The University of New South Wales
Australian School of Business | School of Economics

Foreign Direct Investment and Export Diversification in Low Income Nations

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Honours Thesis
October 2009

Bachelor of Commerce (Accounting & Finance)
Bachelor of Economics (Honours)

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Declaration of Originality

I, Shasheen Dileepa Jayaweera, declare that this thesis is my own work, and that any contributions or materials by other authors have been appropriately acknowledged. This thesis has not been submitted to any other university or institution as a requirement for a degree or other award.

Shasheen Dileepa Jayaweera
26th October 2009

Acknowledgements

I would like to acknowledge the kind and valuable support of a number of people over the course of this year who have helped me make this project a reality.

Firstly I would like to thank my supervisor Dr. Nigel Stapledon for his guidance throughout the year and for always challenging me to think differently and push new boundaries with this project. I am also very grateful to Dr. Arghya Gosh for helping me understand trade models and to Professor Denzil Fiebig for his helpful econometric advice. I would also like to thank Professor Andy Tremayne and Dr. Valentyn Panchenco for their econometric guidance and Dr. Gautam Bose for fuelling my interests in development economics. I am also very grateful to the Australian School of Business for their generous financial support during my honours year and to the UNSW Co-op program for a fulfilling undergraduate learning experience.

This project also could not have been completed without the generous support of the World Bank who supported the masses of trade data I required. For their support I would like to thank Nigel Roberts, Dr. Denisse Pierola, Tomas Ernst, and Harinder Jassal.

I would also like to thank my honours colleagues for their support and for being a great group to work with. Furthermore, I owe a special note of thanks to Rahul Nath for his mathematical guidance and for helping me understand economic modelling.

Finally, I would like to thank my family for their priceless support and my friends who have inspired and motivated me through all my adventures.

Abstract

This paper seeks to understand whether increased foreign direct investment (FDI) can help low income nations to diversify their export bases. Numerous governments in low income nations have sought to attract FDI with an aim of diversifying their export bases while many large multilateral development organisations have also advocated such policies. Using Melitz's (2003) trade model, I identify a number of potential drivers of export diversification including firm productivity, the cost of trade, the fixed costs of export market entry and consumer preferences and incomes. In the literature on FDI, a number of theoretical and empirical studies link FDI to these drivers of export diversification. These linkages are primarily based on FDI leading to improved productivity in the host nation, together with a number of spillover benefits which help local firms to become export competitive leading to an increase in export diversification. I construct a rich panel dataset of 29 low income nations from 1990 to 2006 and employ an instrumented variables estimation technique using differenced data to test the link between FDI and export diversification. The results suggest a positive association between increases in FDI and increases in export diversification and provide support for the spillover argument. The results also find that this effect is reversed for nations which export a high proportion of oil and mineral resources. Furthermore, the value in signing free trade agreements with import partner nations is reinforced as these are found to be associated with improved export diversification.

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1 Introduction

The dramatic rise of exports from low income nations has been one of the most prominent economic trends witnessed over the past three decades. While economic growth led by exports saw millions lifted out of poverty in the newly industrialising nations of East-Asia, many other small, low income nations have only recently begun to target exports as a channel for development. Some have already begun to reap the benefits of such policies. For example, Cambodia's new export orientated garments industry has created tens of thousands of new jobs, many for women from rural areas. A less discussed, but potentially more significant aspect of this export growth has been the changing composition and diversity of the export bases of low income nations as these changes may be more important in influencing overall economic development. While almost all low income economies have managed to diversify their export bases, vast differences exist between their diversification experiences.

Almost every major international institution including the World Bank, the United Nations and the OECD, have advocated the benefits of export diversification. Furthermore, a number of studies including Lederman and Maloney (2007), Herzer and Nowak-Lehmann (2006) and Ghosh and Ostry (1994), have also noted a number of benefits accruing to economies with diversified export bases including lower terms of trade volatility and increased macroeconomic stability. In addition to these benefits, Hesse (2008) also suggests that developing nations which diversified their export bases also experienced higher income growth rates. Export diversification has also been found to contribute to export growth especially in low income nations. Brenton and Newfarmer (2007) found that export diversification accounted for 57% of the total export growth in some African nations.

It should be of no surprise then that the governments of many developing countries are striving to diversify their nation's export bases. What is interesting, however, is that

many are also concurrently seeking to attract increased longer term capital flows or foreign direct investment (FDI), not just for its perceived direct economic benefits, but also due to a belief that FDI may contribute towards the export diversification process. Many low income nations have experienced large increases in FDI inflows and have engaged in competition with their neighbours to attract FDI, often by offering significant incentives. The export development and export diversification strategies of Pakistan, Kenya, Botswana and Cambodia all make direct reference to an important role for FDI to help boost competitiveness and develop new export industries while the World Bank has proposed a similar strategy for Bolivia to help reduce their reliance on primary commodity products (World Bank, 2009). The motives of Kenya's export diversification policy also centre on a move away from primary commodity products and increasing the quality of manufactured exports (International Trade Centre, 2001). Many other countries including Costa Rica, Mauritius and Chile have also had similar policies in the past. Both Costa Rica and Mauritius partly credit their diversification into the electronics industry as being driven by FDI flows.

While large bodies of literature have examined the drivers of export diversification, the importance of export diversification, and the benefits of FDI, only a few have explored the links between FDI and export diversification. Specific case studies of instances where FDI helped develop new export industries have been documented in many countries including India (Banga, 2003), and Bangladesh (Rhee, 1990). Yet to my knowledge, no studies have sought to develop a theoretical connection between FDI and export diversification. Furthermore, no papers have explored this connection empirically despite the fact that many governments seek to attract FDI to assist with export diversification.

In an attempt to shed some light on this vital area of policy in low income nations, this paper seeks to answer the following questions:

1. What are the theoretical mechanisms through which FDI may influence the diversity of the export baskets of low income nations?
2. Does the empirical evidence support the argument that FDI helps recipient nations to diversify their export baskets?

3. Given the findings from the above two questions, what policy implications can be drawn for low income nations to help them on their path of economic development?

I adopt a commonly used definition of export diversification, being a growth in the *'extensive margin'* of exports, similar to definitions in numerous studies including Brenton and Newfarmer (2007). The extensive margin has both a geographical and product variety dimension and export diversification occurs when either:

1. A non-exporting industry producing a specific product variety begins to export, thus increasing the number of product varieties the nation exports; or,
2. An industry which is already exporting a specific product variety begins to export that variety to a new destination market which it did not export to previously.

While the literature has proposed a variety of methods to measure export diversification, I adopt a simple and widely used count indicator of the number of product categories exported between pairs of countries. Changes in both the geographical and product dimensions of export diversification will register as a change in the proposed 'count of bilateral export channels' indicator. An increase in this count variable would constitute a diversification of exports.

Two key areas of research are then considered to form a theoretical basis for answering the key questions posed in this thesis. The first involves understanding the drivers of export diversification while the second involves understanding the effects of FDI and any interactions it may have on the drivers of export diversification.

In developing a theoretical frameset for understanding the drivers of export diversification, I draw heavily on Melitz's (2003) trade model which has been used widely in recent trade literature due its rich predictions. Melitz's model introduces the notion of heterogenous firms (in terms of productivity) to monopolistically competitive industries with increasing returns to scale and differentiated products. Firms must incur fixed costs to begin producing for the domestic market and, due to differences in

productivity and thus marginal costs, only the most productive firms find it profitable to produce for the domestic industry. A further fixed cost must be incurred if a firm is to establish an export market for its products and a per-unit cost of trade must also be forfeited to reach each export market. As such, only some of the most productive firms find it profitable to export. In some industries, no firms may find it profitable to export, while in others, firms may only export to a few destinations.

