, **, *** = significant at the 10%, 5%, 1% level.*

Table 20 shows evidence to support the second part of our third hypothesis H3b that 'In R&D-intensive industries, *R&D spending tends to be negatively correlated with outward FDI'*. We get a negative coefficient of -0.039 for the share of outward FDI, which is statistically significant at the 1 percent level, thus supporting our hypothesis. This means that in random samples drawn from a population of R&D-intensive industries, in which there is either no effect or a positive effect of the share of outward FDI on the share of domestic R&D investment, there is a 1% probability that that for every 10 percentage point increase in the share of outward FDI, there will be a 0.39 percentage point decrease in the share of domestic R&D spending.

Though the R-squared values for the regressions are low implying that the model does not explain much of the variability in the dependent variable, the overall F-statistic values are significant at the 5% level, suggesting strong relationship between the regressand and the regressors in our sample. Looking at the other regressors, both the share of inward FDI and value-added growth do not exhibit coefficients that are statistically significant. Similar coefficients for the effect of the share of inward FDI and value-added growth on domestic R&D spending were obtained in the regressions using the overall data for all types of industries as well in the regressions using the data for traditional industries. This suggests that the share of inward FDI and value-added growth might not have any effect on domestic R&D spending across all types of industries. Our results are further strengthened when robustness checks are performed by repeating the regressions by adding a linear time trend (Column

2), linear and quadratic time trend (Column 3) and time dummies (Column 4), and almost similar coefficients are obtained.

While our results are in line with the substitutability demonstrated by Braunerhjelm & Oxelheim (1992) for knowledge-intensive industries, they are in contrast to findings by Goedegebuure (2006) who argued that the market-expansion associated with FDI will lead to more sales for the firm and increase its domestic R&D spending. One reason for our results is that our primary theory related to firm-level financial constraints can have a dominant effect. But also, as hypothesized in our secondary theory, there could be other negative effects associated with outward FDI in R&D-intensive industries. Goedegebuure (2006) only looks at the market-seeking motive for FDI. But R&D-intensive industry is highly competitive with shorter product life-cycles and huge product development costs. So, firms might also engage in efficiency-seeking FDI to try to reduce the R&D costs. Since labour costs associated with R&D personnel is major R&D cost, firms might transfer a lot of their R&D activities to host countries with cheaper high-skilled labour. Even if high-skilled labour is not available in the host country, if cheaper low- or moderately-skilled labour are abundantly available and the costs of training them for R&D are less than the wages in the home country, firms might prefer to concentrate their R&D activities in the host country. Thus, this in-turn could take R&D investment away from home country and cause a negative effect.

6.4. Tests to check for the validity of the regression results:

6.4.1. Checking for multicollinearity:

One of the common problems associated with multiple regressions is multicollinearity amongst the independent variables. Multicollinearity can be tested by computing a score called the variance inflation factor (or VIF), which measures how much the variance of a regression coefficient is inflated due to multicollinearity in the model. A VIF value of 1 indicates absence of multicollinearity, while VIF values above 5 or 10 indicate high multicollinearity. We get the following VIF values for the independent variables in our model:

Table 21: Variance Inflation Factor (VIF) values to check for multicollinearity

Share of outward FDI	**Share of inward FDI**	**Value-added growth**
1.040090	1.013453	1.053716

Thus, the low VIF values indicate that multicollinearity is very low amongst our independent variables and thus does not affect the regression results.

6.4.2. Checking for Pooled OLS vs. Fixed Effects:

Though we are using Fixed Effects method, it is important to check whether this complex model gives a better fit than a simple Pooled OLS. We can verify this by doing a simple F test. The time-demeaned 'within' equation is taken as the unrestricted model and a simple pooled equation is taken as the restricted model. We get the following results:

Table 22: Results of the F-test

Dependent Variables	F-value	df1	df2	p-value
Share of GFCF	30.719	85	91	< 2.2e-16
Share of R&D expenditure	52.531	85	91	< 2.2e-16

Notes to Table 22*: p-values less than 0.1, 0.05 and 0.01 indicate significance at the 10%, 5% and 1% levels.*

The very low p-values indicate that the fixed effects model is better.

