Multiproduct Firms and Outward Foreign Direct Investment

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Abstract

This paper investigates the relationship between internationalisation of firms and the firm's domestic product scope. The investigation is applied to Indian firms. Thus, the insights of a new dataset is added to the growing (but still infant) literature in this field. Indian firms that invest abroad are the most productive firms in the home country. The most productive firms in the home country have the greatest scope of products. This paper shows that outward investor firms have the greatest range of products in the home country. As a result of engaging in OFDI, these outward investor firms consolidate their product range and their product scope shrinks.

Contents

1 Introduction

In "new" international trade, investigations into the reallocation of scarce resources are focused on the inter-firm resource exchange that occurs between entering and exiting firms. Entry and exit occurs as a result of the productivity differences across these firms and symmetric changes in the fixed costs of doing business abroad. However, resource reallocations need not only occur across firms, they can also occur within a firm.

The central question that this paper seeks to answer is what effect, if any, does an engagement in outward foreign direct investment (OFDI) have on the investing firm's domestic product scope. The product scope of a firm is the number of products that the firm produces. In response to a shock, a firm can reallocate it's own resources from unproductive product lines to more productive product lines. Thus, the adding and dropping of products (product churning) within a firm is akin to the mechanism of the entering and exiting of firms in the market. This paper seeks to determine the relationship between these internal efficiency adjustments, namely product churning, and the OFDI.

The study of the internal dynamics of resource reallocation is relatively new and, in the area of international trade, the focus has been on the effects of a decrease in the fixed cost of exporting. However, in this paper, the focus is placed on overseas investments and the fixed cost of overseas investment. There are a variety of different avenues available to an internationalising firm by which it may access the foreign market. Thus, globalisation can affect the firm's internal resource reallocation through different avenues.

The internationalising firm can export its products abroad, it can locate its production facility abroad and supply the foreign market from within the foreign market, or it can issue licenses to other firms in the foreign market to produce those products in the foreign market (Helpman et al., 2004). In this work, the focus will be on the substitutability of OFDI and exports, or the proximity-concentration trade-off.

This paper studies the nexus of the theories of the proximity-concentration trade-off and product churning with a focus on India, as a developing country. India experienced a rapid expansion in OFDI in a very short space of time, from the late 1990s to the present day (see figure 1). It is one of the largest sources of foreign direct investment (FDI) in the developing world (UNCTAD, 2013). In addition, there is a rich pool of firm-level product and financial data on Indian firms. The analysis of the changes in product scope is done using a panel dataset, constructed for this purpose by the author, that contains detailed firm-level data of Indian manufacturing firms over the period 2005 to 2011 and firm-level overseas investment data over the period 2007 to 2011.

To analyse these firms, this paper will draw on theory of multi-product firms and product switching developed by Bernard, Redding and Schott (2010, 2011) and on the theory of the proximity-concentration trade-off, which has a longer history. Using these strands of "new" trade theory, a story is developed about the expected relationship between OFDI and product scope. The story culminates with the theory developed by Stephen Yeaple (2013) that models the relationship more precisely. This paper analyses the productivity implications of engaging in OFDI. The theoretical prediction in Yeaple's (2013) model, and the expectation in this work, is that an increase in OFDI from a firm results in a decrease in the firm's product scope.

The newly constructed dataset shows that firms that engage in OFDI are the firms that have

the highest total factor productivity (TFP). Furthermore, the firms that produce the greatest number of products are the firms with the highest TFP. A decrease in the fixed costs of OFDI faced by a firm is related to a decrease in the number of products produced by the firm.

The rest of the paper is laid out as follows. Section 2 describes the evolution of Indian OFDI and how this makes it uniquely placed in answering the central question of this paper. Section 3 looks back at some of the early literature on the motives of OFDI and applies it to the case of India. Section 4 uses "new" trade theory in both the areas of OFDI and product scope to create a coherent picture of the types of firms that engage in OFDI, their expected product scope relative to others, the expected changes in product scope in response to OFDI and changes in the OFDI of these firms. Section 5 describes the data in more detail. Section 6 explains the estimation procedure, and reports and discusses the findings that have been found to support the testable hypotheses of section 4. Section 7 concludes.

2 Background

2.1 The Turning Point

Prior to the mid-1990s, there had been little to no incidence of OFDI from India. Indian firms invested around US$32million, US$87million and US$152million in the 1960s, 1970s and 1980s respectively (Khan, 2012). However, it is clear from figure 1, which illustrates the volume of OFDI from India over time, that the late 1990s marked a turning point for Indian OFDI. The investment that has occurred since the 1990s dwarfs that of the earlier periods. In the 2010-2011 period alone, the value of OFDI reached US$16843.37million, which is more than sixty times the total OFDI during the entire period 1960-1989.

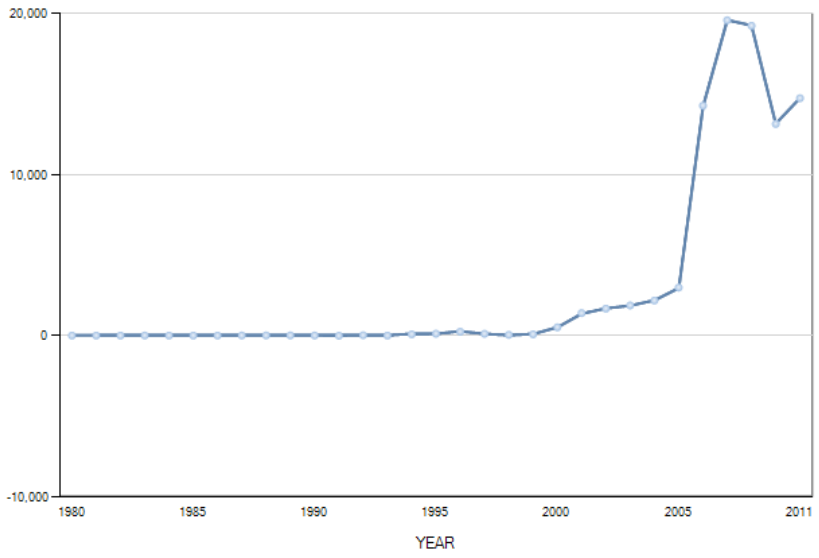

Figure 1: Foreign Direct Investment Outflow (in US$millions) from India
Source: UNCTAD (2013) FDI Database

The first stirrings of Indian multinational overseas activity can be traced back to the early 1960s.

Young versions of the now large conglomerates like the Tata Group and the Birla Group were the first outward investors (Sauvant et al., 2010). The OFDI in the decades prior to 1990 mostly originated from the manufacturing sector and the recipient nations were predominantly other developing countries, particularly Sri Lanka and countries in Africa. These initial investments were motivated by a need to escape a restrictive growth environment in India (Sauvant et al., 2010).

The post-1990 wave of OFDI is dominated by the manufacturing and service sectors and the recipients have, for the most part, been primarily developed economies (Khan, 2012). India undertook widespread policy reforms during the 1990s. India's industrial licensing system (License Raj), which required the approval of sometimes up to 80 different government agencies and restricted investment both domestically and internationally, was systematically dismantled from 1991 (Khan, 2012). This formed part of the International Monetary Fund (IMF) bailout agreement, which included trade reforms, privatisation and increased competition (Sauvant et al., 2010).

The Foreign Exchange Regulation Act (FERA), which prohibited all transactions except those permitted by the Reserve Bank of India (RBI), was only repealed in 1998, but it had been loosened slightly in 1992 to comply with imposed reforms. The RBI allowed for automatic approval of investments less than a specified cutoff point (see table 1). The cut off restriction was gradually relaxed over time (see table 1).

Table 1: Cut offs for automatic approval of investments (Khan, 2012)

Date	Cut off
1992	US$2million
1995	US$15million
2001	US$50million
2003	US$100million
2004	100% of net worth
2005	200% of net worth
2007, June	300% of net worth
2007, September	400% of net worth

An explanation of the explosion in OFDI and the pressure to loosen OFDI policy lies with the firm internationalisation decision and the political and economic environment of India at the time. This evolving environment and the resultant multinational firms that developed within it, will be discussed in section 2.2.

2.2 The Growth of Indian Multinationals

The early 1990s was a turbulent time for the Indian economy. The protectionist License Raj facilitated the development of large family-owned corporations. However, the overly bureaucratic environment became too stifling for growth prospects to remain robust (Sauvant et al, 2010). Early OFDI by these large corporations was partially motivated by the need to escape the restrictive legislation (Khan, 2012).

Until 1990, India had a fixed exchange regime; the Rupee was pegged to a basket of currencies (Dua et al, 2010). Following the rising oil price in the wake of the Gulf war, the fiscal

and trade deficit expanded. Investor confidence slumped after the sequential assassinations of two prime ministers (McCartney, 2010). IThe Rupee rapidly depreciated and India's foreign exchange reserves plummeted. By July 1991, India only had enough exchange reserves to finance three weeks worth of imports (McCartney, 2010).

The interim Indian government secured a bailout from the IMF using India's gold reserves as collateral. This helped carry the country through the crisis (McCartney, 2010). The swearing in of the new Prime Minister, Narasimha Rao, and appointment of the new finance minister, Manmohan Singh, catalysed extensive policy reforms by the new conservative government as part of the IMF loan agreement (McCartney, 2010).

These significant reforms created a more favourable environment for global expansion. The large corporations that had once benefitted from a restrictive environment were now able to benefit from a more open policy environment by leveraging off their size and market share in India to expand their market share abroad (Khan, 2012). Furthermore, smaller corporations were given more room to expand in the new policy regime. However, international transactions continued to be dominated by the larger corporations producing multiple products on the international market place (Sauvant et al., 2010).

The increasing importance of Indian multinationals in the international market makes them a very interesting case for evaluating the impact of outward investment on firm product scope. It may seem that standard theory cannot explain the unique transformation of Indian outward direct investment. However, the standard assumption in economics underlying a firm's decision-making is profit maximisation. Thus, this paper assumes that the impetus behind the decision to invest abroad is an internal decision by the firm to enhance profit potential. The profit motive can operate through different avenues: revenue boosting, cost reducing, or efficiency improving. The following section will review the early literature on the multinational corporation, which best describes the internal strategic decision-making of the internationalising firm.

3 Literature Review: Early Theories

3.1 Motives to Invest Abroad

The corporate strategy literature was the first to deal with the internationalising activity of firms through cross-border investments. The literature highlights four broad motives to invest abroad: the resource-seeking motive, the market-seeking motive, the efficiency-seeking motive, and the strategic asset-seeking motive (Behrman, 1972; Dunning et al., 2008). These motives arise when investing abroad becomes a more attractive option that outsourcing, importing, and exporting.

Following Dunning and Lundan (2008), the resource seeking motive arises from the possibility of obtaining "particular and specific resources" that the firm is either incapable of obtaining at home or can obtain at a lower real cost in a different country. These resources can either be natural resources, or unskilled and skilled labour (Franco et al., 2010).

Market-seeking OFDI is the establishment of a production facility in a foreign market either to supply that market or some other market that is more easily accessible from the OFDI destination. There are two factors that could possibly lead to this kind of investment. First, the goods or services are difficult to trade from the home country. Second, there could be a lack of adequate patent protection in the home country. This produces a trade-off between exports and

OFDI.

The third motive, efficiency seeking, optimises profit by taking advantage of the differences in product and factor prices in different countries; either because it is cheaper, or to diversify risk. Diversification that spreads risk and arbitrages on factor prices is known as global sourcing. If the strategic assets of the investing firm are significant and the investment is motivated by the above three motives, then the preferred method of engaging in OFDI would be through greenfield investments. A greenfield investment is the creation of a subsidiary from scratch instead of buying an existing firm in the country. The latter is classified as a merger and acquisition (M&A).

Strategic asset-seeking OFDI targets non-marketable assets that cannot be acquired through normal market transactions. They can only be used inside the foreign country. A firm will typically acquire these assets by taking over an existing firm (M&A) or by acquiring that firm's assets. Either they are composed of agglomeration economies or the asset being sought out could be a sticky resource that is a characteristic of a specific firm (e.g. organisation principles). To capitalise on the sticky resource, these are usually joint ventures.

Section 3.2 outlines the framework proposed by Dunning (1980) and the later augmentation by the same author (Dunning et al., 1981), both of which attempt to explain OFDI in terms of these motives. An alternative suggestion, the latecomer theory (Matthews, 2006), is also explained in terms of these motives, but within the context of a developing country.

3.2 The Initial Framework

In 1980, Dunning developed the eclectic paradigm or ownership-location-internalization (OLI) framework from the corporate strategy literature. To engage in OFDI, three conditions have to be met. First, the firm must have a strong *ownership* advantage. The firm must have some competitive advantage over other firms in the same industry. Some (Helpman et al., 2004) prefer to refer to this as an index for firm productivity.

Secondly, the recipient country must have stronger *location* advantages than the home country. Thus, the firm must find it profitable to locate the production process there rather than at home. In terms of the motives, there must be an attractor for that location. These may include untapped markets, resources, lower factor prices, attractor firms ripe for a buyout, or a combination of all of these attractors.

Thirdly, the firm must have a strong *internalization* advantage. High trade costs or high costs of enforcing contracts could incentivise the firm to produce the goods themselves, rather than exporting, or licensing the rights to produce to another firm already located in the host country.

This framework cannot explain why some of the firms from developing countries do invest abroad, but do not possess ownership advantages. The model treats country-specific anomalies as exogenous and considers only the investment decision of the firm in isolation. It fails to acknowledge that the firm's investment decision could be intimately related to the home country environment[1].

Dunning recognised these shortcomings. Hence, he postulated that the country-specific anomalies were not country-specific *per se*, but development-specific. Thus, the investment development

[1] "Environment" encompasses the institutional environment including, but not limited to, capital markets, regulation and industrial structure

path (IDP) theory was proposed as an alternative to the OLI framework. IDP incorporated the country's stage of development into the conventional OLI framework. Thus, the firm's investment decision adjusts depending on the country's stage of development.

There were five stages of development classified by Dunning (1981). They are classified according to the balance and volume of inward and outward investment. The first is described as the plight of most of the least developed countries. In these countries there will be little to no investment, neither inward nor outward. The little investment that does take place is inward foreign direct investment (IFDI) and is used mainly to exploit resource advantages. At this stage, the role of government is merely to provide basic infrastructure and to improve human capital through education.