The model predicts that changes to foreign consumer preferences, firm productivity, or trade costs may all influence whether a firm may find it profitable to export. As a result, these factors also influence the diversification pattern of a nation's export base. If a firm in a previously non-exporting sector finds it profitable to begin exporting and does so, then their nation would effectively begin exporting a new product and thus diversify. Existing export firms may also be induced to now begin exporting their products to a new destination market, also constituting export diversification.

In the literature on FDI, a number of studies suggest linkages between FDI and the key drivers of export diversification described above. Gorge and Greenway (2004), Markusen and Venables (1999), and Kugler (2005) find both theoretic and empirical evidence that FDI may contribute towards firm productivity. Backward linkages, learning effects and increased domestic competition were commonly cited as channels through which FDI may have productivity enhancing spillovers to other firms in the host nation. Other studies including Crespo and Fontoura (2007), Aitken, Hanson, Harrison (1997) and Kokko, Tansini and Zejan (1997), argue that there are additional spillover effects (such as those pertaining to an information nature on foreign markets) which may even reduce the fixed costs of 'discovering' and establishing export markets, another key driver of export diversification. As a result, I find a theoretical foundation upon which export diversification may be seen as being influenced by FDI and next move to test this empirically.

I construct a rich panel dataset using highly disaggregated, 6-digit level, bilateral mirror export data obtained from the UN Commodity Trade Statistics Database (COMTRADE) for 29 of the poorest developing nations between 1990 and 2006. I calculate a count

indicator of the number of active 6-digit level product categories exported between each of the exporter nations and each of 21 significant importing partner nations, as a measure of the level of export diversification. Overall, the data confirms a general pattern of increasing diversification and exports across the sample of countries, however with significantly varying magnitudes of change. The reasons for these differences in diversification experiences and the question of whether FDI has contributed to the pattern of increased diversification are the prime motives of this study. Data on other explanatory variables including FDI, GDP, exchange rates, and trade agreements were also collected and used to enhance the estimation of the partial effects of changes in the FDI.

I initially employ simple fixed effects and random effects models to estimate the effects of FDI on export diversification in levels. While the signs of the estimators from these regressions were as predicted by my theoretical discussion, evidence of spurious results were found and thus little emphasis was placed on these models. I then adopt another commonly used model estimating the effects in differences using an instrumental variable dynamic panel approach to control for non-stationarity and omitted variables. Post estimation diagnostics found the model to be robust and no evidence of non-stationarity was found in the errors. Using this model, I find that FDI has a positive effect on the number of export counts. Furthermore, positive coefficients estimated on the lagged FDI variables possibly indicate the effects of spillovers which help other sectors to also begin exporting a few years after the FDI investment was made, consistent with the effects described in the theoretical literature.

In section 2, I present a background discussion on the benefits of export diversification and its importance in contributing towards export and economic growth. Section 3 then reviews the theoretical models in the literature which have been used to understand the patterns of export diversification and the potential influences of FDI. I then present an overview of the Melitz model in section 4 which I use to describe the drivers of export diversification. The data and its stylised features are introduced in section 5 and the empirical estimation techniques are discussed in section 6. The results of the empirical estimation are presented in section 7 and the conclusions and policy implications drawn from these are detailed in section 8.

2 Background: The Benefits of Export Diversification

The benefits of export diversification, while not the focus, are the prime motivation for this study which aims to understand if FDI plays a role in driving export diversification. After defining export diversification, I provide a brief overview of its benefits before then introducing the literature on the forces driving it.

2.1 Defining Export Diversification

Studies to date have employed a number of methods to describe and then measure export diversification. While most of the differences between these studies have centred on the measurement of diversification[1], many of these differences have also been subtle and they are generally in agreement on the definition of diversification itself. Recent studies have generally considered export diversification from a bilateral angle as an increase in the number of product varieties exported between country pairs. Besedes and Prusa (2008), Carrère, Strauss-Kahn and Cadot (2007), and Brenton and Newfarmer (2007) all describe export diversification as the export of new product varieties to existing or new destination markets, or the export of currently exported product varieties to new markets. In effect, there is a geographic and product level aspect of diversification. Such patterns are also collectively referred to as the "extensive margin" of trade in a number of studies.

As an illustrative example, assume Benin exported only one product, say coffee beans, and exported that to only one country, say France. In the next year, suppose they then exported another product variety such as bananas, to France. As this constitutes the export of a new, previously non-exported variety, then this would be an example of

[1] The measurement of diversification will be discussed in section 5.2

diversification. Furthermore, if Benin were to now begin exporting coffee to another market, say Germany, then this too would constitute as growth in its 'extensive margin'.

2.2 The Benefits of Export Diversification

Many multilateral organisations have called for greater export diversification in developing nations. In the preface to a recent OECD working paper[2], the director of the OECD Development Centre Louka Katseli described that many low income nations pursue export diversification strategies to ensure export price stability and to foster income growth and that it was in the OECD's interests to help them achieve this. Furthermore, the final report from the World Bank led Commission on Growth and Development (2008) also called on governments to promote policy leading to export diversification.

Hesse (2008) suggests that export diversification could assist developing countries in overcoming export instability, terms of trade shocks and macroeconomic instability, a view also documented by Ghosh and Ostry (1994). Hesse (2008) also suggests that export diversification is associated with higher income growth rates and a number of spillover benefits (production, management, marketing and informational) which further serve to foster higher economic development.

Using Chilean data, Herzer and Nowak-Lehmann (2006) found robust evidence that both horizontal (increasing the number of export sectors) and vertical (movement from primary to manufacturing) export diversification benefit economic growth. They proposed that horizontal diversification generates positive externalities as firms learn about foreign markets and improve their competitiveness. Furthermore, they suggest that primary industries including agriculture generally have low spillovers (and are vulnerable to declining terms of trade) and thus any vertical diversification into secondary industries would result in stronger potential for learning and spillovers. While a handful of developed nations including Australia, Canada and some Scandinavian nations have

[2] See Bonaglia and Fukasaku (2003)

benefited strongly from having large primary industries and a concentrated range of exports, the case is very different for low income nations where the majority of those exporting mostly primary goods have struggled to grow and faced declining terms of trade. Al-Marhubi (2000) also tested the thesis that diversification could potentially lead to stronger economic growth through both knowledge spillovers and less export volatility induced through shocks to primary commodity prices. He examined 91 countries between 1961 and 1988 and found a positive relationship between the level of export diversification and the rate of economic growth.

Lederman and Maloney (2007) find empirical support that export concentration[3] results in lower overall economic growth. They propose that the negative effects, including terms of trade volatility, which are associated with export concentration, may outweigh the potentially positive effects such as scale economies.

However, Ferreira (2009) studied one of the prime examples of export diversification, Costa Rica between 1965 and 2006 and failed to conclude that its diversification Granger caused higher economic growth. In effect, it may simply be possible that diversification could be a consequence of economic growth itself. Nevertheless, most studies have suggested that export diversification may have direct economic benefits in the form of lifting economic growth and positive industry spillovers. Furthermore, it may also play a vital role in driving overall export growth which contributes to overall economic growth.