6.4.3. Checking the residual plots for randomness:

To validate our model, we need to ensure that the assumptions for Ordinary Least Squares (OLS) are followed. To asses this, we must check if the unexplained stochastic error part of our model remains random and does not have any predictive power. The residuals are the estimates of these error components, that is, estimates of the difference between the observed values and the actual values. Thus, plotting the residuals against the fitted values estimated by our model is a good way to check for randomness. The residual plots for the original two regressions are given as follows (Figure 19 and Figure 20):

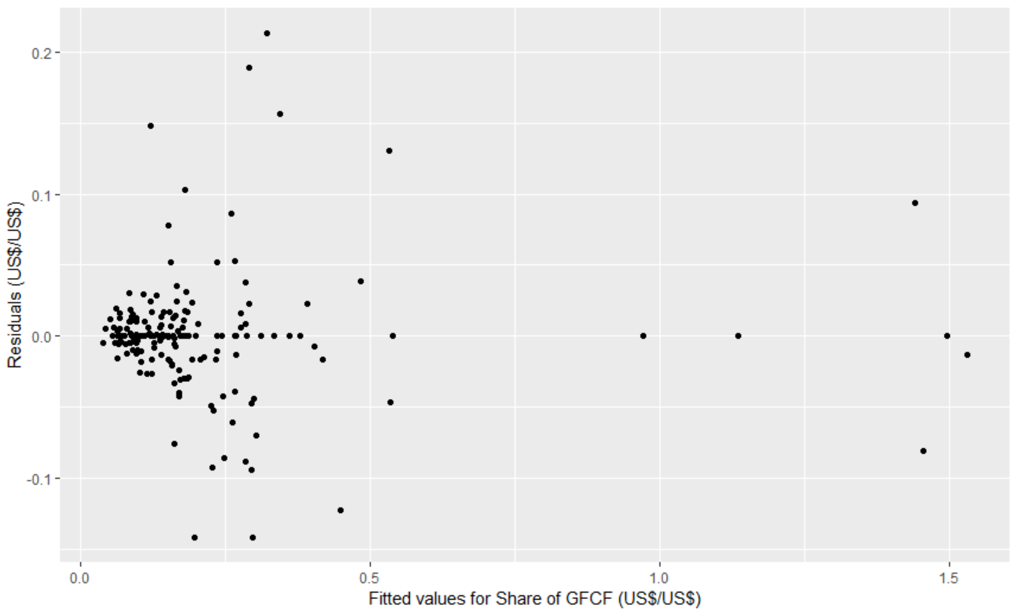

Figure 19: Residual plot for the dependent variable 'Share of GFCF'

Notes to Figure 19*: The fitted values and residuals are taken for the regression of the share of GFCF on the share of outward FDI, the share of inward FDI and value-added growth.*

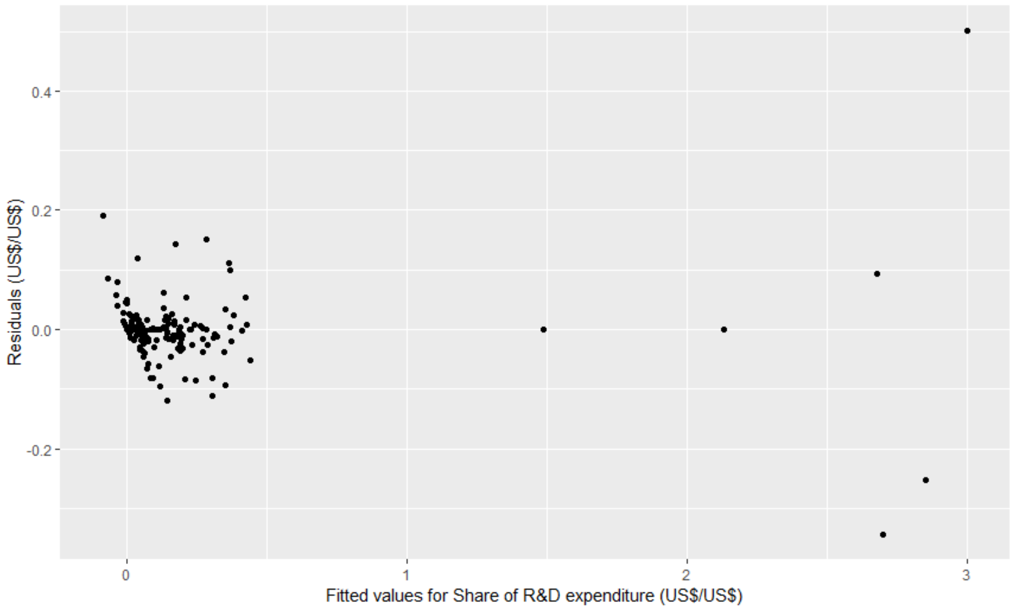

Figure 20: Residual plot for the dependent variable 'Share of R&D expenditure'