A country in the second stage of development sees rising inward investment, but still insignificant outward investment. At this stage, the normal form of government intervention is to develop domestic industries through trade barriers and subsidies. The location advantages of the home country are more apparent in the second stage than the first. This attracts investment from abroad. There are four consequences of the intervention. The ownership advantages in the home country improves, the government intervention raises the internalisation advantages of the domestic firms, development improves, and outward investment emerges, rising at the same rate as inward investment.

The third stage of development is characterised by a fall in the growth of inward investment. The domestic firms have stronger ownership advantages. The international exposure of domestic firms through second stage outward investment leads to strategic asset upgrading in the domestic firms. There is likely to be a strong surge in outward investment due to the new ownership advantages. The volume of outward investment converges on that of inward investment. Any government intervention at this stage is micro managing at a sector level. This promotes inward investment in sectors where there are little domestic ownership advantages and promotes outward investment where there are few domestic location advantages.

The fourth stage is characterised by outward investment outstripping inward investment in terms of stock and growth. Created assets are now, almost exclusively, the source of any location advantages of the domestic economy. The ownership advantages are more likely to be related to minimising transaction costs than on the internal public goods (intangible assets). The role of government becomes that of a facilitator, improving the efficiency of markets and removing distortions.

At the fifth stage of development, the dominance of OFDI or IFDI fluctuates but the volume of both will increase. The internalisation advantages of multinationals become more pronounced as firms become more efficient; organizational costs fall below market transaction costs. As ownership advantages are augmented by firm efficiency, they become more dependent on efficient exploitation of strategic assets.

To arbitrage against the different location advantages, multinationals relocate different functions. Thus, their behaviour is reminiscent of "mini-markets". Due to the location advantages of highly developed economies and other five-stagers who are engaging in similar arbitrage investment, IFDI rises in countries in the lower stages of development.

The IDP goes some way to explaining how in development stage two firms lacking significant

ownership advantages can engage in OFDI if government provides incentives for internalisation. Both the eclectic paradigm and the IDP predict a gradual rise in OFDI in India. However, neither theory can explain the rapid rate of OFDI growth in India.

The latecomer theory (Matthew, 2006) addresses this shortcoming. The theory suggests that a new breed of multinational has emerged. They are more capable of exploiting the myriad opportunities offered by globalisation. The lack of ownership advantages that would ordinarily constrain OFDI in the earlier stages of development is overcome through the acquisition of complementary assets.

Complementary assets are defined as those assets necessary to exploit the knowledge generated by innovation. Firms obtain these assets by developing relationships with established multinationals in a combination of three ways: by setting up a joint venture (JV), by becoming a supplier to them, or buying complementary assets on the open market. These opportunities were not accessible to the early multinationals.

In addition to complementary assets, the latecomer theory suggests that the new breed of multinational is not constrained by the traditional organisational structures of Western multinationals (Matthew, 2006). They can innovate. These innovations are called linkage, leverage and learning (Matthew, 2006). The latecomer firm obtains strategic assets through alliances and joint ventures (linkage) and are able to efficiently diffuse these assets internally (leverage) and build upon them to create new advantages (learning). This asset augmenting capability, coupled with a low cost base, has allowed the latecomer firm to expand its capabilities at a much lower cost and faster rate than the early multinationals were capable of. Thus, the internationalisation of these firms could occur faster.

Some argue that the differences among developing country MNEs themselves may be more significant than the difference between developing and developed country MNEs. If so, generalizations about developing countries would be a mistake. The reason for this is that the national institutional structure of the home country has a significant impact on corporate strategy.

It is tempting to fall into the trap of weaving ever more specialised and complex ideas about corporate strategy to explain the phenomenon of OFDI. However, while this literature is useful in describing the characteristics of investing firms they are either too simple to explain the Indian case, or they are too descriptive to be useful in a research framework.

The primary motive of a firm is the profit motive. The overarching motive of foreign direct investment is to maximise future expected profits. Future expected profits are affected by various different factors in terms of how they impact a firm's cost and future revenue streams. Thus, when the aim of OFDI is market seeking, the firm is attempting to expand future revenue streams.

The ownership and internalization features of the IDP framework are easily connected to conventional economic theory in terms of lowering transaction costs and scale economies. The location feature does link into factor price arbitrage and the expansion of the available resources. However, the framework does not explain why some firms invest abroad and others do not in a coherent model. Furthermore, there is no recourse in this literature for the incorporation of a multiproduct firm, except in a purely descriptive manner. The corporate strategy insights outlined in this section will not be tested in this paper. The limitation of the framework in providing testable hypotheses is addressed by applying the "micro-foundations" of "new" trade theory to the ideas

of corporate strategy. The "new" trade theory contributions are outlined and elaborated on in the next section.

4 Literature Review: The Simple Model

The aim of this paper is to investigate the product turnover behaviour of Indian firms that engage in outward foreign direct investment (OFDI). The model that would ideally be used is one that is able to predict the relationship between engaging in OFDI and the product scope of a firm. There are models that describe the decision-making process of a firm when it comes to choosing between exports and OFDI (also known as the proximity-concentration trade-off). Furthermore, there are models that describe the implications of engaging in exports for the firm's product mix.

In the proximity-concentration trade-off theory and the theory of multiproduct firm product churning, both areas of "new" trade theory; the focus has mainly been leveled at developed countries. There are a few exceptions in the area of multiproduct firm product churning. The Arkolakis and Muendler study (2011) investigates the changes in the product scope of Brazilian firms. Ma, Tang, and Zhang (2014) investigated product churning in Chinese firms that have engaged in exports. They compare them to firms in countries that do not export, but have similar characteristics. Considering OFDI as a substitute to exports, Bhattacharya, Patnaik and Shah (2012) have studied chemical and software industries in India. Foster-McGregor, Isaksson and Kaulich (2013) analysed sub-Saharan African firms in the manufacturing and services sectors.

The proximity-concentration trade-off predicts that only the most productive firms can engage in OFDI (Helpman, 2004). The multi-product firm and product switching literature predicts that the most productive firms have the broadest product scope (Bernard et al, 2010). Furthermore, the literature predicts that a positive productivity shock in a firm (specifically due to trade liberalization in the existing literature) results in a decrease in the product scope of the firm (Bernard et al., 2011).

This section navigates a short route from the proximity-concentration trade-off models to the multiproduct firm models. The existing product scope models implicitly make the assumption that the decision between export and OFDI has already been made and that the decision was "export". It is possible to track the impact of OFDI on product scope by altering this initial decision and carrying through the implications from one model to the next. The combination of these types of models allows firms to produce multiple products in multiple locations for multiple markets (Yeaple, 2013).

New theories of OFDI incorporate the later advances of trade theory into the traditional models of corporate strategy. They include ideas such as imperfect competition and firm heterogeneity. The latter is first done implicitly (Brainard, 1997). Later, in Helpman, Melitz and Yeaple (2004), these ideas are incorporated explicitly in terms of productivity in the tradition of Melitz (2003). Finally, the theory developed by Yeaple (2013) includes the multi-product element to the theories of OFDI. The limitation of these models is that they are unable to account for all the motives of OFDI.

When there is an exogenous trade liberalisation shock, firm heterogeneity causes a reallocation of resources from the low productivity firms to the high productivity firms. This increases the efficiency of the factors of production. However, this is not the only reallocation that can

occur. There can also be an intra-firm reallocation of resources, from low productivity products to high productivity products. Firms can drop low productivity products in favour of high productivity products.

In this study, the motive to export is linked back to the strategic decision between OFDI and exports in the proximity-concentration trade-off. The decision between the two methods of accessing the foreign market will be different across different products, differing according to the ability of each to generate profits. Any change in exports or investment will affect this decision across products and the reallocation of resources across these products, thereby determining which products get dropped or added. The question that this paper answers is how a change in international investment affects this product churning. The theory of monopolistic competition is the basis of the models used.

4.1 Monopolistic Competition

The new trade theory builds on a monopolistic competition framework with product differentiation. It illustrates the internalization advantage for firms due to increasing returns to scale (Brainard, 1997). Krugman (1983) highlighted the necessity of imperfect competition in models of OFDI as a crucial aspect of the multinational firm.

There are three basic features of new trade theory. The consumer problem incorporates a taste for many differentiated products, there is a fixed component of total production costs and thus declining average costs, and the structure of the market is characterised by monopolistic competition with firms setting marginal revenue to equal marginal costs and free entry resulting in zero profits (Krugman, 1979). The firms are identical and only differ implicitly in the product that they produce.

To characterise these firms as multinationals, Krugman (1979) redefined the fixed production cost as a headquarter service cost. Thus, expanding production abroad results in a decline in average costs in the same way that expanding production at home would. The impetus in this model, for expanding abroad instead of intensifying home production and exporting instead, would be to exploit differences in production costs (Krugman, 1979).

The location advantage, in this model, stems from differences in factor costs in the destination country. Thus, it would not predict a situation where there are high volumes of both IFDI and OFDI in a specific country. This makes it a poor model for the Indian situation, which was described in the World Investment Report of 2013 to be the "dominant recipient of FDI inflows to South Asia in 2012" and the "region's largest FDI source." The next section describes a model developed by Brainard (1997) that is not dependent on factor price differentials as a motive for OFDI, yet still incorporates the advantages of the monopolistic competition model.

4.2 The Proximity-Concentration Trade-off

The Brainard (1997) model differs from the earlier model by explicitly introducing a trade-off between economies of scale advantages and proximity advantages. The internationally competitive firm has multiple options for gaining access to foreign markets. The export option has the advantage of concentrating production in one plant, resulting in scale economies. The horizontal FDI option has the advantage of gaining proximity to the foreign market by setting up a production facility in that market. The trade-off occurs because concentration is lost once production

is spread over multiple production facilities and close proximity is lost when production is concentrated in the home facility.

Following Krugman (1983), scale economies at the headquarter level would not be lost in spreading production facilities abroad. Thus, if scale economies are larger at the headquarter level relative to facility level, then proximity may be favoured over concentration. The trade-off between horizontal overseas investments versus exports will now arise due to variable transportation costs and tariff barriers (Brainard, 1997). If these costs are prohibitive, then producing abroad may be cheaper. However, locating the production process abroad will also incur the fixed cost of opening the additional plant. Thus, by gaining proximity to the end consumer, trade costs are eliminated, but by exporting instead of gaining proximity, the fixed costs are eliminated. When the benefit of eliminating transportation costs (by incurring the fixed cost of opening a fully functional affiliate abroad) is greater than zero (Helpman et al, 2004), then the firm will choose to invest abroad.

The imposition of a restriction on outward investment distorts the trade-off. The distortion can be modeled as an additional fixed cost to investing abroad. Since it inflates the cost of proximity, a policy environment that is unfriendly towards outward investment would bias the trade-off in favour of concentration. A loosening of these restrictions would increase the attractiveness of proximity and the outward investment to export ratio of the country should rise. This explains Indian outward investment growth. A reduction in trade barriers would increase the attractiveness of concentration; and a rise in trade barriers would favour proximity.

The Brainard (1997) model assumes that the firms are symmetric in their response to the proximity-concentration trade-off. Like the traditional models of monopolistic competition on which it is based, the firm heterogeneity is implied but not explicitly incorporated into the theory. However, a major stylised fact apparent from analyzing the data is that firms differ in terms of size and productivity (Melitz, 2003).

4.3 Firm Heterogeneity

The incorporation of firm heterogeneity in new trade models was a necessary consequence of the inability of the gravity-style models to account for the differences between firms that do export and firms that do not export. First, it was shown that exporters are not only different from non-exporters, but they are also very special. The most noteworthy aspect of their uniqueness is the fact that they are more productive on average than non-exporters (Bernard et al, 2003). Secondly, subsequent to a trade liberalization shock, the least productive firms will exit the market, which increases the overall productivity of the industry (Bernard et al, 1999; Pavcnik, 2002). Similarly, OFDI firms are different from non-OFDI firms in terms of productivity (Helpman et al., 2004). Thus, it is necessary to incorporate firm heterogeneity into the analysis.

Melitz (2003) developed a trade framework incorporating monopolistic competition and increasing returns with heterogenous firms. The firms are heterogenous with respect to their marginal productivity of labour, which will hereupon be referred to as productivity. The productivity of the firm is not observed by the firm prior to entry and is drawn randomly from a distribution upon entry. Differences in productivity create a profitability hierarchy in the economy, where the most productive firms are the most profitable. There are two cost components added to the model: variable trade costs (transportation and tariff costs) and a fixed cost component (Melitz, 2003).

There is a fixed cost for all markets. The fixed cost has to be paid for domestic production and, once trade liberalisation occurs, to enter a foreign market through exports. There is a profitability requirement in production, which divides the industry by productivity into those that can cover the fixed cost of production with their expected future profits and those that cannot due to an insufficient level of productivity (who subsequently exit). The domestic industry is further divided along productivity lines into those that can cover the additional fixed cost of exporting with their expected future profits and those that cannot due to having a lower level of productivity than the absolute minimum required to cover the cost. The latter firms will still produce for the domestic market only. The former produce for the domestic market and service the international market through exports.

Introducing this heterogeneity to the proximity-concentration trade-off models allows the choice between exports and OFDI to differ across firms operating in the same industry (Greenaway et al, 2007). The productivity draw upon entry determines the profitability hierarchy in the industry, which establishes the difference in the choice between the exports and OFDI.

4.4 The Proximity-Concentration Trade-off with Heterogeneous Firms

Helpman et al (2004) develop an extension of the Melitz (2003) model incorporating a decision to invest abroad. Their model incorporates the proximity-concentration trade-off by incorporating additional cost components to the normal costs of production. Exports have an added variable component (attributed to tariff and transportation costs) and a fixed component (attributed to setting up distribution networks). FDI does not have an added variable component (if we assume countries are symmetric in terms of factor prices). It does have an added fixed component that is significantly larger than the export fixed component (Helpman et al, 2004); because OFDI involves setting up (and maintaining from afar) separate production facilities abroad. Thus, exporting incurs high variable costs and low fixed costs, whereas OFDI incurs low variable costs and high fixed costs (see table 2).

Table 2: Cost Trade-off of Exports and FDI

	Variable Costs	**Fixed Costs**
Exports	High	Low
FDI	Low	High

As in Melitz (2003), upon observing their productivity draw, the least productive firms do not produce. Of those that do produce, only the most productive internationalise. Of the firms that internationalise, the most productive locate their production processes abroad. The model predicts two testable relationships: exports will decrease as trade costs increase, and the export component of total sales will be smaller in industries that have high productivity dispersion (Helpman et al, 2004). These relationships will not be tested in this paper.