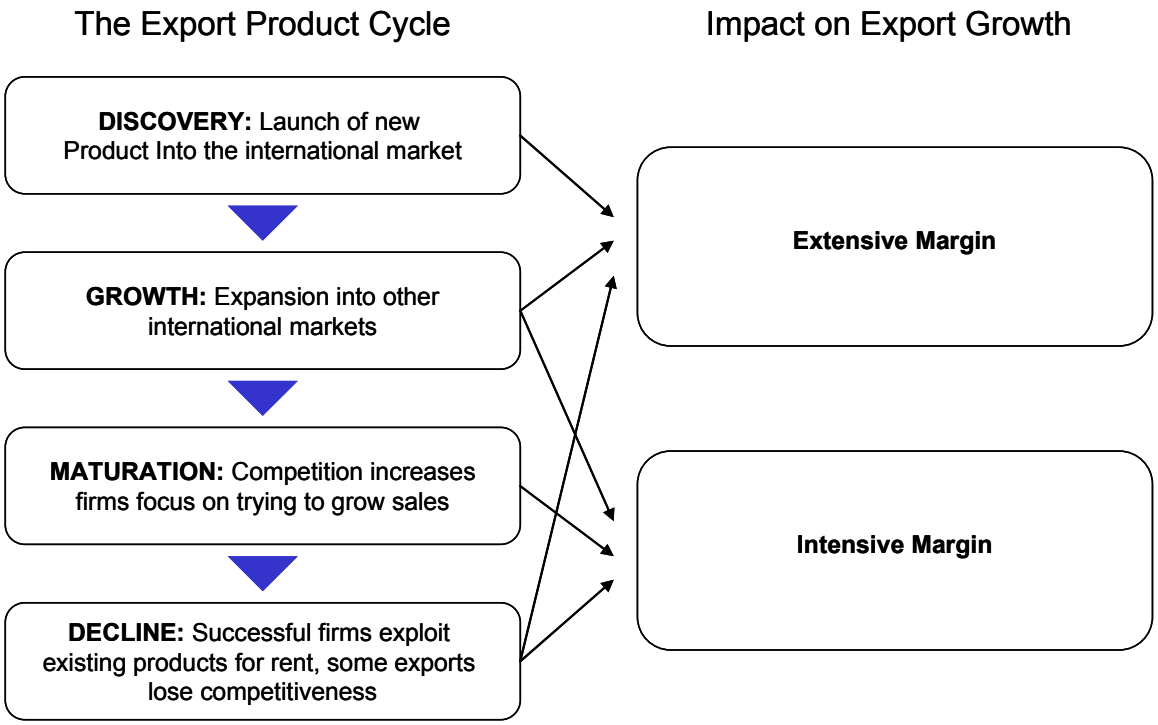
2.2.1 Export Diversification and Overall Export Growth

Brenton and Newfarmer (2007) decompose the growth in exports of a sample of 99 developing countries between 1995 and 2004 to observe the contributions of both the intensive (growth in exports of existing exports to existing markets) and extensive margins (growth of exports due to new product varieties being exported or existing exported products being exported to new markets). Figure 2.1, adopted from Brenton and Newfarmer illustrates the impacts of each stage of the export product cycle on these two

[3] Lederman and Maloney (2003) measure export diversification using a Herfindahl concentration index calculated using 4 digit SITC data, and also by calculating the share of natural resources to exports

key components of export growth. The stages of the product cycle which developing countries are more likely to be focused on, discovery (the establishment of new product export relationships) and growth, are both linked towards the extensive margin. As a result it could be expected that diversification may be higher in developing countries. Furthermore, this figure also highlights the importance of export diversification towards overall export growth.

Figure 2.1 Components of Export Growth



Brenton and Newfarmer find that on average, the intensive margin accounts for 80% of the total growth in exports while the extensive margin accounts for 20%. However, the extensive margin is more significant in the developing nations in their sample, where it accounts for 35% of total export growth. This number is higher at 57% for African nations. Evenett and Venables (2002) arrive at a similar result estimating that a third of export growth was accounted for by exporting existing exported products to new markets.

Freund and Pierola (2008) take a different approach and study 92 periods of sustained export surges across a range of countries to understand the driving forces behind these

surges. They find that 25% of the growth in exports in the developing countries in their sample during these periods was accounted for by new products and new markets highlighting the importance of diversification and the extensive margin.

Overall, most studies examining the components of export growth find that while the intensive margin accounts for the majority of observed growth, the extensive margin is also very significant, especially in developing nations. An understanding of the drivers of the extensive margin is fundamental to understanding the drivers of export growth.

3 Literature Review

Fundamental to understanding any relationships between FDI and export diversification is an understanding of the factors which drive export diversification and explain the patterns of trade between nations. I firstly consider the literature on export diversification before then discussing literature on FDI and the links between the two.

3.1 Export Diversification: Theoretical Perspectives

The acceleration of global trade in the later half of the 20th century saw patterns of trade vastly differing to those predicted by classical trade theories built around perfect competition, comparative advantage and constant returns to scale (Krugman, 1980). These models were unable to explain the quantum of trade of similar, but differentiated products between similar nations. Krugman proposed a '*new framework*' for analysing trade which addressed economies of scale, costless product differentiation and monopolistic competition. Under these conditions, even similar economies have the potential to gain from trade due to scale economies for each differentiated good. Each good will only be produced in one country and the world economy experiences a broader range of products. Krugman's model also found that after introducing trade costs, countries were more likely to export goods for which they have large domestic markets, and, where large domestic markets were not present (i.e. in smaller economies), those countries will need to compensate through lower wages. In the 80's and 90's, new firm level data revealing that firms within an industry were heterogenous and that only the most productive tended to export (Clerides, et. al., 1998 and Bernard and Jensen, 1999) began a move towards firm level models for explaining export patterns (known now as the '*new, new trade theories*').

In his pioneering model, Melitz (2003) introduced firm heterogeneity by allowing firms to differ in terms of productivity. Firms pay an up-front cost allowing them to discover their level of productivity. A further fixed cost is payable if the firm chooses to produce for the domestic market (for the establishment of facilities and overheads). Given a level of demand, only firms who are productive enough to be able to recover their fixed cost and break even will choose to produce domestically. A further fixed cost is payable for entry into the export market (for example to establish foreign distribution networks and learn about foreign standards) together with a variable cost on each unit reflecting the transport costs. Baldwin (2005) proposes a downward sloping productivity density function to describe the structure of a typical industry with fewer firms in the high productivity category. From this density function, and due to the additional fixed and variable costs of exporting, it becomes clear that only the most productive firms will choose to export, and in many industries, there may not be any firms which are productive enough to export at all.

Melitz's model yields rich predictions capable of explaining a number of the patterns observed in international trade including the presence of significant zero trade flows between nations, and the extensive trade of similar but differentiated goods between similar nations. Export diversification as described in section 2.1 can be easily interpreted within the Melitz framework. If a firm begins exporting a product variety between a given country pair, where no other exports of this variety have occurred, then the exporting nation has diversified into the new product variety. In the framework of the model, this means that a firm in the exporting country has now become productive enough to be able to profitably export.

The model yields a number of possible factors which may drive this shift including:

- A change in the industry productivity distribution (with at least one firm now productive enough to profitably export)
- A reduction in the fixed costs of exporting (which would reduce the productivity threshold above which a firm can profitably export)
- A reduction in the variable costs of exporting
- A change in the demand characteristics for the particular product variety

I provide more detail on these factors in section 4.1 where I characterise the model however this initial summary is necessary before considering the literature on FDI. When aiming to understand if FDI may influence export diversification, the effect of FDI with regards to the factors listed above should be considered.