Notes to Figure 20*: The fitted values and residuals are taken for the regression of the share of R&D expenditures on the share of outward FDI, the share of inward FDI and value-added growth.*

As we can see, both the plots show random distribution of the residuals, thus satisfying the assumptions for applying OLS. Now, the coefficient estimates can be interpreted to be unbiased.

7. Conclusions and Reflections:

In this section, I first present the overall conclusion of the thesis by providing a summary and overview of the findings. After that, I analyze the contribution of this research from a scientific perspective. This is followed by outlining the practical relevance and providing a set of recommendations based on the findings. Finally, I discuss the limitations of this study, what I would do differently if I were to do the research again and also suggest multiple directions for future research.

7.1. Summary and key findings:

The aim of this research was to understand the nature of association between outward FDI and domestic investment, which includes both domestic fixed capital investment and domestic R&D spending. The findings help answer the main research questions, as outlined in the next paragraphs.

My primary research question was '*What is the effect of outward FDI on domestic investment, while controlling for industry growth?'.* To answer this, I first developed a theoretical model based on the theory of a financially constrained firm and its investment behaviour. Firms have limited access to funding because of financial constraints, and thus have to choose between investments abroad and at home. Thus, I theorized that more money spent elsewhere will mean less to spend in the home country. This firm-level investment behavior will translate to aggregate patterns at the industry level. This led to the development of my primary hypothesis, H1a: '*Domestic investments tend to be negatively correlated with outward FDI'.* To test my hypothesis, I looked at longitudinal industry-level data for the OECD countries covering the period 1995-2009, taken from three different databases. I regressed the share of domestic investment (GFCF and R&D expenditure separately) on the share of outward FDI, with the share of inward FDI and value-added growth as control variables. I obtained statistically significant negative coefficients of -0.013 and -0.025 for the share of outward FDI in the two sets of regressions respectively. The negative sign of the coefficients supports my primary hypothesis that outward FDI reduces domestic investment. The very small magnitude of the coefficients was interpreted to mean that there are both positive and negative effects associated with outward FDI, but the negative effects dominate. Expectations of future growth of an industry can trigger investment flow into that industry. So, I also repeated the regressions taking future value-added growth, which was assumed to act as the proxy for expected growth, as the control variable instead of contemporaneous value-added growth. But the regression results were not statistically significant, showing poor fit for the data. This implies that my assumption that future value-added growth accurately reflected expected growth is wrong. So, the original model with contemporaneous value-added growth is better suited to explain the variability in our data.

Previous works showed a difference in the nature of the association between outward FDI and domestic investment across industry types. This led to my secondary research question: '*How does the effect of outward FDI flows on domestic fixed capital investment and R&D spending vary across traditional and R&D-intensive industries?'* In establishing the conceptual framework to answer this, I propose secondary theories which take into account the other important ways in which outward FDI might impact domestic investment. Looking at traditional industries, I argued that traditional industries mainly engage in efficiency-seeking FDI. This will lead to vertical fragmentation of activities, with low skill-intensive production activities offshored and skill-intensive R&D activities centrally retained in the home country. Thus, this led to the development of my second hypotheses H2a: '*In traditional industries, domestic fixed capital investment tends to be negatively correlated with* *outward FDI*', and H2b: *'In traditional industries, domestic R&D spending tends to be positively correlated with outward FDI*'.

To assess the hypotheses empirically, industries were divided based on their technology classification, and high and medium-high tech industries were taken as R&D-intensive industries, and low and medium-low tech were taken as traditional industries. While regressing the share of GFCF on the share of outward FDI, the share of inward FDI and value-added growth for traditional industries, I could not find any statistically significant correlation between the shares of outward FDI and GFCF, and thus failed to reject the null hypothesis. This was interpreted to imply that outward FDI had both positive and negative effects on capital investments in traditional industries, and they cancelled out each other. Looking at R&D expenditures, I found a statistically significant positive coefficient of 0.005, which supports my hypothesis H2b that outward FDI increases domestic R&D spending, by retaining R&D activities in the home country. I also attributed this to the sales-increasing effect of efficiency-seeking outward FDI, which increased the output over which R&D costs can be averaged, thereby stimulating domestic R&D.