This paper will test the following two predictions that are also a consequence of the model: there is a clear ex-ante productivity hierarchy in any industry characterised by the firm's international activity, and changes in the fixed costs of investing and the variable costs of exporting results in an increase in OFDI. The most productive firms in the industry can cover the fixed cost

associated with maintaining multiple plants at home and abroad. Therefore, they can engage in OFDI and produce for the domestic market. The firms that are not productive enough to invest abroad (but still highly productive) can export and produce for the domestic market. The firms that are not productive enough to service the market abroad through either OFDI or exports, but are still productive enough to make non-negative profits by producing can only service the domestic market. The rest of the firms do not produce.

The productivity hierarchy is based on the assumption that exports and OFDI are substitutes. Thus, the most realistic scenario for observing this phenomenon is in the context of horizontal OFDI. A fall in the fixed cost of investing abroad is expected to cause a fall in the firm's exports and a rise in the firm's outward investment. Similarly, a rise in the variable cost of exporting is expected to have the same effect.

This model assumes that the market-seeking motive is the only motive for OFDI. The model is only useful in explaining the market seeking outflows. So, it may not be useful if outflows are predominantly attributed to the other motives. A concern may be that investments in the primary sector are predominantly resource seeking. It is expected that investment into the primary sector may contradict the conclusions of this model. The model is, therefore, not a comprehensive explanation of OFDI.

Another shortcoming of this model is that it operates in the single-product firm context and it is only in this context that exports and OFDI are substitutes. In reality, most OFDI firms also export. There needs to be some measure of complementarity in the model to induce a positive correlation between exports and OFDI within firms. A model of firms with multiple product lines does this.

The assumption of complementarity is not the only way to induce a positive correlation between aggregate firm exports and aggregate firm outward investment. Substitution can still be assumed in the case of multiple product lines, because the substitution could be occurring within product lines only. The choice between proximity and concentration is determined at the product level. A particular product line is not produced abroad and produced at home for export, therefore allowing the assumption that the two international activities are substitutes to hold. Thus, the correlation between OFDI and exports is a spurious relationship caused by the productivity draw and lack of cross-line substitution. Some product lines are produced at home for export and some product lines are produced abroad. Therefore, firms can both export and invest abroad. Multiple product lines are necessary in explaining certain empirical anomalies (Baldwin et al., 2001; Greenaway et al., 2007; Yeaple, 2013) irrespective of the assumption of complementarity.

4.5 The Multi-Product Firm

There are two main reasons for the necessity of including multiple product lines in the model. The first is the potential explanatory value that multiple product lines have for the lack of evidence for substitution between OFDI and export volumes. The second is to determine whether the intra-firm reallocation of resources occurs in response to shocks. In a single product world, the reallocation of resources occurs across firms in the form of entry and exit according to productivity. In a multi-product world, the reallocation can also occur within a firm across product lines (depending on how productive the firm is at producing each of those product lines). This implies that the incidence of export and OFDI can vary across products.

The idea of the multi-product firm is not unreasonable (particularly in an international trade framework where cross-border economic activity is predominantly undertaken by multi-product firms in various destinations). The inclusion of the multiproduct firm to explain the lack of empirical substitutability between exports and OFDI has mostly occurred on an empirical level in the literature. It has only recently been formalised by Yeaple (2013). Intra-firm reallocation of resources has been studied extensively in models for international trade.

Bernard, Redding, and Schott (2010) developed a model of endogenous product selection. Firms are heterogenous in terms of productivity. The firms observe their productivity draw upon entry, which determines firm capability across all products. The firm observes its relative capabilities in producing each specific product (Bernard et al, 2010). It decides the range of products to produce and which of those products to export. The firm incurs a fixed cost to produce; the firm incurs a fixed cost to export. Each product also has a fixed cost of production and a fixed cost for exporting. Both are common across all products.

In the steady state industrial equilibrium, there is, for each product at each level of productivity, a cutoff product capability value for domestic production and for export. The profitability of all product lines is improved with an across the board productivity premium. Therefore, the model concludes that the most productive firms are capable of sustaining the largest set of products. The fixed costs associated with maintaining multiple product lines can be covered (Bernard et al, 2010). Thus, their cutoff capability thresholds for each product production and export are lower for all product lines.

There are also firm-level cutoffs for becoming a producer and/or an exporter. The firm's productivity draw determines whether it can produce enough variable profits to cover the fixed cost of entry in the production market and the export market. Therefore, the productivity draw determines whether the firm can produce and whether it can export.

An exogenous drop in trade costs in the standard Melitz model would result in an industry-wide reallocation. The cutoff productivity would rise, so that resources could be funneled towards their most productive use. Low productivity firms would exit of the market. In the multi-product augmentation, the reallocation would occur both across and within firms. The zero-profit cutoff for firm productivity and the zero-profit product capability (for each level of productivity) cutoffs would both rise. The least productive firms exit. Surviving firms reallocate their resources towards products that they are more capable of producing and drop marginal products. Thus, the product scope of surviving firms shrinks and they experience an internal increase in productivity.

Only the most productive products of an exporting firm will be exported. In the scenario of an exogenous shock resulting in a fall in trade barriers (which is investigated in the study by Bernard et al, 2010), the product scope of all firms (both exporters and non-exporters) would diminish. Furthermore, this narrowed focus on core products is expected to improve productivity of the firms and improve the overall productivity of the industry as a whole.

The following subsection will link the existing bits of literature and outline the model developed by Yeaple (2013). The nexus of the two strands of heterogenous firm international behaviour is the role of firm productivity. It is indelibly connected with the firm's internationalisation decision and with the choice of the firm product scope.

4.6 The Proximity-concentration Trade-off with Multi-product Firms

The baseline implication of the models is that firms that are capable of investing abroad should be producing the greatest range of products, because they are the most productive firms in the home country. Firms that are capable of exporting, but not investing abroad, will have a smaller range of products than those firms capable of outward investment. Firms that can only produce for the domestic market will have the smallest range of products. The product ranges of successive types of firms will follow the productivity hierarchy of investment.

According to both models, a reduction in variable trade costs would result in an inter-firm and intra-firm reallocation of resources. The least productive firms exit. Surviving firms drop marginal products to focus on their core capabilities. The most productive firms export the products in line with their core capabilities. The firms that are capable of investing abroad still produce the greatest variety of products. They export the greatest variety of products. Thus, the hierarchy is expected to persist.

The resources and factor inputs can be purchased in the recipient market, so a reduction in the cost of investment would not necessarily require a reallocation of resources. Firms that invest abroad are not constrained by domestic resource limits. Thus, it is not clear from the existing models whether an internal reallocation would occur. However, a reduction in investment costs imply that more firms are capable of investing abroad and this will be done with their most productive products. Furthermore, firms that already invest are capable of investing more than before and to relocate the production processes of more products abroad.

To invest abroad, the firms have to be generating sufficient variable profits to cover the high fixed cost of investing. Only the most productive firms can make this investment. Thereafter, the variable profits of those products produced abroad should increase as the variable trade costs are eliminated. The variable profits of the outward investing firm should increase post-investment. This improves their ability to cover the fixed costs of producing, exporting, and investing abroad for each product line. The increase in variable profits implies that the firm is capable of sustaining a broader product scope after engaging in OFDI. However, the larger variable profits also implies that the firm is capable of relocating the production processes of more product lines abroad, implying a reduction in the domestic product scope of the firm.

The impact of investment is similar to a productivity shock in domestic production, whether for domestic consumption or export purposes. An internal productivity shock reallocates resources within the firm and across all the firms based in the home economy. The least productive firms exit. The most productive firms drop their marginal products to focus on their core competencies in order to compete with the increased productivity of the outward investors. The outward investors undergo the same internal reallocation to compete with each other. They drop their marginal products and focus on their core competencies in home production.

The Yeaple (2013) model is a slight simplification of the Bernard et al. (2011) model to incorporate the ability to produce in multiple locations. Yeaple reduces multiple locations to two identical countries. In the two locations framework, the normal production inputs - capital, labour and raw materials - are no longer constrained to that which the home country can provide. To incorporate the opportunity cost of producing a certain set of products (rather than an alternative set of products or a larger set of products) Yeaple introduces a scarce internal resource: organisational capital.

Like the Bernard et al. model (2010), there is a continuous set of products available in each country, Ω_j, each produced by an industry, normalised to the interval $[0, 1]$. Within each industry, there is a continuum of horizontally differentiated varieties (Bernard et al., 2011). The elasticity of substitution across varieties (σ) is constant and greater than one; it is assumed to be the same for all goods. The sub utility function developed by Yeaple (2013) describes the preferences across varieties within each industry and is of the Dixit-Stiglitz (1977) form.

$$Q(i) = \left[\int_{\omega\in\Omega_i} q(\omega)^{\frac{\sigma}{\sigma-1}} d\omega\right]^{\frac{\sigma-1}{\sigma}}, \quad 0 < \tfrac{\sigma}{\sigma-1} < 1 \tag{1}$$

A representative consumer in each country (since the two countries are identical) has a Cobb-Douglas utility function over all the products.

$$U = \int_0^1 lnC(i)di \tag{2}$$

Yeaple (2013) assumes there is a continuum of identical potential entrepreneurs, which is analogous to the Bernard et al. (2011) assumption of unbounded identical potential firms. There is a fixed cost of entry, ubiquitous to all Melitz-type models, equal to $f^E > 0$ units of labour. Upon entering the market, the firm obtains a blueprint for a specific variety of all the products, an endowment of organisational capital, and a cost of employing the organisational capital abroad. Each of these characteristics is drawn from ex-ante known distributions. The blueprint of firm-specific varieties for each product indirectly indicates the firm's productivity draw (Z) from the distribution $G(Z) = 1 - Z^{-\kappa}$, where $\kappa > 1$.

The endowment of organisational capital, K, and the cost of employing the organisational capital abroad, $\lambda \in [1, \bar{\lambda}]$ are drawn from the bivariate distribution H with a density function h (Yeaple, 2013). The productivity of the particular plant ($\tilde{\phi}$) is dependent on the amount of organisational capital allocated to that plant by the firm ($k_j(Z)$), as well as the firm productivity draw (Z) implied by the variety blueprint. The allocated organisational capital is exponentiated by the product level degree of control of organisational capital (Yeaple, 2013).

$$\tilde{\varphi}(k_j(Z), Z) = Z \cdot k_j(Z)^{\tilde{\theta}}, \quad \tilde{\theta} \in \left(0, \tfrac{1}{\sigma-1}\right) \tag{3}$$

The constraint on the number of different products produced is dependent on the endowment of organisational capital and on the firm's allocation choice.

$$K \geq \int_0^\infty \sum_j \lambda_j k_j(Z) dG(Z), \qquad \lambda_j = \begin{cases} \lambda & \text{if } j \text{ is foreign,} \\ 1 & \text{if } j \text{ is domestic.} \end{cases} \tag{4}$$

Once it has incurred the fixed cost of entry, the firm observes product variety blueprint, the endowment of organisational capital, and the cost of employing the organisational capital abroad. Then it decides where to produce each product for each market. Home production incurs a fixed cost, F, per product. The decision to export to the foreign country incurs an additional fixed cost, F^x, plus variable trade costs, $\tau \geq 1$, which are assumed to take the form of melting "iceberg" costs. The trade costs are transformed to a parameter (ρ) denoting the "freeness" of trade to confine the set of possible values capturing trade costs to a compact set (Baldwin et al., 2003). The parameter is a function of trade costs and the elasticity of substitution.

Alternatively, the firm can choose to locate the production of the product abroad to service the foreign market, thus circumventing the costs of exporting. Opening a foreign affiliate incurs a fixed cost, F^m. The following relationship between the costs is assumed:

$$F < \frac{F^x}{(1+\rho)^{\frac{1}{1-\theta}} - 1} < F^m, \qquad 0 < \rho \equiv \tau^{1-\sigma} < 1 \tag{5}$$

Thereafter, the firm decides how much organisational capital to allocate to each plant, thus determining the organisational capital allocated to each product produced at those plants.