3.2 FDI and Export Diversification

The literature considered in section 3.1 above described a few possible drivers of export diversification. I now consider the literature on FDI, with particular attention to whether FDI may be able to influence any of the potential drivers of export diversification especially links between FDI, the distribution of firm productivities and the fixed costs of exporting.

FDI may be motivated for the purpose of starting a firm in a low-cost nation solely for serving an export market. Ekholm, Forslid and Markusen (2007) recognize that not all FDI is driven by foreign firms aiming to substitute exports to a local market through local production. They suggest that some FDI may instead serve the purpose of exporting to a third country market through the establishment of an export-platform in the FDI recipient nation. In 2000, they present evidence that about two-thirds of the 36% of production of US foreign affiliates which was exported, was exported to third countries (other than the US).

Ekholm, Forslid and Markusen develop a three country model and show that under certain circumstances, FDI affiliates may be established to produce solely for exporting to third countries (i.e. not for domestic consumption in the FDI origin or recipient countries). They find that this is probable when a firm in either of two high income nations use a plant in a smaller low wage nation to serve the other high income nation. Furthermore, this is more probable if the low income nation is part of a trade-block (such as the EU) with the other high income nation thus providing lower cost access to the other high income market. They also find that their model provides a theoretical

explanation for the empirical observations that affiliates located outside of larger free trade areas do not solely concentrate their exports to third countries, but divide them across both the FDI origin nation and third countries (they find empirical support observing US affiliates in South-East Asia).

The theory presented in Ekholm, Forslid and Markusen forms a direct link between FDI and the growth in exports, some of which may be to new markets or on new industries thus resulting in export diversification. The presence of a higher-productivity export-platform foreign affiliate could represent a direct change in the distribution of firm productivities in an industry. I next examine further linkages in the literature between FDI and productivity, and the fixed costs of exporting.

In aiming to relate country characteristics to the trade and investment behaviours of firms, Markusen (2000) concludes that multi-national corporations (MNCs) only choose to incur the significant costs involved with establishing a foreign affiliate if they have offsetting benefits which put them at an edge to local and other competitors. He describes these benefits collectively as the "*knowledge capital*" brought by the MNC which is defined to include the "*human capital of the employees, patents, blueprints, procedures, and other proprietary knowledge, and finally marketing assets such as trademarks, reputations, and brand names*" [4]. Similarly, Gorge and Greenway (2004) also suggest that at the very least, MNC's should bring better management, process practices or technology to be viable in foreign markets.

Much of the literature on FDI has focused on whether this '*knowledge-capital*' could spillover beyond the local affiliates of the MNCs to other firms in the same industry and other industries, contributing to higher levels of productivity or market knowledge. Such spillovers could induce a change in the distribution of firm productivities, potentially leading to export diversification.

Markusen and Venables (1999) develop a theoretical case suggesting that FDI could act as a catalyst for local industry development. They propose that over time, the local

[4] Markusen (2000), p 3

industry may even develop so fast that they overtake the MNCs in competitiveness and size. Their model is based on a competition effect where the foreign entrant increases competition in the industry forcing domestic firms to increase efficiency, and a backward linkage effect where the foreign entrant boosts demand for intermediary suppliers helping them to grow and generate scale economies. The authors look to East Asia for empirical evidence citing the developments in quality and productivity of local intermediary suppliers. Blomstrom and Kokko (1998) conduct a wide review of studies on spillovers from MNCs and also find evidence in support of spillovers to local firms, however noting that too few studies have explicitly reviewed this area to confirm the magnitude of such effects with confidence. They suggest a role for competition effects similar to Markusen and Venables, while also adding that vertical linkages, demonstration effects and the training of local employees may also serve as important channels for spillovers.

While Markusen and Venables and Blomstrom and Kokko find support for spillovers from FDI, Kugler (2005) and Crespo and Fontoura (2007) present a more sceptical review of the literature. In a study on FDI in Venezuela, Aitken and Harrison (1999) also found limited support for the spillover argument.

However, Kugler then explains that the limited evidence may be a circumstance of the fact that most studies sought to find empirical support for intra-industry spillovers, which intuitively, MNC's would be seeking to avoid as they protect their investments from rent erosion. In reconciling the mixed empirical evidence on spillovers, Kugler suggests that potentially only inter-industry spillovers could be justified in theory. Kugler supports this argument through the effects of forward linkages, backward linkages, and competition similar to those described in Markusen and Venables (1999) together with selection effects where only the more productive domestic firms survive. Using longitudinal data in the Columbian manufacturing sector, the paper then found evidence of inter-sectoral FDI spillovers as predicted by the theory.

Gorg and Greenaway (2004) arrive at a similar conclusion that evidence of spillovers is at best mixed at an aggregate level, also stating that some studies have in fact found a negative correlation. They note, however, that studies with disaggregated data have

proved more promising suggesting that spillovers occur to only some firms, especially those with a high 'absorptive capacity' or who are located close to the multinationals. Similarly to Kugler, they also conclude that more pronounced effects of spillovers may be found between industries (inter-industry) rather than within the same industry.

Saggi (2002) provides a comprehensive review of the studies on FDI and technology spillovers from MNCs to date. He also argues that foreign investors would have an interest in protecting their innovations and technology from diffusion to competitors limiting the scope for such spillovers. Nevertheless, he notes that such protection can be costly or impractical and also that theoretical and empirical studies have found a basis for potential technology spillovers through demonstration effects, labour turnover, and vertical linkages, similar to the channels identified in Markusen and Venables. The extent of such diffusion is likely to depend heavily on the absorptive capacity of local firms too. Furthermore, he suggests that vertical spillovers (such as those resulting through backward linkages between MNC's and their suppliers) are more likely than horizontal spillovers, and that these are also in the interests of the MNC. Saggi suggests that despite the mixed empirical evidence on technological spillovers (partly due to difficulties in measuring this effect), there remains strong support for other positive externalities which could reduce the cost of exporting for other local firms such as improvements to infrastructure. A number of other studies also describe the potential for such non-productivity orientated spillover effects.

Crespo and Fontoura (2007) describe how domestic firms may learn about export markets from the local affiliates of MNCs (or simply imitate or collaborate with them) and begin exporting. This implies a reduction to some of the key fixed costs of establishing an export market including the costs of forming distribution networks, and learning about consumer's tastes and preferences and regulatory conditions.

Aitken, Hanson and Harrison (1997) also propose that the probability of a domestic firm exporting increases with its proximity to MNCs due to the informational spillovers that the MNCs may unveil about foreign consumers, technology, and distribution. Using data from Mexican firms, they test their hypothesis that MNCs may act as export catalysts and

yield empirical support. The possibility of such '*market access spillovers*' was also documented by Blomstrom and Kokko (1998). Rhee (1990) makes a more dramatic postulation after examining the effects of investments by the Korean MNC Daewoo into Bangladesh which effectively jump started Bangladesh's multi-million dollar textile export industry. A significant feature in the expansion of the textile industry was the turnover of trained local labour from the MNC to local businesses. The paper postulates that the export success of the textile industry was the catalyst steering the country towards an outwardly orientated industrial development path, similar to many other East-Asian nations which also began with basic outwardly orientated industries like textiles before advancing.

Kokko, Tansini and Zejan (1997) present an interesting case of evidence for Uruguay supportive of both the productivity spillovers and export learning. In a study of 1,243 manufacturing firms, they found that industries with import-substituting MNCs (established before 1973) were associated with higher overall labour productivity, while industries with MNCs established after 1973 (during the outward-orientated period) had higher likelihoods of exporting.