Next for R&D-intensive industries, I argued that R&D-intensive industries engaged mainly in market-seeking horizontal outward FDI, where production takes place simultaneously in host countries to serve newer markets, without significantly affecting home country production. This led to the hypothesis H3a: *'In R&D-intensive industries, domestic fixed capital investment tends to be uncorrelated with outward FDI*'. But R&D-intensive industries are also highly skill-intensive, with higher labour costs. So, to reduce this, they also engage in efficiency-seeking outward FDI with R&D activities offshored to countries with low labour costs and low costs of training. Thus, this led to the hypothesis H3b: *'In R&D-intensive industries, domestic R&D spending tends to be negatively correlated with outward FDI*'. Testing these empirically, in the case of capital investments, I did not find any statistically significant coefficient for the share of outward FDI, thus adding support to the hypothesis H3a. For R&D expenditures, I found a statistically significant negative coefficient of -0.038, which supports the hypothesis H3b that outward FDI reduces domestic R&D spending in R&D-intensive industries.

Thus, to conclude, while GFCF appeared to be negatively correlated with outward FDI for the aggregate data, looking at a specific industry type, I did not find any significant correlation. This is because industry-type-specific secondary effects, as discussed above, might be more dominant. Also, the sample size is reduced when disaggregating to the level of industry type, that could also affect our results. In the case of R&D expenditure, while it appeared to be negatively correlated with outward FDI for the aggregate data as well as in R&D-intensive industries, it had a positive correlation with outward FDI in traditional industries. This makes sense as the huge sample size of R&D-intensive industries could have influenced the results for the aggregate data. Looking at the other control variables, I did not find any significant correlation between the share of inward FDI and the share of domestic investment. While, value-added growth did not have any effect on domestic R&D spending, it had a strong negative effect on domestic GFCF. Both of these results are contrary to expectations. While I can speculate about the probable reasoning, future research is needed to explore this. An overview of the main findings is presented in *Table 23* and comparison with previous works is presented in *Table 24*.

Table 23: Overview of Key Findings

Hypothesis	Main Coefficient of Interest	Conclusion	Reasoning
H1a: Domestic fixed capital investment tends to be negatively correlated with outward FDI	-0.013** (0.006)	Support the secondary hypothesis H1a	Negative effect is in line with our primary theory that a financially constrained firm has limited access to capital and has to allocate this limited capital between FDI and domestic fixed investments.
H1b: Domestic R&D spending tends to be negatively correlated with outward FDI	-0.025** (0.010)	Support the secondary hypothesis H1b	Negative effect is in line with our primary theory that a financially constrained firm has limited access to capital and has to allocate this limited capital between FDI and domestic fixed investments.
H2a: In traditional industries, domestic fixed capital investment tends to be negatively correlated with outward FDI	-0.002 (0.005)	Coefficient is not significant; thus, we fail to reject the null hypothesis	The statistically insignificant coefficient values could be because in addition to the negative effects associated with outward FDI as hypothesized by our primary and secondary theories, there could also be unexpected positive effects which compensate for the negative effects.
H2b: In traditional industries, domestic R&D spending tends to be positively correlated with outward FDI	0.005*** (0.001)	Support the secondary hypothesis H2b	The positive effect suggested by our secondary theory is more dominant than the negative effect suggested by our primary theory of the financially constrained firm, thus resulting in an aggregate positive effect.
H3a: In R&D-intensive industries, domestic fixed capital investment tends to be uncorrelated with outward FDI	-0.014* (0.008)	Coefficient is not significant at the 5% level, thus, supporting the secondary hypothesis H3a	R&D-intensive firms mainly engage in market-seeking FDI. So, production takes place simultaneously in the host country to serve the new market without displacing domestic production activities which serve the domestic market.