The price index also takes the constant elasticity of substitution form:

$$P_l = \left[\int_{\omega \in \Omega_l} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}} \tag{6}$$

In the monopolistic competition setting, the firm will set a price (p_{jl}) for each product of productivity, Z, consisting of a constant mark-up on marginal cost. The marginal cost of the firm that locates its plant at home is the inverse of the productivity of the plant, whereas if the firm locates the plant abroad the marginal cost is inflated by the trade cost.

$$C_{jl}(Z) = \begin{cases} \frac{1}{\tilde{\varphi}(k_j(Z),Z)} & \text{if } j = l, \\ \frac{\tau}{\tilde{\varphi}(k_j(Z),Z)} & \text{if } j \neq l. \end{cases} \tag{7}$$

Thus,

$$p_{jl}(Z) = \begin{cases} \frac{\sigma}{(\sigma-1)\tilde{\varphi}(k_j(Z),Z)} & \text{if } j = l, \\ \frac{\sigma\tau}{(\sigma-1)\tilde{\varphi}(k_j(Z),Z)} & \text{if } j \neq l. \end{cases} \tag{8}$$

Given the pricing index and the cost function, and if A is defined as the level of demand in each country adjusted by the mark-up, then the profit from domestic (π^D), export (π^X), and foreign production (π^M) can be written as follows:

$$\pi^D(k_d, Z) = AZ^{\sigma-1}(k_d)^\theta - F, \tag{9}$$

$$\pi^X(k_d, Z) = (1+\rho)AZ^{\sigma-1}(k_d)^\theta - F - F^x, \tag{10}$$

$$\pi^M(k_d, Z) = AZ^{\sigma-1}((k_d)^\theta + (k_f)^\theta) - F - F^m, \tag{11}$$

$$\text{where} \qquad A \equiv \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma} EP^{\sigma-1}$$

The first problem that the domestic firm faces is to choose the optimal allocation of organisational capital to the different product lines in such a way that the total profit (which is a combination of equations 9, 10, and 11) is maximised. Suppose that all the products that the firm produces can be allocated into three sets: the set of product lines produced domestically for the domestic market only (Φ_D), the set of product lines produced domestically and exported only (Φ_X), and the set of product lines produced abroad for the foreign market only (Φ_M). All other products are not produced by the domestic firm. Further suppose that B denotes the burden from the

total network of plants of the firm for organisational capital. Then, the first-order conditions for the optimal allocation choice are:

$$k_j(K;\lambda,K) = \begin{cases} \frac{K}{B} Z^{\frac{\sigma-1}{1-\theta}} & \text{if } j = d \text{ and } Z \in \Phi_D, \\ \frac{K}{B}(1+\rho)^{\frac{1}{1-\theta}} Z^{\frac{\sigma-1}{1-\theta}} & \text{if } j = d \text{ and } Z \in \Phi_X, \\ \frac{K}{B}\lambda^{-\frac{1}{1-\theta}} Z^{\frac{\sigma-1}{1-\theta}} & \text{if } j = d \text{ and } Z \in \Phi_M \end{cases} \tag{12}$$

where $B =$

$$\int_{Z\in\Phi_D} Z^{\frac{\sigma-1}{1-\theta}} dG(Z) + \int_{Z\in\Phi_X} (1+\rho)^{\frac{1}{1-\theta}} Z^{\frac{\sigma-1}{1-\theta}} dG(Z) + \lambda^{-\frac{\theta}{1-\theta}} \int_{Z\in\Phi_M} Z^{\frac{\sigma-1}{1-\theta}} dG(Z)$$

Substituting the optimal allocation choices into the profit equations yields the following system of equations:

$$\pi^D(k_d, Z) = AK^\theta B^{-\theta} Z^{\frac{\sigma-1}{1-\theta}} - F, \tag{13}$$

$$\pi^X(k_d, Z) = AK^\theta B^{-\theta} Z^{\frac{\sigma-1}{1-\theta}} (1+\rho)^{\frac{1}{1-\theta}} - F - F^x, \tag{14}$$

$$\pi^M(k_d, Z) = AK^\theta B^{-\theta} Z^{\frac{\sigma-1}{1-\theta}} (1+\lambda^{-\frac{\theta}{1-\theta}}) - F - F^m \tag{15}$$

The optimal organisational capital allocations capture the opportunity costs of the firms. Adding another product to a firm's portfolio reduces the overall productivity of the firm as organisational capital is spread more thinly across products. The allocation is skewed in favour of those products that dominate the firm's blueprint productivity (i.e. those products that have a disproportionately higher Z in the firm blueprint), thereby enhancing the differences. Running a foreign affiliate requires less organisational capital than producing at home and exporting abroad, but maintaining a domestic headquarter and running a plant abroad requires more organsational capital than just maintaining a domestic plant (Yeaple, 2013).

As is expected in the Meltiz-type (2003) model, there exist zero-profit productivity cutoffs for each mode of operation for each product line. If the firm's productivity at producing its variety of a certain product (Z) is not greater than that product's zero-profit productivity cutoff for domestic production (z_D), then it will not produce that product. If Z is greater than z_D, but not greater than that product's zero-profit productivity cutoff for export (z_X), then the firm will produce the product for the domestic market, but not export it. Suppose the firm's product variety productivity is greater than the zero-profit productivity cutoff for export, but not the zero-profit productivity cutoff for producing abroad (z_M), then the firm will export the product, but not produce it abroad. Now suppose that there exists some firms that are endowed with "sufficient finesse" in adapting to maintaining a foreign affiliate that some subset of the products produced by that firm can be produced abroad. "Sufficient finesse" is defined as:

$$\lambda^{-\frac{\theta}{1-\theta}} > \Delta, \qquad \text{where} \qquad \Delta \equiv (1+\rho)^{\frac{1}{1-\theta}} - 1$$

If this criterion is satisfied and the firm's productivity at producing it's variety of a product is greater than the zero-profit productivity cutoff for producing abroad, then the firm will produce both domestically at the headquarters, and abroad, in an overseas subsidiary. Thus, yielding the following relationship between the cut-offs:

$$z_D > z_X > z_M$$

Using the defined characteristics of the zero-profit cut-offs and the profit equations (13, 14, 15), the firm's total profit from all modes of operation can be written as follows:

$$\pi = AK^{\theta}B(z_D, z_X, z_M)^{1-\theta} - (1 - G(z_D))F - (1 - G(z_M))F^m - (G(z_M) - G(z_X))F^x \quad (16)$$

with B redefined as $B(z_D, z_X, z_M) =$

$$\int_{z_D}^{z_X} Z^{\frac{\sigma-1}{1-\theta}} dG(Z) + (1+\rho)^{\frac{1}{1-\theta}} \int_{z_X}^{z_M} Z^{\frac{\sigma-1}{1-\theta}} dG(Z) + \left(1 + \lambda^{-\frac{\theta}{1-\theta}}\right) \int_{z_M}^{\infty} Z^{\frac{\sigma-1}{1-\theta}} dG(Z) \quad (17)$$

Maximising the profit function (16) and obtaining the first-order conditions allows for the zero-profit cut-offs to be denoted as follows:

$$z_D = \left((1-\theta)AK^{\theta}B(z_D, z_X, z_M)^{-\theta}\frac{1}{F}\right)^{-\frac{1-\theta}{\sigma-1}} \quad (18)$$

$$z_X = \left((1-\theta)AK^{\theta}B(z_D, z_X, z_M)^{-\theta}\frac{\Delta}{F^x}\right)^{-\frac{1-\theta}{\sigma-1}} \quad (19)$$

$$z_M = \left((1-\theta)AK^{\theta}B(z_D, z_X, z_M)^{-\theta}\frac{(\lambda^{-\frac{\theta}{1-\theta}} - \Delta)}{F^m - F^x}\right)^{-\frac{1-\theta}{\sigma-1}} \quad (20)$$

To solve the integration problem in equation 17, the zero-profit cut-offs (18, 19, 20) are substituted into 17. The distribution, from which the firm productivity is drawn from, is assumed to the Pareto distribution (Yeaple, 2013).

$$B(K,\lambda) = \left(\frac{a((1-\theta)AK^{\theta})^{a-1}}{a-1}\Theta(\lambda)\right)^{\frac{1}{1-\theta+a\theta}}, \qquad \text{where} \qquad a \equiv \kappa\frac{1-\theta}{\sigma-1} > 1$$

$$\text{and} \qquad \Theta(\lambda) \equiv F^{1-a} + \Delta^a(F^x)^{1-a} + (\lambda^{-\frac{\theta}{1-\theta}} - \Delta)^a(F^I)^{1-a} \quad (21)$$

Expressions 18 to 21 are used in the key analysis. Suppose there is a reduction in the fixed cost of OFDI. This is equivalent to observing a decrease in the parameter, F^m. Thus, the zero-profit cut-off for engaging in foreign production decreases. For some products, it will now be more profitable to relocate production abroad to serve the foreign market, than to export to that market. While it may be more profitable to do so, producing those products abroad requires more organisational capital on average than exporting them did. The additional organisational capital requirements are diverted from the production of marginal domestically produced goods (for both domestic consumption and export) resulting in the closure of some product plants. Therefore, it is expected that the number of products produced by the firm in the domestic market will fall.

4.7 Limitations of the Theory and Overlooked Mechanisms

This analysis is restricted to horizontal OFDI and it is based on the assumption of symmetric factor prices. Furthermore, productivity is drawn from a distribution. Thus, there is only scope

within the model to explain market-seeking OFDI. However, efficiency seeking and resource seeking OFDI also stem from a desire to cut costs. If the resource requirements are the same across all product lines, then resource-seeking investments will decrease costs in the future across all product lines produced domestically by that firm. This increases the profitability of all product lines and is expected to increase the product scope, as it will be feasible to produce products that were not profitable beforehand. If all firms engage in this form of OFDI, then across firm reallocation of factors and internal reallocation of factors result in the opposite effect. However, if the resource requirements are asymmetric across product lines, then the products that are resource heavy will have the greatest drop in costs in the future. Thus, production is expected to be concentrated in these products, and less profitable marginal products are expected to be dropped, resulting in a fall in product scope.

Factor price arbitrage (efficiency-seeking OFDI), shifts the production of those products that rely intensely on a factor that is cheaper in the destination country abroad. The first round effect is that product scope will fall. However, the result is that variable profits will increase. Domestic production may expand into a greater range of product lines, but only for the products not intensely reliant on the factor that is cheaper abroad. Thus, there will be an increase in the number of product lines that are intensive in the factor that is most abundant in the home country.

The strategic asset-seeking motive is concerned with directly improving the productivity of the firm through the ownership advantages. Assume the productivity improvement is restricted to the product lines produced in the destination country. The firm experiences an increase in variable profits after relocating processes abroad. Some product production is relocated abroad, so the product scope will decrease. Across firm reallocations creates a competitive environment and pressurises firms to make internal efficiency adjustment, so the product scope will fall further.

4.8 The Road from OFDI to Product Scope

Helpman, Melitz and Yeaple (2004) predicts that exporting firms are more productive than purely domestic firms, but OFDI firms are the most productive firms in the industry. Thus, an investigation into the productivity of firms by their mode of production is expected to reveal a clear productivity hierarchy based on their degree of commitment to outward expansion.

The Bernard, Redding, and Schott (2010) model predicts that the most productive firms can sustain more product lines. So, the number of products produced by a firm has a positive relationship with firm productivity. A simple count of the number of product lines produced by a firm should have a positive and significant relationship with the firm productivity measure.

A simple integration of the relationships derived from these papers suggests that there is a relationship between the international activity of the firm and the number of products that the firm produces. This relationship operates through the firm productivity. It is expected from the interlinked relationship that firms that engage in exports can sustain more product lines than firms that produce solely for the domestic market, but firms that engage in OFDI are capable of sustaining the greatest amount of product lines. The firm's international activity determines the product number hierarchy. Furthermore, a positive relationship between the number of products produced by firms and engaging in OFDI is expected.

Yeaple (2013) formalised the relationship between international activity and product scope. His

model suggests that a decrease in the cost of investing abroad will divert organisational capital from domestic production (geared towards domestic sales and exports), because for at least some products it is more profitable to engage in foreign production. The drain of organisational capital in domestic production drops the marginal products from the domestic plants' repertoire. Thus, there is a negative expected relationship between the number of products produced domestically by a firm and the fixed costs of investment faced by the firm.

This narrative is used to guide the empirical analysis, but before this is done, the data will be described in the next section.

5 Data

The hypotheses outlined in the previous section are tested using a newly constructed dataset that incorporates OFDI data, detailed firm-level financial information and product-level data of Indian firms. The OFDI data is published monthly by the Reserve Bank of India (RBI) and it is freely available from their website (RBI, 2012). Firm-level financial information and product data is available by subscription from the Prowess database produced by the Centre for Monitoring the Indian Economy (CMIE, 2012).

The financial year of India is at the end of March. In the paper, results from a particular year are referring to the year-end that occurs in the following March. For example, the results of 2008 are referring to the results in the financial statements published in March 2009. The OFDI data is disaggregated by month. In order to match OFDI data to the firm-level data, the OFDI data has been aggregated to a gross yearly outflow from that firm. The OFDI data remains disaggregated on the basis of other key characteristics of the OFDI, such as destination, sector and subsidiary. Several companies in the Prowess database have financials published for a different year-end from March. In order to render all the companies comparable, companies with a year end in all the months up to and including June will be assumed to be referring to the previous year's results.

5.1 OFDI Data Source

The RBI signaled the intention to publish monthly overseas direct investment statistics on its website in June 2011. The RBI defines overseas direct investment (equivalent to OFDI) as "...investment by way of contribution to the capital or subscription to the Memorandum of Association of a foreign entity or by way of purchase of existing shares of a foreign entity either by market purchase or private placement or through stock exchange, but does not include portfolio investment" (Reserve Bank of India, 2004). The declassifying process began in July 2011 and included data for the period July 2007 to May 2011. The constructed dataset used for this paper only has overseas direct investment figures from July 2007 to October 2012. Thus, the data is incomplete for the year 2007 and the year 2012.

All international transactions must be conducted through an authorised dealer (AD). ADs are authorised by the RBI to deal in foreign exchange or foreign securities. It applies to the RBI to get this role, except for financial institutions, which are already granted this role. The OFDI data made available by the RBI is collected from the reports filed by the Authorized Dealer Category-I Banks who receive the Form ODI from the Indian parties engaging in OFDI. All firms engaging in OFDI, even those firms eligible for the automatic route, are required to complete the Form ODI.

The automatic route implies that approval from the RBI is not necessary to invest abroad. Eligible investors are allowed to invest up to 400% of their net worth through the automatic route. This limit does not apply to investments of funds from the Exchange Earner's Foreign Currency (EEFC) account; or raised abroad through an American Depository Receipt (ADR), or Global Depository Receipt (GDR); or investments made by Indian parties operating in the natural resource sector. The approval route applies to investments that do not satisfy the criteria for the automatic route. To obtain permission from the RBI through the approval route, the entity completes and submits the Form ODI through an AD. It must submit an Annual Performance Review and repatriate funds owed by the entity to India. It submits the same form when using the automatic route, but only within 30 days of having already effected the transaction (Reserve Bank of India, 2004).

OFDI is classified as either joint venture (JV), or wholly-owned subsidiary (WOS). Both types of OFDI involve the formation of a "foreign entity [that is] registered or incorporated in accordance with the laws and regulations of the host country" (Reserve Bank of India, 2004). However, if the capital ownership of the entity is entirely held by Indian parties, then the OFDI is classified as a WOS. Otherwise, the OFDI is classified as a JV.

The Foreign Exchange Management Act of 1999 regulates the governance of OFDI in India. Any such investment can occur through one of two routes: the automatic route, and the approval route. However, there is a blanket ban on such investments in real estate, banking, and any activity in Pakistan.

The OFDI data is reported and published online. It consists of the following fields: the name of the investing firm, the name of the subsidiary, categorization of the subsidiary (joint venture/wholly-owned), the destination country, the major activity of the subsidiary, and the amount in US$millions committed in the form of equity, loans and guarantee issued. Monthly transaction data between the firm and it's subsidiary is reported, but the reports do not indicate when the first transaction between the firm and this subsidiary took place.

5.2 Firm-Level Financial and Product Data

The firm-level financial data has been obtained from the Prowess database, collected by the CMIE. Prowess contains firm-level data on 27548 Indian companies. The data is from the financial statements of the companies and from stock exchanges (for publicly listed companies). There is firm-level data available from the 1989-90 financial year until the most recent financial year-end, 2012-13. For the purpose of this study, the analysis will be restricted to manufacturing firms and the period 2005-06 to 2011-12 (which will be referred to as 2005-11 from here on).