Overall, the literature supports the possibility of FDI directly leading to the establishment of exporting firms, having positive productivity enhancing spillovers to other firms, and providing informational '*market access*' spillovers which may reduce the fixed costs associated with exporting. The empirical evidence of these effects is however mixed partly due to measurement difficulties and limited information.

While the theoretical and empirical relationships between FDI, productivity and other spillovers have been explored in a number of studies, I was only able to find one empirical study linking FDI and export diversification. Banga (2003) studies the export-intensity of domestic Indian firms and finds that the presence of US and Japanese MNCs in the same industry, and increased levels of FDI from the US and Japan are correlated with increased export intensity. While concluding that FDI has a significant effect on export diversification, he also notes that the source of the FDI is also an important consideration with the US originated FDI having a stronger contribution towards

diversification. While Banga presents a rare empirical study linking FDI and export diversification, such a relationship has been documented in a number of qualitative case studies.

OECD (2003) describes FDI as playing a vital role in the diversification of Chilean and Costa Rican exports. It also reports how FDI was responsible for a transformation of Kenya's horticultural industry making it more export competitive. The Costa Rican example is discussed in more detail in Rodrígues (1998). He notes that the US Agency for International Development (USAID) was instrumental in establishing a private sector foundation to attract FDI. Costa Rica subsequently received significant investments from US chipmaker Intel and other companies and has successfully diversified its export base since. Similarly, Wells (1993) describes how foreign capital and MNCs made a large contribution towards the growth of non-traditional exports in Indonesia.

3.3 Export Diversification: Empirical Perspectives

A number of empirical studies have explored the patterns and drivers of export diversification. The relationship between per capital income and diversification was found to follow a U shape by Carrère, Strauss-Kahn and Cadot (2007) who showed that countries tend to diversify their export bases as they grow from low income to middle income nations, but then begin concentrating their exports after reaching a high income level. Their study confirmed the non-monotone relationship between sectoral diversification and income per capital found by Imbs and Wacziarg (2003). These findings seem intuitive given the frameset of the export product cycle described in Figure 2.1 where developing nations were expected to experience a higher level of diversification.

While the papers discussed above primarily focused on relationships between GDP and diversification, only a few papers have attempted to use a broader range of economic variables to estimate the pattern of diversification. Amurgo-Pacheco and Pierola (2008) use highly disaggregated bilateral trade data and find that export diversification patterns

can be estimated using a gravity equation with diversification being positively correlated with the origin and destination market size and lower trade costs. Trade costs were proxied through a dummy variable indicating the presence of a trade agreement between an exporter and an importer and a variable measuring the distance between the countries. These results support the predictions of the Melitz model. Dennis and Shepherd (2007) provide further support. They found that a 1% decline in export costs was associated with a 0.3% rise in diversification. Furthermore, they include a set of policy variables to estimate the costs of business in a foreign market from the World Bank's 'Doing Business' database and find these to also be significant. Freund and Pierola (2008) also find an important role for the exchange rate. Studying 92 episodes of strong and sustained export growth, they find that exchange rate depreciations can significantly boost export diversification.

Other indicators of the strength of the macroeconomic environment are also significant in influencing diversification (Bebczuk and Berrettoni, 2006). In a cross sectional study (which included developed nations), they found that indicators including access to credit, the quality of infrastructure, and the gross investment ratio were all significantly associated with less export diversification, possibly due to the effects noted in Carrère, Strauss-Kahn and Cadot (2007) whereby economies tend to concentrate their exports after a certain level of development. Interestingly, Bebczuk and Berrettoni also include FDI as one of their measures of "macroeconomic efficiency and strength" but provide no explanation on the statistical insignificance of its estimator. It may be possible that their measure of export diversification (a sectoral Herfindahl index[5]) was simply too aggregated to pick up every new product line or destination that their sample nations may have diversified to. Furthermore, it is also possible that they may not have considered sufficient lags of FDI.

Bebczuk and Berrettoni also include the share of fuel exports as an independent variable and find that it is significantly positively correlated with export concentration, consistent with the "Dutch Disease" effects suggested by papers such as Lederman and Maloney (2007). Sachs and Warner (2000) also arrive at a similar conclusion while summarizing

[5] The Herfindahl index measures the concentration of exports through calculating the sum of the squared shares of each aggregate industry's share of total exports.

that the main disadvantages of large natural endowments is that it may pull employment out of the manufacturing sector, limiting the economy's ability to benefit from the positive production spillovers (including learning induced growth and backward linkages) created by the manufacturing sector. Sachs and Warner also summarise a range of literature on this topic suggesting that natural resource abundance may also be associated with higher corruption and inefficient bureaucracies, and that governments may have less incentive to develop 'growth supporting public goods' such as infrastructure and legal codes due to the high rents they may earn from the natural resources. These arguments are not difficult to fathom given the poor development performance of numerous resource rich low income nations such as Nigeria.

While generally supporting the theoretical model developed by Melitz, the findings from these empirical studies also provide guidance on which variables to include when aiming to empirically estimate export diversification. I describe my detailed econometric considerations in section 6.

4 Modelling Export Diversification

4.1 The Melitz Model

Given the rich and empirically testable predictions it yields, its flexibility and its simplicity, I build my theoretical discussion on Melitz's (2003) model. Melitz builds on the works of Krugman (1980) and Hopenhayn (1992) and his model has been used as the basis of a number of key theoretical and empirical studies into trade and export diversification including Baldwin (2005), Amurgo-Pacheco and Pierola (2008), and Helpman, Melitz and Rubinstein (2006).

I now characterize a simple firm level model based on Melitz which I discussed in the literature review (section 3.1). My description of the Melitz model is based closely on the discussion provided in Helpman (2006). Consider a monopolistically competitive industry which supplies a differentiated product, and where firms are heterogeneous in their productivity and produce a particular brand. Assuming a constant elasticity of substitution consumer utility function resulting in a 'love for variety', the demand for firm i's brand can be derived to be,

$$x(i) = Ap(i)^{-\varepsilon}, \tag{4.1}$$

where the quantity demanded is represented by x, the price by p, and other factors relating to the level of domestic demand (including income levels) may be captured in A. A is treated as being exogenous due to the marginal size of each firm. The constant demand elasticity is given by $\varepsilon = 1/(1-\alpha)$ where $0 < \alpha < 1$ implying that $\varepsilon > 1$.

After incurring an initial 'discovery' cost, a firm discovers its own productivity expressed here as $\theta(i)$, which can be thought of as the units of output per labour unit. The variable production cost per unit of output can then be expressed as $c/\theta(i)$ where c represents the

cost of a unit of the resource upon which productivity is expressed (for example labour in this case). Letting f_D express the fixed costs of domestic production in terms of units of resources, the fixed costs of domestic production can then be denoted as cf_D. The firm's profit function can then be written as follows,

$$\pi(i) = p(i)x(i) - \frac{c}{\theta(i)}x(i) - cf_D . \tag{4.2}$$

Substituting equation 4.1 into the profit function and then maximising with respect to $p(i)$ yields the firm's optimal price level,

$$p(i) = c/\alpha\theta(i). \tag{4.3}$$

Substituting 4.3 into 4.1 allows the demand function to be expressed as,

$$x(i) = Ap(i)^{-\varepsilon} = A\left(\frac{c}{\alpha\theta(i)}\right)^{-\varepsilon} . \tag{4.4}$$