H3b: In R&D-intensive industries, domestic R&D spending tends to be negatively correlated with outward FDI	-0.039*** (0.014)	Support the secondary hypothesis H3b	R&D-intensive industry is highly competitive with shorter product life-cycles and huge product development costs. So, firms might engage in efficiency-seeking FDI to try to reduce the R&D costs, by transferring R&D to countries with cheap high or moderately skilled labour.

Table 24: Comparison to Previous Empirical Evidence

Our Results	**Comparison to Prior Work**	**Explanation for similarities/deviations**
Domestic fixed capital investment tends to be negatively correlated with outward FDI	Similar to the results obtained in country-level analyses by Feldstein (1995) and Desai et al. (2005), though our regression coefficient is way smaller in magnitude.	The smaller coefficient could reflect the competing positive effects in terms of increase in foreign demand for intermediary goods caused by FDI, which was not visible when looking at data aggregated at the country-level.
Domestic R&D spending tends to be negatively correlated with outward FDI	In contrast to the positive effect observed in firm-level analyses by Mansfield et al. (1979) and Chen & Yang (2013).	While a positive correlation could exist between outward FDI and domestic R&D spending for specific countries, while for the aggregate cross-country data, the effect could be negative
In traditional industries, domestic fixed capital investment tends to be uncorrelated with outward FDI	Different from the positive effect observed in the industry-level analysis for Sweden by Braunerhjelm & Oxelheim (2000), and from the negative effect observed in the industry-level analysis for Netherlands by Goedegebuure (2006).	The varying positive and negative effects reflect the dominance of different types of effects for traditional industries in different countries. At the aggregate cross-country level, the positive and negative effects could cancel out each other, resulting in no net effect.
In traditional industries, domestic R&D spending tends to be positively correlated with outward FDI	Similar to the positive correlation observed by Goedegebuure (2006) in both firm and industry-level analyses of Dutch MNC data in traditional industries.	Traditional industries engage in FDI to lower production costs. This could translate to lower price for the consumer, which can increase sales revenue, thereby providing more money to invest in domestic R&D. This might be observed not only for

		Netherlands, but across all countries.
In R&D-intensive industries, domestic fixed capital investment tends to be uncorrelated with outward FDI	Similar to the no effect observed by Goedegebuure (2006) in his industry-level analysis of Dutch MNC data.	Similar to what Goedegebuure (2006), that the competing positive and negative effects produced by outward FDI cancel out each other.
In R&D-intensive industries, domestic R&D spending tends to be negatively correlated with outward FDI	While our results are in line with the substitutability demonstrated by Braunerhjelm & Oxelheim (1992) for knowledge-intensive industries, they are in contrast to findings by Goedegebuure (2006) who argued that the market-expansion associated with FDI will lead to more sales for the firm and increase its domestic R&D spending.	Goedegebuure (2006) only looks at the market-seeking motive for FDI. But R&D-intensive industry is highly competitive with shorter product life-cycles and huge product development costs. So, firms might also engage in efficiency-seeking FDI to try to reduce the R&D costs, by transferring R&D to countries with cheap high or moderately skilled labour.

7.1.1. Effect of Underlying Data Quality on Regression Results:

As discussed earlier, the composition of the underlying sample by countries and industry types could have affected the reliability of our results. While the number of non-missing observations is 249 for R&D-intensive industries, it is 85 for traditional industries. Thus, our sample is biased towards R&D-intensive industries, and this might have affected our results. If the effect observed at the aggregate level can also be interpreted as the sum of the effects observed for each industry type (hypotheses H1a = H2a + H3a and H1b = H2b + H3b), the higher number of observations for R&D-intensive industries could have greatly influenced our results for the overall data.

Table 25: Comparing results for Overall data and Industry types

Effect of outward FDI on	Effect for R&D-intensive industries (249)	Effect for Traditional industries (85)	Effect for Overall data (334)	Reliability of the overall effect
Domestic Capital Investment	Uncorrelated	Uncorrelated	Negatively correlated	Overall effect might be reliable, but the individual effects might suffer from data limitations
Domestic R&D Expenditure	Negatively correlated	Positively correlated	Negatively correlated	Individual effects might be reliable, but the overall effect might be biased because of the increased weightage of R&D-intensive industries