There is firm-level data on 7017 firms spanning one or more years in the period 2005-11. Of those firms, 545 have been matched to the OFDI database in the period 2007-11. If there has been positive financial inflows from exporting activity, then firms are classified as an exporter in a particular year. 3592 firms engaged in exporting activity in at least one of the years in question. Of the 545 Prowess firms matched to OFDI, 489 of them also engaged in exporting activity.

The data set contains the sales data of products where each product is classified according to the product material name. This data is used to determine whether certain products were traded during a particular period and determine the number of different products that are pro-

duced by the firm. For each product material name, a unique product is counted only if the sales volume of that product is greater than zero. The Prowess database does not contain product disaggregated export data.

5.3 Descriptive Statistics of OFDI Data

Since the OFDI data for 2007 and 2012 is incomplete, the analysis is restricted to the period 2008 to 2011. It is apparent from figure 2 that 2010 was a very signigicant year for OFDI. The total OFDI more than doubled from 2009 to 2010. It dipped slightly in the following year, but not back to the levels of 2008 and 2009. This level of an increase has not been observed in the Indian OFDI data since the 2006 period after the first rounds of OFDI liberalization (Khan, 2012).

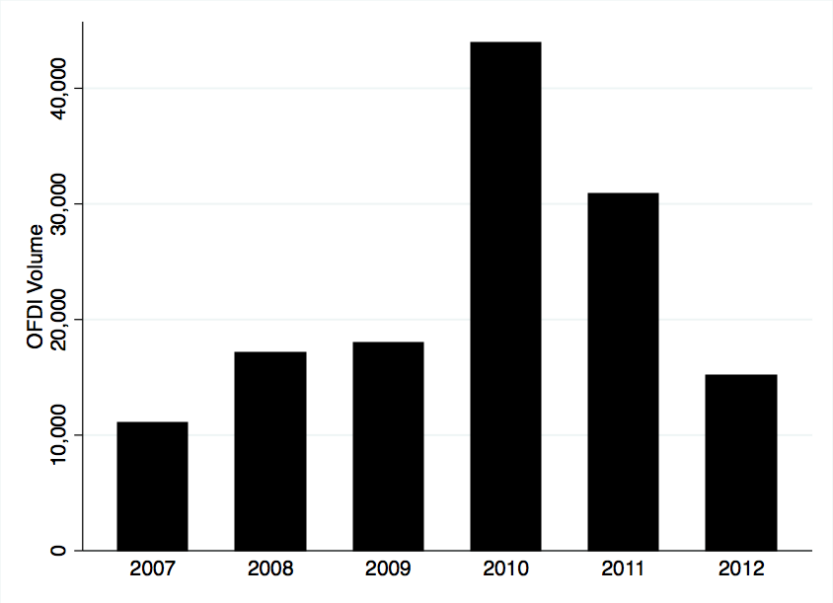

Figure 2: OFDI Values in US$millions

However, from table 3 and figure 3, it is not clear that this increase is as dramatic as was at first glance. Breaking down the total OFDI into its component parts reveals a different story. Most of the observed increase in OFDI can be attributed to a massive increase in the amount of guarantees issued in that year. Issuing a guarantee does not imply an immediate outflow of capital to the subsidiary abroad. The amount of guarantees that are actually invoked in a given year are an insubstantial fraction of the amounts issued in each year (Khan, 2012). Thus, the outflow of these commitments has not been effectively realised as of yet.

Separating out the equity and loan component of OFDI suggests that dramatic jump figure 1 can be misleading (see figure 3). The equity contributions have been somewhat erratic over the period, but the loan component has been steadily increasing in a vaguely logistic shape. Separating out the guarantee issued OFDI from total OFDI leaves the actual outflows of FDI in a particular year. Not all guarantees issued in a year will be invoked; thus these cannot be counted as actual outflows. Interestingly, the total actual outflow (see figure 4) is still higher

Table 3: Value of OFDI leaving India in US$million

Year	Equity		Loan		Guarantee Issued		Total
2007	6074.7	55%	2387.2	22%	2568.0	23%	11029.8
2008	10713.6	62%	3329.0	20%	3104.9	18%	17147.4
2009	6763.3	38%	3620.2	20%	7603.8	42%	17987.3
2010	9351.8	21%	7346.9	17%	27230.5	62%	43929.2
2011	6288.4	20%	8325.2	27%	16249.4	53%	30862.9
2012	3183.9	21%	2744.6	18%	9207.7	61%	15136.2
Total	42375.7	31%	27735.1	20%	65964.3	29%	136075.1

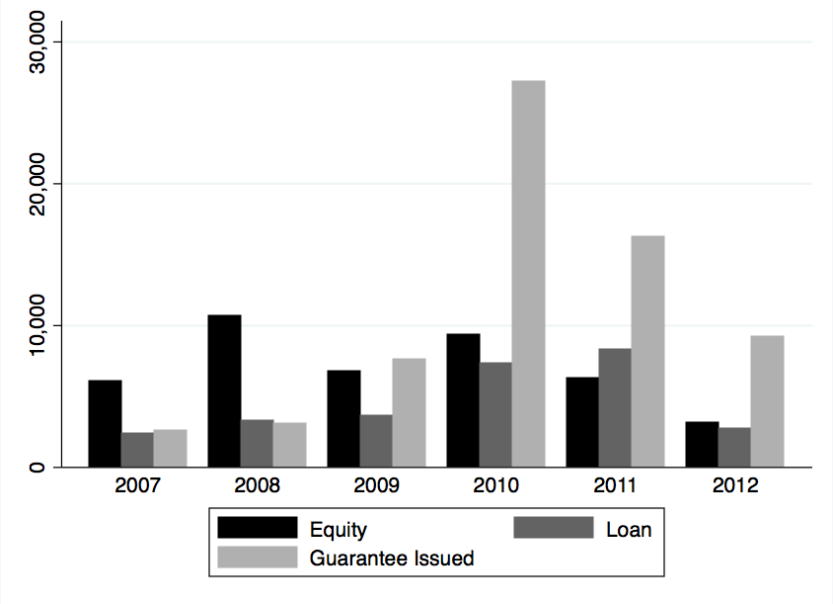

Figure 3: Decomposed OFDI Values in US$millions

in 2010 than any of the other years under consideration. The lowest actual outflow occurred in 2009. This drop could be attributed to the 2008 financial crisis (Satyanand et al, 2010).

The published statistics on OFDI are classified into two types of investment: JV and WOS. The vast majority of Indian OFDI is directed at WOS (table 3; figure 5). JV OFDI does appear to be slowly increasing in the post-crisis period. The JV share of actual OFDI increased from 12% at the heart of the crisis in 2008 to 35% in 2011. The skewed emphasis on WOS OFDI suggests that Indian parties have in the past, for the most part, preferred to engage in foreign activities alone rather than leveraging off the local firms and investors, but it appears that this tendency is beginning to diminish.

The most important dollar amount recipients of OFDI from India over the period are emerging markets[2] (see figure 6). This bias is artificially inflated by guarantee issues. Actual FDI outflows

[2] "Emerging markets" are countries that are not members of the European Union and the Organization of Economic Cooperation and Development, plus Chile, Mexico, the Republic of Korea, Turkey.

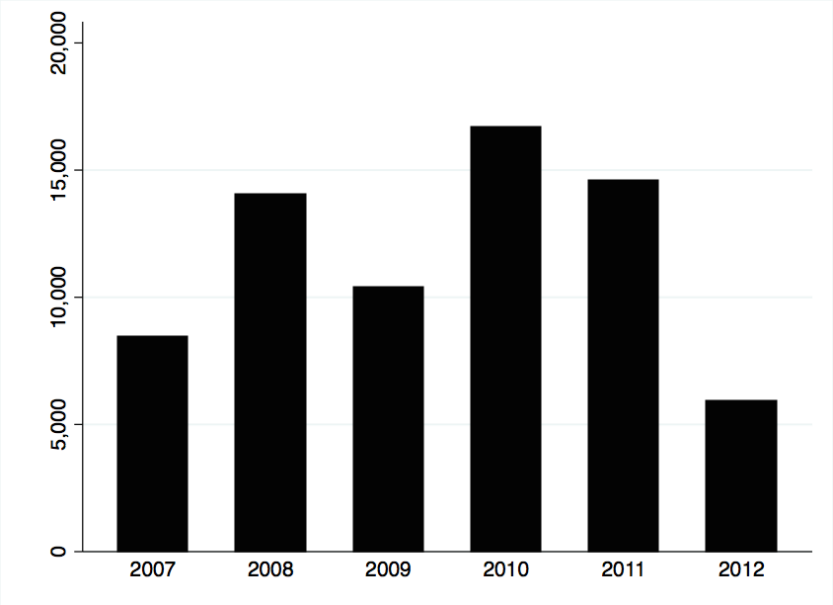

Figure 4: Actual Outflows in US$millions

Table 4: OFDI Decomposed by Type in US$millions

	Type	2007	2008	2009	2010	2011	2012
Total OFDI	JV	1638.8 (15%)	1888.9 (11%)	2079.0 (12%)	15338.4 (35%)	7666.5 (25%)	3678.9 (24%)
	WOS	9391.0 (85%)	15258.5 (89%)	15908.3 (88%)	28590.8 (65%)	23196.4 (75%)	11457.3 (76%)
Actual Outflows	JV	1268.9 (14%)	1744.5 (12%)	1423.5 (14%)	3488.9 (21%)	5049.9 (35%)	1346.7 (23%)
	WOS	7192.9 (86%)	12298.0 (88%)	8960.0 (86%)	13209.8 (79%)	9563.7 (65%)	4581.8 (77%)

from India are biased in favour of emerging markets for all the years under consideration (see table 5). The post-crisis period does not appear to exhibit any change in the shares of OFDI.

A sectoral breakdown of OFDI reveals that the manufacturing sector is the main recipient of OFDI (see figure 7). This is particularly true for 2008 and 2009 (see table 6). However, in 2010 and 2011, the dominance of manufacturing OFDI is mainly attributed to guarantees and not by actual realised outflows. The financial, insurance, real estate, and business services sector appear to be gaining prominence, particularly in terms of actual outflows.

5.4 Descriptive Statistics of Prowess Data

The Prowess data used in this study spans the period 2005-11. As previously stated, the dataset consists of financial and product level information on over 7000 firms. For the period 2005-11, there are a total of 26516 observations. Of the 26516 observations, 19545 are multiproduct firms,

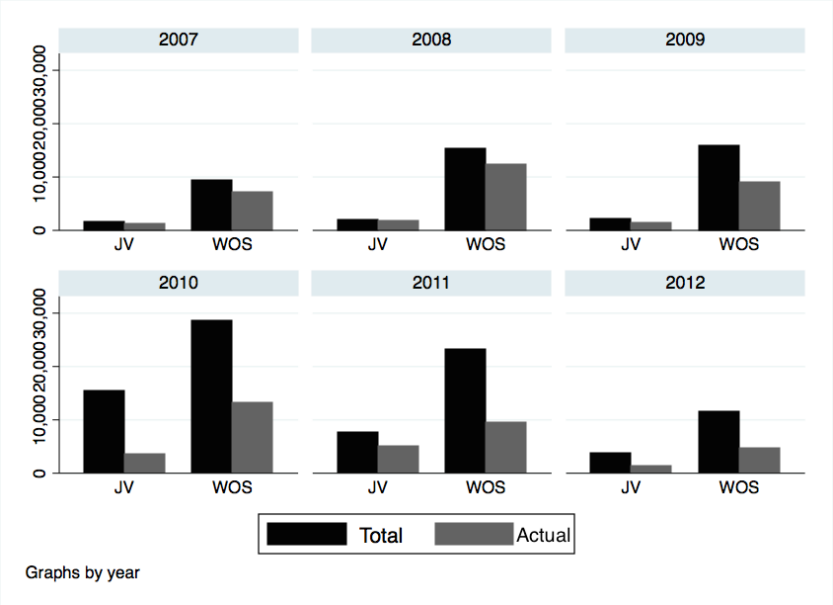

Figure 5: Type of OFDI by year in US$millions

Table 5: OFDI Decomposed by Destination in US$millions

	Destination	2007	2008	2009	2010	2011	2012
Total OFDI	Developed	4712.8 (43%)	6676.1 (39%)	5200.6 (29%)	13033.5 (30%)	10896.4 (35%)	7697.9 (51%)
	Emerging	6317.1 (57%)	10471.3 (61%)	12786.7 (71%)	30895.7 (70%)	19966.5 (65%)	7438.3 (49%)
Actual Outflows	Developed	3186.8 (38%)	5604.8 (40%)	3315.2 (32%)	4753.5 (28%)	4327.3 (30%)	2465.5 (42%)
	Emerging	5275.0 (62%)	8437.8 (60%)	7068.3 (68%)	11945.2 (72%)	10286.2 (70%)	3463.0 (58%)

15309 are exporters, and 2773 are outward investors (see table 6).
The mean of sales of multiproduct exporters is higher overall than the mean sales of all firms. The same can be said of exporters and outward investors, to an even greater degree. Outward investors are much larger in terms of sales than all other types of firms.

This observation is robust to disaggregation over time. OFDI firms are larger on average in terms of sales values than any other type of firm. Exporters are larger than multiproduct firms. Multiproduct firms are larger than the average firm. Average sales for all types of firms fell in 2008 (probably because of the financial crisis) but sales recovered quickly in the period after.