Substituting 4.3 and 4.4 into 4.2, the profit function can then be expressed as,

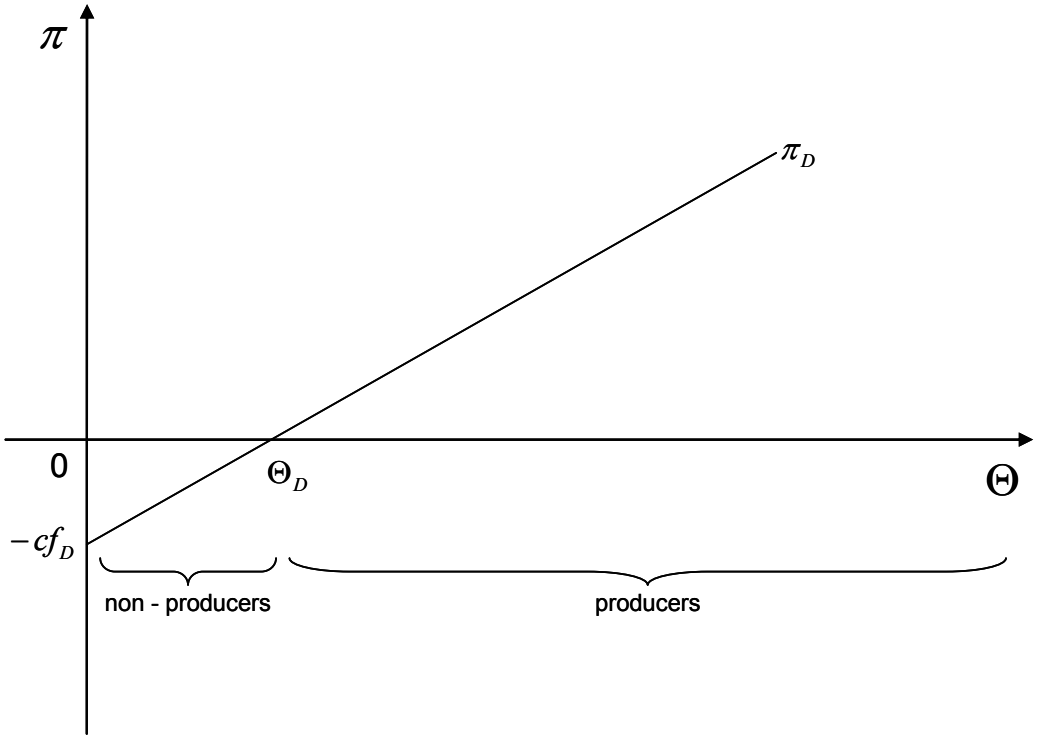
$$\pi(i) = \theta(i)^{\varepsilon-1}B - cf_D , \tag{4.5}$$

where the exogenous market demand conditions are grouped into one term $B \equiv (1-\alpha)A(c/\alpha)^{1-\varepsilon}$ for simplicity. In equation 4.5, profit is an increasing function of firm productivity and market demand and a decreasing function of fixed costs. The productivity measure can then be further condensed to $\Theta \equiv \theta(i)^{\varepsilon-1}$. The profit function can then expressed in productivity terms (instead of being in terms of the firm i) as firms only differ by productivity levels. The domestic profit function then simplifies to,

$$\pi_D(\Theta) = \Theta B - cf_D , \tag{4.6}$$

where D denotes domestic production. There then exists a productivity threshold level Θ_D below which domestic production would be unprofitable as the firm would not be able to cover its fixed costs. Firms which discover that their productivity is below this level will choose to not produce even for the domestic market as depicted in Figure 4.1.

Figure 4.1 The Domestic Production Decisions of Firms



This model can now be easily extended to describe export participation by allowing A to differ for each export market j while the demand elasticity remains constant. The export demand function then becomes,

$$x(i) = A^j p(i)^{-\varepsilon}. \tag{4.7}$$

There also exist variable costs of trade[6] τ which can be described in the 'melting iceberg' fashion where $\tau > 1$ units of the product must be shipped for every one unit sold

[6] Variable costs of trade include transport costs, tariffs, insurance and other fees that may be associated with selling in a foreign market.

in the export market. The fixed costs associated with establishing an export market are f_X. Assuming that the fixed costs of exporting are greater than those incurred for establishing a domestic market, $f_X > f_D$, the export productivity threshold will be higher than the domestic production threshold $\Theta_X > \Theta_D$ (these also take into account the effect of the trade costs τ) and only the most productive firms will be able to profitably enter the export market (as such, not all firms producing domestically will export). If a firm exports to a destination market j it can then earn extra profits equal to,

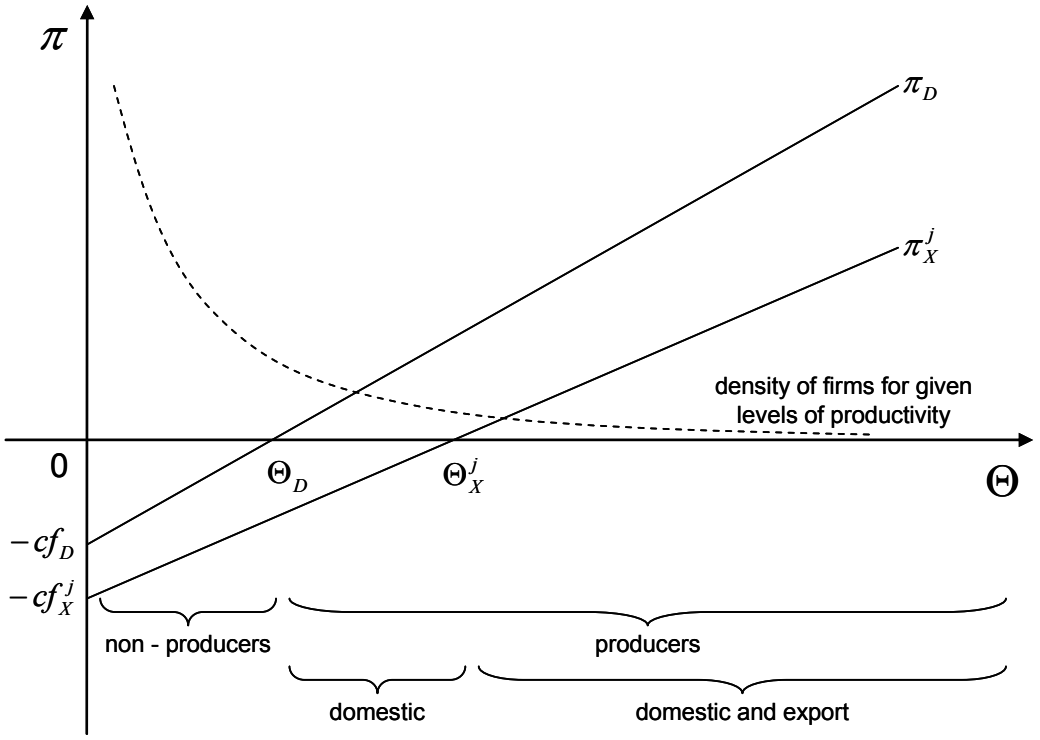
$$\pi_X^j(\Theta) = \left(\tau^j\right)^{1-\varepsilon} \Theta B^j - cf_X^j, \tag{4.8}$$

where $B^j \equiv (1-\alpha)A^j(c/\alpha)^{1-\varepsilon}$.