Comparing the effects observed at the level of the individual industry type and for the overall data (Table 25), it can be seen that for capital investment, while there is no significant correlation observed for the individual industry types, there is a strong negative correlation observed for the overall data for all industry types. To understand this, if we look at the coefficients for the effect on domestic R&D expenditure in both traditional and R&D-intensive industries from Table 23, we can see that both these regressions produce negative coefficients which are not statistically significant, and thereby, result in no effect. Thus, it could be that the sample size is not adequate to reliability estimate the correlation between outward FDI and domestic fixed capital investment for individual industry types, but at the overall level, the data is adequate to produce a significant negative effect. Looking at the results for the effect on domestic R&D expenditure, while for traditional industries, it is positively correlated, for R&D-intensive industries, it is negatively correlated. The increased sample size for R&D-intensive industries could have influenced the effect observed for the overall data. Thus, this result for the overall data might possibly change when the sample composition is varied.

7.2. Theoretical Contribution

The effect of FDI on host country economy is well documented (Lipsey (2004), Faeth (2006), Johnson (2006)). Looking at the effect of outward FDI on home country, while there have been extensive studies discussing the impact of outward FDI on home country exports and employment (Lipsey & Weiss (1981), Lipsey & Weiss (1984), Brainard (1997), Kokko (2006), Simpson (2012), *et cetera*), those discussing the effect on home country investment are limited. Among these limited studies done on home country, most are firm–level analyses for a specific country (Mansfield, Romeo, & Wagner (1979), Stevens & Lipsey (1992), Herzer & Schrooten (2008), Desai, Foley, & Hines (2009), *et cetera*), whose results cannot be generalised for a wider context. Looking at aggregate studies, we have few country-level analyses (Feldstein (1995), Desai et al. (2005)) and very few industry level analyses (Arndt et al. (2010), Goedegebuure (2006), Hejazi & Pauly (2002)). The country-level analyses may overlook considerable heterogeneities existing among industries, and how the impact of outward FDI can vary accordingly. The industry-level studies focus on a specific country, so again we encounter the problem of transferability. Thus, in this context, analysing cross-country data at the level of industry is one of its kind, and greatly improves the existing literature. By using industry-level data, I was able to distinguish between traditional and R&D-intensive industries, and identified significant differences in the relationship between domestic investment and outward FDI between the industry groups. Also, by combining pre-existing theories from previous literature and intuitive understanding, I developed a strong theoretical framework for the industry-type-effects, which can shed light on the underlying reasons for the different positive and negative effects associated with outward FDI in different industry types, with the empirical results demonstrating the dominant effects. Thus, this can be a valuable addition to the theoretical and empirical literature.

7.3. Practical implications and recommendations:

Globalisation, internationalization and the advent of technology have led to increasing interconnectedness and global financial integration like never before. This happens through international trade of goods and services, through flows of investments, capital and technology as well as through migration of people. But this makes countries and economies more susceptible to financial shocks and crises. Even minor disruptions which affect one part of the world get amplified and transferred to the rest of the global economy. They happen mainly through the financial channels of international trade and capital flows. So, governments have a great interest in exerting some control over these channels to ensure that their economies don't get affected adversely by global events. While international trade happens via both goods and services, international capital flows consist of FDI, foreign portfolio investments (FPI) and debt. International trade, FDI, especially exports, FPI and debt are interlinked, in that, policies affecting one can have a huge positive or negative effect on the others.

Policy makers are always interested in promoting the domestic investment climate as well as increasing the trade surplus or reducing the trade deficit. A healthier domestic climate can mean more productivity, more employment, more infrastructure development and in general, a healthier economy. More domestic R&D spending by companies especially can greatly influence the technological advancement of the country and improve the average skill level of the population. Similarly, an improved trade surplus or reduced trade deficit also means more revenue coming into the country in the form of foreign exchange reserves. Thus, policymakers have a huge impetus to carefully decide upon the desired trade account imbalance or capital spending that is optimal for the domestic economy. While taxes and tariffs are sources of revenue for the governments, they are also tools for policymakers to control capital flows in and out of the country, as well as trade behavior. Outward FDI is sensitive to tax policy, since after tax profits are main determinants of firms' investment decisions (Cummins & Hubbard, 1994). Similarly industrial and innovation policy can also be effective in influencing outward FDI flows, especially for emerging countries (*UNCTAD World Investment Report - Investment and new Industrial policies*, 2018). For example, China mainly specializes in low-tech labour-intensive manufacturing and is dependent on outward foreign investments for advanced technology. To change this, China introduced the 'Made in China 2025' strategy in 2015 to modernize China's industrial capabilities by focusing heavily on intelligent manufacturing in 10 strategic high-tech sectors (Li, 2018). By structuring its industrial policy this way, China can develop the industrial capabilities needed to make domestic investments more attractive to both domestic and foreign investors. Thus, it can control the outward FDI in these industries.