An alternative measure of size is number of employees employed by the firms. In this paper, the measure will only be used descriptively, because the measure is severely underreported (22239 missing). The size hierarchy established by the firm sales holds for the employee measure of size. Over the whole period, multiproduct firms, exporters and outward investors are larger than the

Table 6: OFDI Decomposed by Sector in US$millions

Major Activity		2007	2008	2009	2010	2011	2012
OFDI	Agriculture, Mining, Hunting, Forestry & Fishing	607.5	591.2	868.1	2593.0	2767.1	302.4
	Community, Social and Personal Services	236.3	459.6	354.8	730.2	461.1	763.6
	Construction	705.7	409.6	947.3	848.3	3362.2	1406.6
	Electricity, Gas and Water	29.1	125.3	814.1	172.4	316.5	104.3
	Financial, Insurance, Real Estate & Business Services	2469.3	3908.3	2893.3	7068.4	6083.6	3063.6
	Manufacturing	4137.0	9048.1	7250.2	14732.0	9720.4	5065.0
	Miscellaneous	161.7	353.5	110.6	735.5	161.6	165.7
	Transport, Storage and Communication Services	1143.1	1005.9	3027.6	13905.3	4470.9	2778.7
	Wholesale, Retail trade, Restaurants and hotels	1540.3	1246.0	1721.3	3144.1	3519.6	1486.3
Actual Outflow	Agriculture, Mining, Hunting, Forestry & Fishing	607.5	531.6	798.6	1344.5	2296.7	170.2
	Community, Social and Personal Services	84.8	450.4	178.2	720.3	208.9	325.5
	Construction	705.7	331.7	339.3	407.3	425.5	418.1
	Electricity, Gas and Water	29.1	125.3	813.9	85.4	102.6	34.7
	Financial, Insurance, Real Estate & Business Services	1852.9	3172.9	1936.6	5800.8	4212.1	1830.1
	Manufacturing	3233.0	7350.0	4742.8	5395.6	3343.5	1771.1
	Miscellaneous	156.7	334.3	110.6	276.5	117.1	35.6
	Transport, Storage and Communication Services	843.1	705.6	340.5	778.4	1995.5	871.5
	Wholesale, Retail trade, Restaurants and hotels	949.2	1040.7	1122.9	1889.7	1911.5	471.7

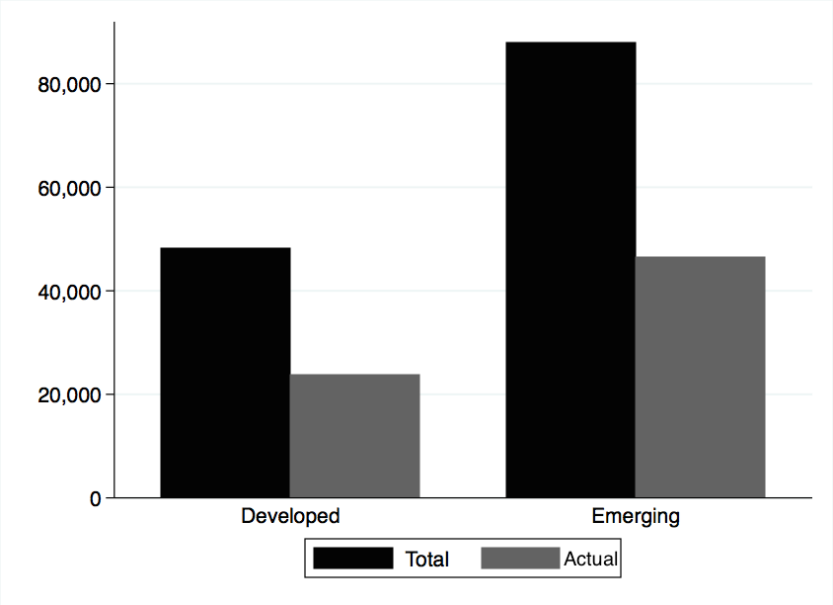

Figure 6: OFDI by Destination in US$millions

Table 7: Summary Statistics of Prowess Firms

Description	Number of Observations	Mean Sales
Years	2005-2011	-
Firms	26516	125.9
Multiproduct Firms	19545	161.5
Exporters	15309	199.3
Outward Investors	2773	620.2

Table 8: Sales, Multiproduct Firms and Internationalising Firms in US$millions

Year	Total Sales	Mean Sales	Mean Sales of Multiproduct Firms	Mean Sales of Exporters	Mean Sales of OFDI Firms
2005	301039.6	68.0	89.9	115.2	348.5
2006	387703.8	86.2	112.2	141.4	437.3
2007	491233.4	110.6	142.4	176.8	549.1
2008	438441.2	98.7	125.8	154.7	492.0
2009	518659.3	124.8	158.7	196.6	608.7
2010	601035.9	227.8	274.7	325.5	942.1
2011	597317.3	307.1	373.7	409.3	1201.7

average firm. Internationalising firms are larger on average than multiproduct firms. Outward investors are the largest of the internationalising firms.

The mean number of products per firm ranges from 3.3 to 4.0 products. The number of products per multiproduct firm ranges from 4.3 to 4.8 products. In 2010, there is a sudden drop in the

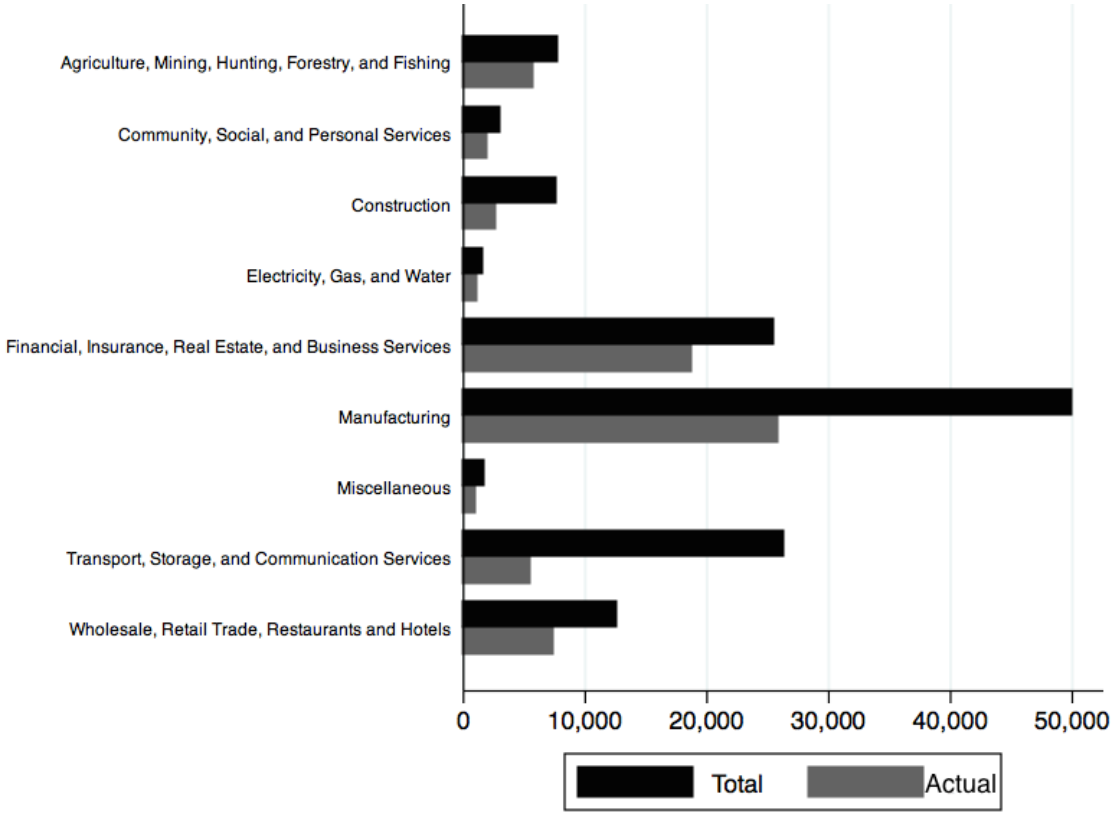

Figure 7: OFDI by Sector in US$millions

Table 9: Number of Employees, Multiproduct Firms and Internationalising Firms

Year	Mean Employees	Mean Employees of Multiproduct Firms	Mean Employees of Exporters	Mean Employees of OFDI Firms
2005	2256.2	2467.0	2599.1	3983.9
2006	2206.0	2431.3	2567.9	4066.3
2007	2150.8	2402.0	2506.7	4013.9
2008	2135.0	2345.7	2474.1	4081.3
2009	2396.4	2523.8	2846.4	4427.7
2010	2659.8	2753.8	3049.8	4823.1
2011	2708.3	2837.3	3029.8	4782.5

total number of products. There are a number of explanations for this phenomenon, including a crisis hangover and rising inflation in that particular period (Government of India, 2012). This will need to be kept in mind in the empirical analysis in the next section.

The product scope investigation will be investigated in greater detail in the next section. The following section presents the empirical evidence for the narrative of subsection 4.8 using the dataset described in section 5.

Table 10: Products and Multiproduct Firms by year

Year	Total Products	Mean Products	Mean Product per Multiproduct Firm
2005	14619	3.3	4.3
2006	15259	3.4	4.3
2007	15354	3.5	4.4
2008	15727	3.5	4.4
2009	15062	3.6	4.5
2010	10503	4.0	4.8
2011	7432	3.8	4.5

6 Empirical Evidence

An early implication of the theory, based on the proximity-concentration trade-off model with heterogenous firms, is that there is a clear productivity hierarchy of firms in terms of their international activity. The least productive firms exit the market. Slightly productive firms service the domestic market. More productive firms export. The most productive firms engage in OFDI.

The heterogenous firm model is empirically testable and several authors have tested for differences in the relative productivity of domestic producers, exporters, and multinationals (Arnold and Hussinger, 2005; Castellani and Zanfei, 2007; Girma et al, 2004; Girma et al, 2005; Head and Ries, 2003; Kimura and Kiyota, 2004; Wagner, 2005). These authors test for substitution between exporting and OFDI due to productivity differences within an industry (Greenaway et al, 2007).

There are two main statistical methods for doing this. The ordinary least squares (OLS) regression compares mean productivity values of domestic producers, exporter, and investors (and combinations thereof). The Kolmogrov-Smirnov tests of stochastic dominance (Greenaway et al, 2007) compares the cumulative distributions of each type of combinatory firm. The prediction that multinationals are more productive than exporters is supported by all the above studies, except for Head and Ries (2003).

To confirm whether the productivity hierarchy exists in this dataset, the first step is to find a good estimate of total factor productivity (TFP) as an approximate measure of productivity. The estimation procedure is conducted using observed input and output data obtained from the Prowess database.

6.1 Relative Productivity of Domestic Producers, Exporters and OFDI Firms

The first step in the TFP estimation procedure is to estimate the logarithmic form of the production function.

$$lnY_{it} = \beta_0 + \beta_1 lnK_{it} + \beta_2 lnL_{it} + \beta lnx_{it} + \varepsilon_{it} \tag{22}$$

Total factor productivity is estimated using the residuals of this estimation. There is a simultaneity problem in direct estimation methods such as ordinary least squares (OLS), because the choice of factor inputs is correlated with the firm's unobserved productivity. Thus, the error term is likely to be correlated with the factor input values. The error term is a function of the

unobserved (by the researcher) productivity (ω_{it}) and determines the amount of factor inputs employed. The OLS estimates are likely to be biased.

$$\varepsilon_{it} = \omega_{it} + \mu_{it} \tag{23}$$

Ordinarily, a fixed effect panel regression would be an option in estimating consistent parameters. However, in order to do so, it must be assumed that the aspect of TFP that influences firms behaviour is invariant over time. This assumption may be an oversimplification particularly since it is expected that TFP will increase after the internal reallocation in response to changes on OFDI.

The endogeneity problem can also be addressed using Olley and Pakes (1996) semi-parametric estimator, which also yield consistent estimates. It utilises the firm's investment decisions as a proxy for shocks in the unobserved (by the researcher) element of TFP. The level of investment signals productivity and is correlated with capital, but current investment does not impact productivity in the current period. Current investment is a function of the firm-observed productivity element and capital. The investment rule illustrates this relationship.

$$I_{it} = I(\omega_{it}, K_{it}) \tag{24}$$

Inverting the investment rule to make ω_{it} the subject of the formula yields a function that can replace ω_{it} in equation 2 and create an unbiased form of equation 1.

$$lnY_{it} = \beta_0 + \delta_1 lnK_{it} + \beta_2 lnL_{it} + \beta lnx_{it} + \delta_2 lnI_{it} + \mu_{it} \tag{25}$$

This will yield more accurate estimates of TFP from the residuals, as the estimates in the function will be more consistent.

In order for these estimates to be consistent, the method requires that there be a strictly monotonous relationship between investment and sales. It is not unreasonable to expect that there will be a not insignificant number of observations with zero investment in any particular year. Unfortunately, these observations will be dropped in the Olley-Pakes correction in order to satisfy the monotonicity condition. An alternative, but similar method developed by Levinsohn and Petrin (2003) uses intermediate inputs, such as materials (M_{it}), instead of investment.

$$lnY_{it} = \beta_0 + \beta_1 K_{it} + \beta_2 lnL_{it} + \beta_3 lnM_{it}(lnK_{it}, \omega_{it}) + \beta lnx_{it} + \omega_{it} + \mu_{it} \tag{26}$$

Intermediate inputs confers the benefit of very rarely being zero (Petrin et al, 2004), thus it is more receptive to the strict monotonicity assumption. In addition, intermediate inputs are easier to adjust in the short-term in response to productivity shocks. The decision to alter intermediate input spend is a less costly decision than the decision to alter investment spend. Thus, as indicated in equation 5, it is expected that intermediate inputs (materials, M) is a function of the observable (capital, K) and unobservable (ω) state variables. This relationship can be inverted under the monotonicity assumption, such that the unobservable state variable (ω) can be written as a function of the intermediate input and the observable state variable (capital).

$$\omega_{it} = \omega_{it}(lnM_{it}, lnK_{it}) \tag{27}$$

Part of the production function can be fully specified (with an error term) by the observable variables, capital and intermediate inputs. Capital and raw materials have an additional indirect

effect on output through the unobserved productivity. The total effect (direct and indirect) of capital and raw materials is denoted by $\phi_{it}(lnM_{it}, lnK_{it})$.

$$lnY_{it} = \beta_2 lnL_{it} + \phi_{it}(lnM_{it}, lnK_{it}) + \beta lnx_{it} + \mu_{it} \tag{28}$$

$$\phi_{it}(lnM_{it}, lnK_{it}) = \beta_0 + \beta_1 K_{it} + \beta_3 lnM_{it} + \omega_{it} \tag{29}$$

The estimation procedure is a two-stage process. The first step is an OLS estimation of the production function (equation 27). An approximation of $\phi_{it}(lnM_{it}, lnK_{it})$ using a third-order polynomial expansion of lnM_{it} and lnK_{it} is incorporated into the estimation procedure. Subtracting the expression $\hat{\beta}_2 lnL_{it}$, where $\hat{\beta}_2$ is the estimate of the β_2 coefficient on the natural log of labour in equation 27, from the residual of this estimation gives estimates for $\phi_{it}(lnM_{it}, lnK_{it})$. Then, using estimates for the coefficients on the log of capital and materials, estimates can be obtained for the unobservable (by the researcher) firm characteristics, $\hat{\omega}_{it}$.

$$\hat{\omega}_{it} = \hat{\phi_{it}}(lnM_{it}, lnK_{it}) - \beta_1^* K_{it} - \beta_3^* lnM_{it} \tag{30}$$

A consistent non-parametric approximation of $E[\omega_{it}|\omega_{i,t-1}]$ is estimated using the estimates constructed according to equation 29 and the regression:

$$\hat{\omega}_{it} = \gamma_0 + \gamma_1 \omega_{i,t-1} + \gamma_2 \omega_{i,t-1}^2 + \gamma_3 \omega_{i,t-1}^3 + \epsilon_{it} \tag{31}$$

In the final stage of the procedure, a generalized method of moments minimization of the squared residual of the production function is conducted by choosing the coefficients on the log of capital and the log of materials. The two coefficients need to be identified separately. Including another moment condition does this: materials from the former period is uncorrelated with the error in the current period. Thus, if the previous period's amount for raw materials usage is incorporated into the minimization problem in place of the present period materials usage, then there exists a single candidate estimator that solves the minimization problem. Newton's method is employed to find the unique solution to the minimization problem.