Figure 4.2 allows for the exogenous demand variables of the export market and the domestic economy to be equal (i.e. let $B^j = B$) for illustrative purposes to demonstrate the differences between the profit functions. For clarity, a cumulative density function of firms for each level of productivity has also been included. Baldwin (2005) introduces such a function to describe that there are fewer 'higher productivity' firms, and more 'lower productivity' firms. The density of the number of firms is thus decreasing with productivity[7].

[7] See Baldwin (2005), p. 7 for a full description of the density function.

Figure 4.2 Exporting and Non-Exporting Firms when Demand is Constant in the Domestic and Export Markets



It is clear that the export profit function is flatter due to the higher variable costs incurred and captured by τ. Furthermore, the y-axis intercept is lower due to the additional fixed costs of exporting which are captured in cf_X^j. As a result the previously described condition $\Theta_X > \Theta_D$ is also clear. The model can be easily extended to a number of foreign markets j, each with unique τ^j's, cf_X^j's and B^j's and unique export productivity thresholds Θ_X^j's.

4.2 Interpreting Export Diversification in the Model

Melitz (2003) does not address export diversification or its drivers explicitly. However, export diversification as described in section 2.1 (the commencement of the export of previously non-exported products, or the export of currently exported products to a new market), can be easily interpreted within the Melitz model.

Consider a simple three world economy, with the domestic country, and two potential export markets, the US and Japan and one product, coffee beans. The domestic firm faces different fixed costs of exporting for each of these markets and different variable unit trade costs. Holding the domestic demand factors to be equal, there are then two differing export productivity thresholds, one for each market. For this illustrative example, if we arbitrarily assume that $\Theta_X^{JAPAN} > \Theta_X^{US} > \Theta_D$, then it is clear that only the most productive firms will be able to export to Japan, the US and sell domestically, while some will export to only the US and sell domestically, while some will only sell to the domestic market. The export patterns of the domestic firms and the presence of any firms in either of the export markets will depend on the unique distribution of the exporting nations' firms' productivities. A high productivity nation may have firms capable of exporting to Japan while a low productivity nation may have no firms which are productive enough to export or produce for the domestic market.

Given this framework, diversification could now be represented easily:

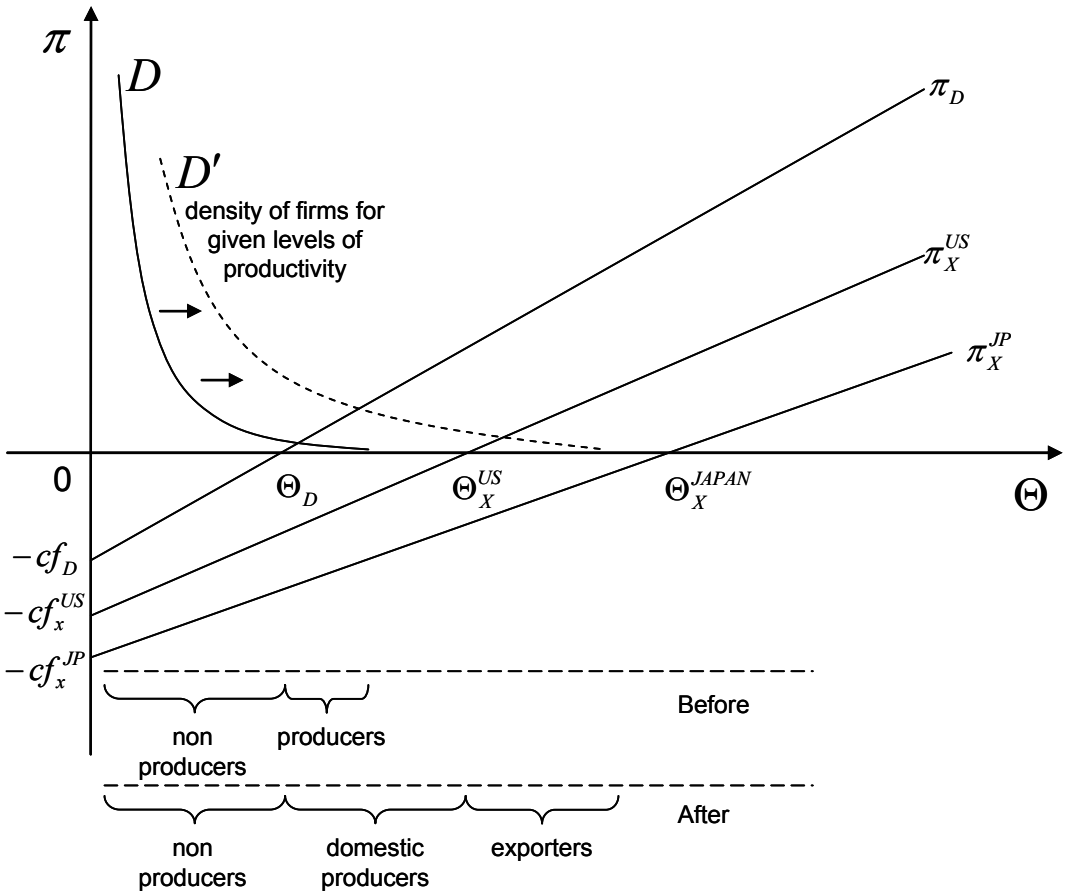
- If a nation that was not exporting a certain product, now begins exporting that product, then it would be diversifying its exports into a new product and a new market.
- If a nation which is already exporting a product to one market, then begins exporting that product to another market, then it has diversified its markets.

From equation (4.8) it is evident that a number of factors may drive these diversification events[8]. These include:

1. A change in the productivity density structure of the particular industry in the country so that there are now firms with productivities $\Theta > \Theta_X$. This effect is illustrated in Figure 4.3 where, following a rise in productivity, some firms are now export competitive in the US market. Further increases in productivity may see some firms eventually competitive in the Japanese market too.

[8] These are the same outcomes suggested in the brief overview of the Melitz model presented in the literature review in section 3.1.

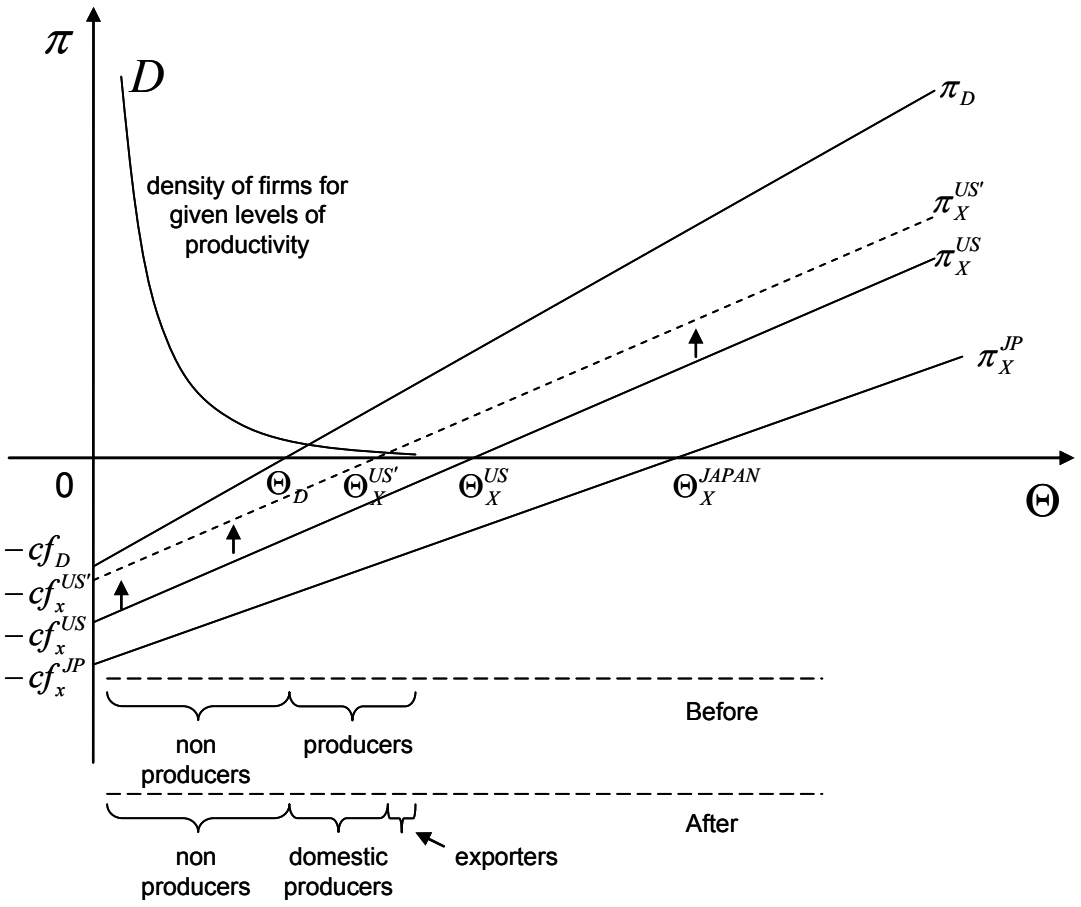
Figure 4.3 Export Diversification through a Change in Productivity