In this context, our research can be practically relevant for policymakers in understanding how outward FDI flows affect the domestic capital investments and R&D spending. We found that outward FDI has a net negative effect on domestic fixed capital investments at the aggregate level, while it tends to be uncorrelated looking at the level of the specific industry grouping. On the other hand, while FDI had a net negative effect on domestic R&D spending at the aggregate level, there was heterogeneity among industry groupings. While FDI outflows negatively seemed to be negatively correlated with domestic R&D for R&D-intensive industries, there was a positive effect for traditional industries. There are three important policy implications of this. One is that if domestic fixed capital investment is desired, tax policies should be designed to reduce direct FDI flows going out of the country, as it either negatively affects domestic capital investment or at the very least, has no net positive effect. But if the government is interested in stimulating domestic R&D, then while for R&D-intensive industries, outward FDI flows should be discouraged through appropriate tax policy, for traditional industries, outward FDI can in fact, be encouraged, as it had a positive effect on domestic R&D investment. For example, most OECD countries currently have a dividend exempt system, wherein, profits from foreign FDI are exempt from domestic taxes. This way, firms only have to pay host country taxes, which usually tend to be lower to attract inward FDI. Thus, countries can promote outward FDI in traditional industries by implementing this tax policy specifically for those industries. But for R&D-intensive industries, countries should either transition to the dividend credit system, wherein, profits from FDI are taxed at the same rate as domestic profits, or increasing the tax rate for foreign profits, thereby, discouraging outward FDI.

Next, while direct FDI policies are one way, since the various financial channels are interlinked, policies that affect international trade as well as FPI can also greatly influence FDI patterns. So, trade and tax policy promoting exports will mean the costs of exporting can be lower than outward FDI, so companies would rather choose to produce in the home country and export from there. This can reduce outward FDI and especially stimulate domestic fixed capital investment. Similarly, more favourable tax policies for income from FPI and debts will encourage investors to reduce outward FDI, which can again increase domestic investments in capital assets. For example, in most countries, income from FPI is subject to double taxation including both corporate tax and shareholder's tax. By exempting domestic investors from the shareholder's tax, countries can promote FPI, thereby reducing outward FDI (Amiram & Frank, 2016). But while such policies might also promote domestic R&D spending in R&D-intensive industries, it can have a negative effect in traditional industries. So, depending on the type of domestic investments desired and the industry type, policymakers have various tools that they can apply.

Both to promote or control outward FDI as well as promote or control FPI and debts, many countries resort to capital controls. There has been an increase in this especially following the 2008 crisis, when governments saw the negative aspects of an increasingly integrated capital market. Many countries choose to freeze money flowing out immediately following a crisis to avoid amplifying or worsening the crisis. China is a key example of a country which controls the money flowing in or out of the country as a whole, as well as specific industries or sectors, to encourage domestic firm and industry growth. For example, the *Administrative Measures for Outbound Investment by Enterprises,* implemented by China on March 1, 2018 is one such capital control aimed at regulating the then increasing outward FDI flows from China. While this regulation restricts outbound investments in real estate, hotel, entertainment, and sport industries, it encourages outward FDI in high-tech and R&D centers abroad. This way, it is possible to control the FDI outflows from specific industries. While there has been debates about the benefits and disadvantages associated with capital controls, our research also adds to this. With FDI affecting domestic investment in a specific way according to the type of investment and type of industry, using capital controls can seem beneficial to drive the domestic investment behavior in the desired direction.

While we mainly looked at implications for policy, one more application of our results is the relevance for companies. Companies, even MNCs care about the investment climate of the countries they operate in, especially their home countries. An industry with high fixed capital and R&D spending can mean more infrastructure and technological development as well as more growth potential in that industry. It can also force the human resource in that industry to skill up, all of which are desirable for a company operating in that industry in that country. So, companies have a huge interest in promoting the investment climate in an industry, and can use their investments decisions to influence this. Thus, in this context, our results are valuable in helping managers determine their desired outward levels in line with the investment climate they want to promote in their home country. A company can choose to either increase or decrease its outward FDI spending accordingly. Thus, our research has strong implications for both policymakers as well as companies.