In conducting the estimation procedure, the dependent variable used is sales of goods. Net fixed assets is used in lieu of capital. Salaries and wages are used to denote labour stock, as there were insufficient observations reporting the number of employees employed. The variable raw materials expenses is used as the materials variable, and plant and machinery additions is used as the variable for investment. The size dummies are based on sales values.

The results of the different methods of estimation are presented in table 11. The coefficients on the controls for each year are not included. The robust standard errors are reported. The company identifier is the panel variable. Except for the estimate of the coefficient of capital using the Levinsohn-Petrin method, all the coefficients are statistically significant at the 1% level. The coefficient estimates on the factor inputs must be interpreted as elasticities, because the dependent variable and the factor input independent variables are in the form of the natural logarithm. The estimates for the coefficients are capital are much lower than expected, particularly in the case of the Olley-Pakes estimation. The OP estimates for capital would normally be larger than the same for OLS and FE. However, the estimates for the coefficients on labour and materials are lower in the OP estimation than in the OLS and FE estimations, which is expected.

The economically and statistically insignificant estimation of coefficient on the capital variable

in the LP estimation procedure is not entirely unexpected. If there is not enough variation in the data, then the LP method has a tendency to produce strange results when the dependent variable is gross sales as has been used here (Petrin, 2004).

Table 11: Productivity Estimation results

Variable	**OLS**	**Fixed Effects**	**Olley-Pakes**	**Levinsohn-Petrin**
lnCapital	0.070***	0.020***	0.049***	0.006
	(0.003)	(0.006)	(0.016)	(0.027)
lnLabour	0.203***	0.221***	0.167***	0.190***
	(0.003)	(0.012)	(0.006)	(0.006)
lnMaterial	0.566***	0.612***	0.494***	0.689***
	(0.007)	(0.016)	(0.013)	(0.057)
Small	0.462***	0.276***	0.623***	0.586***
	(0.014)	(0.020)	(0.028)	(0.027)
Medium	0.679***	0.461***	0.984***	0.963***
	(0.021)	(0.030)	(0.041)	(0.046)
Large	1.026***	0.625***	1.385***	1.413***
	(0.030)	(0.041)	(0.056)	(0.065)
Number of Observations	25338	25338	13599	25338
R-Squared	0.9605	0.9584		

A short note should be made on the use of exporter and investor dummies in both the unconditional and conditional comparisons to follow. Their use is premised on the assumption that there is no difference between the way investors, non-investors, exporters, and non-exporters utilise capital and labour. In order to overcome this assumption, the dummies would have to be interacted with the explanatory variables in the production function.

6.2 Unconditional Comparisons

A comparison of the means and standard deviations of the TFP estimates that have been acquired using the FE and OP procedures are presented in table 12. The estimates using OLS are expected to be biased, thus the need for alternative methods of estimation, so the OLS TFP summary statistics will not be included here. Though the accuracy of the LP estimates is doubtful given the strange coefficient on capital, it is also presented in the table. For all three estimation techniques, the mean of the TFP of the outward investors is the highest, followed by that of the exporters and the domestic producers have the lowest mean.

The comparison of means does not take into account productivity heterogeneity across the distribution. There may just be a handful of outward investing and exporting firms that have such a large productivity premium over domestic firms, that the mean is skewed into misleading the reader into believing that all outward investors and exporters are more productive than domestic producers. In order to improve the robustness of the comparison, the Kolmogrov-Smirnov (K-S) tests for first-order stochastic dominance of the productivity distributions of OFDI firms relative to domestic firms will also be used. Two hypotheses tests need to be conducted in order to confirm dominance: whether the distributions are equal or not, and whether the former distrbution is less than equal to the latter or greater than the latter.

Table 12: Comparative TFP: Means and Standard Deviations

International Activity	**Fixed Effects**	**Olley-Pakes**	**Levinsohn-Petrin**
Outward Investor	1.927	2.465	1.712
	(0.423)	(0.602)	(0.394)
Exporter	1.575	1.840	1.417
	(0.438)	(0.601)	(0.414)
Domestic Producer	1.355	1.390	1.237
	(0.571)	(0.727)	(0.544)

The first test is a two-sided K-S test and the second test is a one-sided K-S test. In the two-sided test, the null hypothesis states that the different between the two distributions is zero and the alternative hypothesis states that the difference is not equal to zero. The null hypothesis of the one-sided test states that the difference between the productivity distribution of OFDI firms and domestic firms is non-positive, and the alternative hypothesis states that this difference is strictly positive. In order to illustrate that the distributions are different and that the difference is not caused by the first distribution lying to the left of the second, the null hypothesis in the first test needs to be rejected and in the second test fail to be rejected. As illustrated in table 13, this criterion is met for all three estimation procedures.

Table 13: P-Values of Kolmogrov-Smirnov Tests of First-order Stochastic Dominance

	Investors	**vs**	**Non-investors**
	FE	**OP**	**LP**
Test 1	0.000	0.000	0.000
Test 2	0.997	1.000	0.997
	Exporters	**vs**	**Non-exporters**
Test 1	0.000	0.000	0.000
Test 2	0.795	1.000	0.350
	Investor vs	**Non-Investor**	**Exporters**
Test 1	0.000	0.000	0.000
Test 2	0.998	0.999	0.996

6.3 Relative Product Range of Domestic Producers, Exporters and OFDI Firms

A testable hypothesis in the Bernard, Redding and Schott (2010) model is that the most productive firms are capable of sustaining the largest array of products. In the previous section, it was shown that OFDI firms are more productive than exporting firms, which are more productive than solely domestic producers. The implication is that OFDI firms should have a larger range of products than exporting firms, which should have a larger range of products than solely domestic producers.

Detailed product data is provided in the Prowess database. From this information, it is possible to calculate the number of different products produced by a firm in each year. A preliminary step in comparing firm product scope would be an investigation as to whether there is a relationship between product scope and productivity. The natural logarithm of the number of

products is used as the dependent variable. Table 14 reports the results using TFP as a proxy for productivity. The OLS and FE estimates are expected to be biased due to the correlation of the factor inputs with the residual TFP in the productivity estimation. The LP TFP estimate is flawed when the gross sales dependent variable is used in the production function estimation. Therefore, the OP estimate of TFP is used in the regressions. Size controls are included in the second regression of each method in order to address ambiguous sources of endogeneity. Table 14 reports the robust standard errors in brackets.

Table 14: Product and Productivity Estimation Results

	OLS		**Fixed Effects**	
TFP	0.375***	0.044**	0.041**	0.015
	(0.013)	(0.020)	(0.016)	(0.018)
Small		0.247***		0.041***
		(0.025)		(0.015)
Medium		0.472***		0.069***
		(0.031)		(0.022)
Large		0.796***		0.120***
		(0.039)		(0.028)
Intercept	0.351***	0.541***	0.902***	0.892***
	(0.021)	(0.021)	(0.027)	(0.027)
Number of Observations	25338	25338	25338	25338
R-Squared	0.1255	0.1751	0.0845	0.1522

The productivity estimate is significant in both the OLS regressions, but only the simple fixed effects regression estimate is significant at the 5% level. The OLS estimate treats gives equal weight to within-firm and between-firm variation by treating the dataset like a cross-section. Time dummies were included in the regression (but are not reported) in order to control for intertemporal variation. The fixed effect estimate captures the within firm variation in product scope and it's relationship with the within firm variation in productivity. The significance of the OLS estimate and the insignificance of the fixed effects estimate indicates that there is a positive and significant relationship between TFP and product scope across firms, but there is no relationship (that is statistically different from zero) between a change in TFP and a change in product scope within firms. A different explanation for the lack of significance once size controls are included, it may be symptomatic of insufficient within-firm variation in both product scope and productivity.

6.4 Unconditional Comparison

In the previous section, it was shown that outward investors are the most productive firms. In the above estimation, it was shown that there is a positive relationship between productivity and product scope. Therefore, it is expected that OFDI firms will have the largest product scope. A comparison of the means and standard deviations of product number by firm type is presented in table 15. Outward investors have the largest mean product scope, followed by exporters, and domestic producers have the lowest mean product scope.

Once again, in order to take into account the heterogeneity in the product scope across the dis-

Table 15: Comparative Product Scope: Means and Standard Deviations

International Activity	Mean	(Standard Deviation)
Outward Investor	1.534	(0.696)
Exporter	1.152	(0.747)
Domestic Producer	0.740	(0.677)

tribution within each firm type and improve the robustness of the comparison, the K-S test for first-order stochastic dominance is employed comparing investors to non-investors and exporters to non-exporters.

The procedure is the same as before: the first test is used to evaluate whether the distributions are equal, and the second test is used to evaluate whether the distribution of the firm that engages in the international activity is everywhere at least as large as the distribution of the other firms. A rejection of equality in the first test, and a failure to reject weak dominance in the second test is required to confirm the mean comparisons of the previous table. The p-values of these tests are reported in table 16.

Table 16: P-values of K-S Tests of First-Order Stochastic Dominance in Product Scope

	Investor vs Domestic	Exporter vs Domestic	Investor Exporter vs Non-investor Exporter
Test 1	0.000	0.000	0.000
Test 2	0.998	1.000	0.991

The mean product scope comparison is supported by the Kolmogorov-Smirnov test of first-order stochastic dominance, thus confirming the hypothesis that OFDI firms have a larger product scope than non-OFDI firms, and exporting firms have a larger product scope than non-exporting firms.

6.5 Conditional Comparisons

In the previous section, it was shown that exporters and outward investors have a larger product scope than domestic producers. This section explores whether there is a relationship between international activity and product scope. Once again, the OLS estimates are used to analyse the cross-section relationship and the fixed effects estimates are used to analyse the relationship between within firms variation of product scope and international activity (see table 17). Time dummies are included (but not reported) in both methods to control for intertemporal variation.

The simple OLS regression directly on the exporter and outward investor dummies yield positive and significant estimates. In the second and third regression, an interaction term on the two dummies is also included in order to investigate whether the two activities augment each other. This is not the case according to both regressions. The second regression indicates the opposite in fact. There is no evidence of complementarity of exports and OFDI in this data. This supports the proximity-concentration trade-off theory, which assumes substitutability of OFDI and exports. The inclusion of the capital, labour and materials in the third regression decreases the significant of the coefficient on the outward investor dummy, but it is still significant at the 10%

Table 17: Product Scope and International Activity Estimation Results

	OLS				Fixed Effects			
	1	2	3	4	5	6	7	8
Exporter	0.406***	0.407***	0.060***	0.162***	0.109*	0.110*	0.089***	0.209***
	(0.019)	(0.019)	(0.020)	(0.020)	(0.062)	(0.062)	(0.064)	(0.050)
Outward Investor	0.393***	0.731***	0.355*	0.391	-0.016	0.161	0.150	0.173
	(0.052)	(0.205)	(0.204)	(0.239)	(0.114)	(0.514)	(0.534)	(0.471)
Exporter×Outward Investor		-0.352*	-0.329	-0.225		-0.184	-0.188	-0.053
		(0.208)	(0.205)	(0.240)		(0.523)	(0.543)	(0.485)
Capital			-0.008				0.151***	
			(0.008)				(0.050)	
Labour			0.125***				0.154***	
			(0.009)				(0.051)	
Materials			0.078***				-0.050	
			(0.007)				(0.031)	
Small				0.209***				
				(0.028)				
Medium				0.416***				
				(0.034)				
Large				0.705***				
				(0.043)				
TFP				0.035*				0.163***
				(0.021)				(0.055)
Number of Observations	17661	17661	16889	16889	17661	17661	16889	16889
R-Squared	0.0871	0.0873	0.2374	0.1863	0.0316	0.0318	0.1537	0.0774

level. Labour and materials coefficients are significant, but the capital coefficient is not.

The relationship between product scope and international activity is motivated using the theories on both through firm productivity. It is expected that the inclusion of the productivity estimate in the OLS regression will eliminate the relationship between product scope and the dummies. The fourth regression estimates indicate that this outcome is observed for the outward investor dummy only. The exporter dummy is still significant. Firm size dummies are also included and have a positive and significant relationship with product scope.

The fixed effects regression for within firm variation paints a different picture. The coefficient on the exporter dummy is significant at the 10% level for the fifth and sixth regressions, but the outward investor dummy is not statistically different from zero. The inclusion of the factor inputs in regression seven results in an increase in the significance of the coefficient of the exporter dummy. The coefficients on capital and labour are significant, but the materials coefficient is not.

The inclusion of TFP in the last regression does not affect the significance of the exporter dummy coefficient estimate. The estimate of the coefficient on the TFP variable is positive and significant. Size dummies are not included here, because they are redundant in the fixed effects regression that accounts for invariant firm characteristics such as size.

The next section will investigate whether an exogenous change in the costs of international investment and trade has a relationship with the engagement of firms in OFDI.