Personally, I believe that in today's world characterized by higher degree of internationalisation, my results add a strong incentive for governments to more actively keep an eye on the strategic and investment decisions of businesses, especially MNCs. The US and much of the capitalistic world has believed in the superiority of the free market, that the market is fair and self-regulating and will bring in the greatest benefits to all by promoting profits and wealth. While in the past, increased profits might have been adequate motive for businesses to take decisions that eventually benefit all, in an increasingly interconnected world, national boundaries are becoming redundant to MNCs. Thus, business decisions while maximizing shareholder profits have resulted an increasingly inequal and polarized world. These neo-liberal policies followed for the last 40 years have resulted in staggering income inequality, where the top 1% of the people in the US earn over 39 times more income than bottom 90 percent. The gap between the rich and the poor is only increasing, and with automation and globalisation, the low wage earners are being left behind.

The foremost way to ensure employment for these people at the bottom of the pyramid is through real investments in infrastructure and production capabilities. If FDI is taking money away that could be used to create real economic growth and jobs, then it no longer makes sense to let the market continue to have the reins to social welfare. While not all protectionism is good, and global interaction and inclusion is bringing in more value, some level of direction as to where the money is being invested in is crucial for ensuring equal growth and income for all. While investments in fixed assets are important in the short term for generating jobs and for the economic security of those at the bottom of the pyramid, in the long run, it's important to invest in innovation and technology. This is where the importance of promoting domestic R&D investment comes in. Along with improving labour productivity, this can increase the standard of living for everyone. It will also help low wage earners upskill, which would greatly eliminate fears of automation and immigrants taking over jobs. Thus, instead of focusing on protectionist measures against labour inflows, governments should instead focus on regulatory policies aimed at promoting domestic investment in fixed capital as well as R&D.

7.4. Limitations and future research

While I looked at the value of our research, it has a few limitations as well. The main problem faced was the limited amount of data available, especially for all the entities used for the regressions. Because a lot of data was missing for a lot of years, the sample size was hugely reduced. As discussed, this could have affected the reliability of our results. Future works can try to rectify this by searching for data from other sources. Time limitations did not enable this. Next, I have used value added as the scaling variable. One can also use production/gross output instead and verify the results. While I looked at heterogeneities among industry groups based on R&D intensity, there can be other types of classifications based on FDI behavior, size, number of employees, *et cetera.* Also, I had discussed about how different motives for FDI can have different effects. While I have tried to account for that is developing our hypotheses, one more possible future research is to study the different effects of efficiency-seeking and market-seeking FDI. One can even use the employee wages as a proxy for the average skill levels of the company, and classify accordingly. One more useful addition to our theoretical model would have been the addition of debt-equity ratios or other financing constraints, which would be in line with my primary theory. But since I did not have data for debt-equity ratios and other financial data, I could not do that. Future research can try to integrate the existing data with financial data if available and perform that research.

If I were to repeat my research again, I would mainly make some changes in the way I approached and executed the thesis. Initially I spent a lot of time reading a lot of literature about many aspects of FDI, for example the effects on host country investments, effects on domestic trade, employment, exports, *et cetera*. While this helped gain a lot of foundational knowledge related to the subject and helped understand the magnitude of the knowledge gap, it was not otherwise directly relevant or useful for my research. I would have liked to optimise the time spent on my literature review. In the analysis, I would have liked to remove my outliers and repeat my regressions to compare the results I get. This would I could have estimated how much effect the outliers actually had on the results. Also, I spent a lot of time trying to repeat my regressions using different panel data estimation methods (random effects, first difference) to identify the best fit for my data. For every method, I spent time understanding the methodology, then simulating it and getting stuck with issues. I was making it too complex. Just performing the standard statistical tests available to check whether my method was well-suited would have been the straight-forward way. One more mistake I did was not checking the units of the data carefully. While some of the data were in USD, some were in millions of USD. Initially without converting them all to USD, I went ahead with the regressions, and wasted time trying to make sense of the unbelievable results I had got. While these are the main changes I would make, I am happy with the rest of how I proceeded with the research.

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