6.6 The Relationship between Investment and Trade Receptiveness, and OFDI

In the previous section, it was shown that in a cross-section analysis, there exists a positive relationship between engaging in international activity and the product scope of the firm. Firm's that do engage in international activity, exporting and investing abroad, have larger product scopes on average than non-internationalising firms. Furthermore, it appears that this relationship operates through firm productivity. However, this relationship does not establish the causal relationship of OFDI on product scope. The next subsection will attempt to establish whether such a relationship exists.

The international activity of interest in this paper is OFDI. In order to tease out the causal relationship between OFDI and product scope, it helps to find a factor that generates a change in OFDI without having a direct effect on product scope, except through OFDI. The proximity-concentration trade-off theory suggests that a change in the fixed cost of OFDI and changes in the variable and fixed costs of exports would be such factors. Furthermore, it would be useful if these factors did not affect all outward investing firms equally. The changes in Indian OFDI regulation are not a very useful factor in this respect. Although the relaxing of the restrictions on Indian OFDI had been an exogenous reduction in the fixed costs of OFDI that has no direct relationship with product scope, it was applied to all manufacturing firms at the same time.

The Indian OFDI data does indicate the recipient country of the investments made by each firm. There are about 59 different recipients of OFDI from India. In table 18, the total flows of the top ten recipients of OFDI are presented over the period 2007 to 2011. The top recipients over the period consist of a mixture of emerging and developed economies that each has their own set of factors (attractors and obstacles) that influences the fixed cost of investing in those countries. These factors no doubt change over time. The changes in these factors are often unique

to each country. The changes that these factors have on the fixed costs of inward foreign direct investment (IFDI) in these countries is expected to have an affect on the amount of investment from Indian firms to these countries, both in total and by firm.

Table 18: Top ten recipients of OFDI from India over the period 2007-2011

Country	IFDI from India in US$ millions	Share of Total
Singapore	30210.047	24.98%
Mauritius	27085.52	22.39%
Netherlands	14974.742	12.38%
United States of America	7459.5698	6.17%
United Arab Emirates	6169.7729	5.10%
Cyprus	5092.3281	4.21%
British Virgin Islands	4344.2383	3.59%
United Kingdom	4076.1492	3.37%
Australia	2838.8389	2.35%
Panama	2208.1057	1.83%
Other	16497.31	13.64%
Total	120956.62	100%

The individual firm invests in a basket of countries that may change from year to year. The combination of factors from all the different countries in the basket that affect OFDI can be aggregated by weight to calculate a total impact on OFDI by that Indian firm. This total impact changes from year to year as certain countries are added or dropped from the basket, or the internal factors of countries in the basket change. Therefore, the fixed cost of OFDI faced by the Indian firm changes over time in a manner independent of the changes of the fixed cost of OFDI in other firms. Thus, it is expected that the firm-level outward investment can change based on factors unique to each firm in every year.

The global competitiveness index measures international competitiveness of 151 countries and is composed of a variety of different measures. The specific measures that are of interest to this paper is the trade-weighted average tariff rate as a measure of variable export costs, the prevalence of trade barriers as a measure of fixed export costs, and the business impact of rules on FDI as a measure of the fixed costs of overseas investment. Other measures, such as GDP, the domestic market size, country development status and the OFDI recipient sector, are also of interest as controls.

This subsection establishes whether the trade and investment attractors and obstacles do have a relationship with the volume of FDI received by these countries from India. The results are sensitive to the choice of firms that are included in the analysis, so the subset of these firms, for which there is firm-level product data, that is used in the later analysis may not exactly mimic the results obtained here.

Table 19 presents the results of the analysis of the relationship between country-specific factors and the amount of OFDI received by those countries. It is expected that the tariff score will have a positive relationship with total FDI flows to the country, but there is no apparent relationship in this database. The trade barriers score is derived from the Executive Opinion Survey of the World Economic Forum and is a measure of the limits to imports by non-tariff

barriers, where one denotes "strongly limit(s)" and seven denotes "(does) not limit at all" (World Economic Forum, 2013).

Table 19: Total OFDI Flows and Trade and IFDI Competitiveness Measures by Recipient

Total OFDI	1	2
Tariff Score	-0.033	0.014
	(0.108)	(0.094)
ln(Trade Barriers Score)	0.190	-1.493
	(3.390)	(5.097)
ln(FDI Rules Score)	6.406**	8.259**
	(2.227)	(3.780)
ln(GDP in US$ billion)		0.112
		(0.221)
Emerging		-0.367
		(1.320)
Manufacturing		1.260
		(1.041)
Other		3.810***
		(0.949)
No. of Observations	80	71

It is expected that the trade barrier score would have a negative relationship with total FDI inflows, but the relationship in this dataset is not statistically different from zero. Time control dummies are included but not reported to control for unobserved variations over time. The dummy variable, Emerging, controls for the recipient country's level of development, where "emerging" is defined as before in section 5.3. The coefficient on the development dummy is not statistically different from zero. Sector controls, which indicate the sector in the recipient country that received the investment, are also included. The base sector is the primary sector. The manufacturing sector does not receive a statistically different amount of OFDI than the primary sectors, but the sector classified as "Other" (which includes retail, business services, construction, electricity and water) receives a statistically significant amount more than the primary sector.

The FDI rules score is also a measure derived from the Executive Opinion Survey of the World Economic Forum indicating whether the regulatory environment of the host country is encouraging towards FDI. One denotes "strongly discourage(s)" and seven denotes "strongly encourage(s)" (World Economic Forum, 2013) FDI. It is expected that there would be a positive relationship between total FDI received by the country and the FDI rules score. The analysis indicates that there is a positive and statistically significant (at the 5% level) relationship and that this result is robust to the inclusion of country and sector controls in regression 2. Thus, there is a relationship between the measure of OFDI costs and actual OFDI flows. The substitution between OFDI and exports is not explicitly tested here, because the export destination is not included in this dataset.

6.7 Investment and Trade Receptiveness and the Entry and Exit of OFDI Firms

Another method for testing the sensitivity of investment flows to changes in the destination country receptiveness to IFDI (whether regulations encourage IFDI) and exports (extent of tariff and non-tariff barriers) is to analyse the relationship of these measures to the entry and exit of firms into OFDI activity with each destination country. The focus is changed from aggregate OFDI flows by recipient country to firm-level flows by recipient country. An increase in countries receptiveness to OFDI effectively lowers the fixed cost of engaging in OFDI. A decrease in countries receptiveness to exports effectively raises the variable cost of engaging in exports. Both changes in receptiveness should be associated with an increased probability of firm entry into OFDI activity in that country, as per the proximity-concentration trade-off.

This method is more consistent than the previous method with the analysis that will take place in the next subsection, because the focus is changed to firm-level behaviour rather than aggregate flows of OFDI. In order to incorporate firm entry and exit into OFDI, the dataset has been filled with zero flows, where a firm-destination-year combination is not accounted for in the existing dataset. When a firm does not invest to one of the countries in the dataset, an observation is created with a zero flow amount.

Following the method employed by Aw and Lee (2014) with a few modifications, a fixed effects multinomial logistic model is employed to analyse the effect of trade and IFDI receptiveness on the likelihood of a firm engaging in FDI with a specific country. Aw and Lee (2014) employ a multinomial logit model with time and sector dummies and investigate the likelihood of a firm engaging in OFDI relative to a purely domestic base group of firms. In this analysis, the likelihood of a firm engaging in OFDI with a particular country is compared to a firm that does not engage in OFDI with that country.

The results of the analysis are reported in table 20. An improvements in a country's business impact of FDI rules is associated with a higher probability of engaging in OFDI to that country. This association is significant and robust to the inclusion of country, firm, and time controls (regression 2). Both regressions in table 19 include a lag of the dependent variable in order to capture the persistence of OFDI engagement to a specific country by a specific firm as a result of having covered a portion of the fixed cost of investment. The regressions include fixed effects for the firm-destination combination. Thus, the relationship that is being captured is the within firm-destination relationship. The second regression includes controls for country characteristics that may be relevant to overall investment climate in the country, such as the domestic market size, taxes on businesses and level of development. The second regression also includes the firm total factor productivity measure to control for other firm characteristics influencing the firm's ability to invest in general.

Thus, it appears that country FDI rules do have a positive relationship with FDI flows from India to that country, as expected. However, tariffs and trade barriers do not appear to have a significant relationship with FDI flows in this dataset, which is contrary to expectations. The significance of the coefficient on the tariffs in the second method is undercut by the relatively small size of the coefficient. In the next section, the relationship between FDI rules and FDI flows will be used to tease out the relationship between OFDI and the product scope of the Indian outward investor.

Table 20: Fixed Effect Multinomial Logistic Model of Entry into Outward Investment

	1	2
Trade Barriers Score	0.358	-0.732*
	(0.341)	(0.403)
Tariff Score	-0.030**	-0.030*
	(0.012)	(0.024)
FDI Rules Score	2.997***	4.217***
	(0.352)	(0.560)
Lagged Invests	5.712***	5.321***
	(0.080)	(0.098)
Domestic Market Size Score		2.379***
		(0.191)
Tax on Business Score		-0.026***
		(0.004)
Emerging		-0.100
		(0.087)
TFP		0.484***
		(0.062)
No. of Observations	173151	130046
Pseudo R-Squared	0.3421	0.3819

6.8 FDI Receptiveness and Product Scope

In the previous section, it was demonstrated that there is a relationship between the receptiveness of a recipient country to IFDI and the FDI flows from India to that country. This section seeks to establish whether an improvement in the aggregate IFDI receptiveness that a firm faces has a positive relationship with that firm's product scope. Drawing on the methodology of Qiu and Yu (2014), the empirical estimation equation posits a relationship between product scope and firm TFP, the domestic receptiveness measure, and the foreign receptiveness measure.

$$P_{it} = \alpha_0 + \alpha_1 TFP_{it} + \alpha_2 R_{It} + \alpha_3 WR_{it} + \alpha_m C_{Ii} + \alpha_n C_{it} + \alpha_p WC_{it} + \varepsilon_{it} \tag{32}$$

P_{it} denotes the number of products produced by the firm i in time t. $R_I t$ denotes the receptiveness of India to FDI in time t. WR_{it} is the weighted average of the receptiveness of all the recipient countries of FDI from firm i at time t. Lastly, C_{Ii}, C_{it} and WC_{it} are India-specific, firm-specific, and the weighted average recipient controls. The model that they have used is altered in two ways. The first is to replace the trade liberalisation measures used in their paper with IFDI receptiveness measures. The second is to create a weighted average (WA) IFDI receptiveness measure, because this study focuses on the number of products produced by the firm in India, whereas their study focused on the number of products exported to the destination.

The share of OFDI from that firm to different destinations the weights in the WA. Thus, the weighted receptiveness faced by a firm is the receptiveness it faces by each of the countries it invests in, weighted by the share of total outward investment by the firm that it invests in each of those countries. This weighting procedure is used for all the competitiveness measures used in this section.

Table 21: IFDI Receptiveness and Product Scope

	FE	FE Poisson
TFP	-0.637	-0.118
	(0.846)	(0.153)
Indian Receptiveness		6.727***
		(1.974)
WA Foreign Receptiveness	-3.016**	-0.446**
	(1.500)	(0.200)
Indian GDP		2.368***
		(0.635)
WA Foreign GDP	0.029	0.007
	(0.068)	(0.011)
$\ln(\frac{Capital}{Labour})$	0.250	0.041
	(0.252)	(0.046)
WA Ease of Financing	2.879**	0.420**
	(1.457)	(0.195)
No. of Observations	633	495
R-Squared	0.0069	

Both regressions have firm fixed effects (FE) and robust standard errors are reported for both. Time dummies are included in both regressions, but not reported here. The results in column one of table 21 clearly illustrates a negative relationship between product scope and a change in the IFDI receptiveness faced by a firm. The coefficient is -3.016 and is statistically significant at the 5% level. Thus, when IFDI barriers are lowered abroad, holding all else equal, the domestic firm will reduce their domestic product scope.

However, the use of the OLS with fixed effects estimation method may not be the best route to take to tease out this relationship and may produce biased results. The product scope or number of products produced by a firm does not follow a normal distribution (Qiu et al, 2014). Most firms produce very few products, but a handful of firms produce very many products. Furthermore, all the data points fall in the set of non-negative integers. Better estimates can be obtained using a Poisson distribution. The Poisson estimation technique is more suitable in dealing with count data models (Qiu et al, 2014). Furthermore, given that at the simplest level the model used is a gravity-type model (Qui et al., 2013), it is expected that the GDP of India is likely to be an important time variant variable. Also, the ability to engage in any type of investment in the country may an important time-variant factor having an affect on the ability of the subsidiary to engage in production. Thus, these variables are also included in the regression.

The results of the fixed effects Poisson estimation is reported in column two of table 20. The coefficient is smaller on weighted IFDI receptiveness measure, but still negative and significant. These regressions provide the required evidence for the hypothesis proximity-concentration trade-off at the product level, supporting the expectation that engaging in OFDI is likely to be associated with a fall in the number of product produced by the firm. This is in line with the hypothesis postulated in the theoretical narrative of section 4.7. The next section concludes.

7 Conclusion

This study focuses its attention on multiproduct multinationals. Drawing from a broad array of theoretical contributions, a narrative is developed to postulate a plausible relationship between the firm's outward investment behaviour and the firm's choice of product scope. Several testable hypotheses were raised in the paper. First, it is expected that outward investing firms are more productive than domestic and exporting firms. Second, it is expected that the most productive firms produce the largest scope of products. Third, a corollary to the first and second hypotheses, it is expected that outward investing firms produce the largest scope of products. The fourth and final hypothesis, an outward investing firm is expected to consolidate its range of products in response to an exogenous decrease in the barriers to outward investment.

These hypotheses were tested using detailed Indian firm-level data and overseas direct investment data. The empirical results were consistent with the hypothesized predictions. Outward investing firms are the most productive firms in the domestic market. There is a positive relationship between firm productivity and the range of products it chooses to produce. Outward investors have the largest product scope in the domestic market, but an exogenous increase in the amount it invests abroad results in product consolidation.

The implication of this analysis is that there are productivity gains from creating policy environment encouraging outward investment. This manifests in an associated fall in the range of products produced at home, in addition to the exit of unproductive firms and reallocation of resources to the most productive firms as predicted in the proximity-concentration trade-off theory developed by Helpman (2004). This selection at the product level indicates that the reallocation of factors to the most productive uses occurs to a greater extent than predicted in the standard proximity-concentration trade-off models.

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