2. A decrease in either the iceberg (variable) trade costs or the fixed costs of entering the particular export market. A change in the variable costs of trade would change the slope of the export profit function, while a change in the fixed costs would change its intercepts. Figure 4.4 illustrates how a change in fixed costs may also make some firms export competitive (in this case for the US market).

3. A change in the exogenous demand factors in the export market B^j may also drive export diversification by increasing demand for the firm's product, and thus reducing the productivity cut-off for exports to be profitable. An increase in B^j would result in a steeper profit curve and potentially make some firms more export competitive.

Figure 4.4 Export Diversification through a Change in Fixed Costs



4.3 Interpreting the Theoretical Effect of FDI on Export Diversification

The direct and spillover effects of FDI discussed in the literature review (section 3.2) have a number of potential linkages to the three drivers of export diversification derived from the Melitz model above namely, a change in the productivity density (Figure 4.3), a decrease in exporting costs (Figure 4.4), and a change in demand factors.

Papers on FDI discussed in the literature review suggested that FDI may lead to productivity spillovers in the host nation through increasing competition, demonstration effects and backward and forward linkages. If these effects indeed result in a change in

the productivity of firms in the FDI-hosting nation, then the productivity density changes described in Figure 4.3 may be plausible leading to export diversification in some instances.

The FDI literature also described effects such as *"market access spillovers"* where firms learn about foreign markets and thus reduce their export discovery costs, a vital component of the fixed costs of establishing export markets. Figure 4.4 showed that such an effect may also lead to export diversification in some instances.

Furthermore, the literature review also described that some foreign firms may invest to establish an export platform, which also may be represented as a change in the productivity density in an industry as a new foreign-invested export platform firm enters the market (similar to Figure 4.3 where the foreign entrant would be the higher productivity firm establishing operations, thus stretching the density function to the right). An important consideration with each of these effects is their timing, as there may be significant lags between the initial investment of the FDI and the spillovers. It may take many months to build a factory for example, and then several more months before local competitors are able to improve their efficiency and then several more months before other firms learn that their products may also be successful in the foreign market.

This paper is thus able to propose a theoretical linkage between FDI and export diversification in low income nations, through the use of a widely accepted trade model and a number of studies on the effects of FDI. To my knowledge, this is the first paper to propose such a linkage and then proceed to attempt to estimate it empirically as well.

5 Data

There is no existing comprehensive single database containing all the country or bilateral level data required for an estimation of the effects of FDI on export diversification. To facilitate the empirical investigation, I create two rich panel datasets comprising of 29 nations over a period of 17 years with a number of country and bilateral explanatory variables. One of these datasets contains aggregate country level data using the count of the country's exported varieties as the dependent variable (construction of this variable will be discussed in section 5.2). The other dataset disaggregates this data on a bilateral level using country pairs for each individual in each panel. This dataset thus has 609 *"individuals"* or exporter-importer country pairs (29 exporters and 21 importers), and allows for analysis using explanatory variables specific to each country pair such as the distance between countries and the importing nation's income levels.

Table 5.1 Datasets Created

	Bilateral	Aggregate
Individuals	Country Pairs	Export Countries
No. of Individuals	609	29
Time Periods	17	17
Observations	10,353	453
Other Variables	• Importer's GDP • FDI stock • Exchange rate vs. USD • Trade Agreement • Distance between countries • Historic colonial ties • Common language • North – is the importer a developed nation? • Landlocked • High share of oil or mineral exports	• Sum of all importer's GDPs • FDI Stock • Exchange rate vs. USD • No. of importers with which the exporter has a trade agreement with • Landlocked • High share of oil or mineral exports

5.1 The Primary Dataset

Consistent with many recent studies on export diversification (including Amurgo-Pacheco and Pierola (2008), Brenton and Newfarmer (2007), Klinger and Lederman (2004)), this paper uses the United Nation's Commodity Trade Statistics Database (COMTRADE) prepared by the United Nations' Statistics Division. COMTRADE is the largest database of international trade statistics with harmonized data from over 140 countries. This study uses the Harmonised Standard 1988 (HS0) system of product classification developed by the World Customs Organisation as it provides harmonized data at a highly disaggregated (6-digits with approximately 5000 product categories) level of classification since 1990. All subsequent years and revisions of the HS are also converted back to the HS0 system for consistency. The bilateral trade values are reported in US dollars at the time of the transaction.

In many developing countries, poor data collection and customs infrastructure lead to inaccurate classifications and thus the incomplete recording of export data. To ensure accuracy, this study constructs bilateral export flows data by mirroring import data from the import partners of the developing countries in the study, consistent with many studies in the same area including Amurgo-Pacheco and Pierola (2008) and Brenton and Newfarmer (2007). The downside to this is that due to the immense scale of the data required from all importing partner nations, this paper restricts the sample of import partners to 21 of the top importing nations in the world.

The 21 nations were chosen by firstly selecting the top 14 importing nations by value in 2006, and then selecting the largest importer in each sub-region which was not represented in the first 14 countries to ensure geographical distribution (Table 5.2). The raw data set thus results in a potential 52 million data points (5000 products by 21 importers by 29 exporters over 17 years). COMTRADE, however, reports only positive trade flows thus reducing the size substantially due to the presence of several zero trade flows.

Table 5.2 Import Partner Nations: Imports (US$bn 2006)

14 Largest Importing Nations		7 Regional Importing Giants	
Canada	$350	Australia	$133
China	$791	Brazil	$91
France	$530	India	$185
Germany	$922	Nigeria	$23
Hong Kong	$336	Russia	$138
Italy	$443	South Africa	$68
Japan	$579	UAE	$98
Korea	$309		
Mexico	$256		
Netherlands	$331		
Singapore	$239		
Spain	$330		
UK	$606		
USA	$1,919		

Source: COMTRADE

Table 5.3 shows the proportion of the sample countries' exports accounted for by the 21 import partner countries chosen. The selected import partners account for the majority (78% on average) of the exports of the sample countries. At least 49% of the sample countries' total exports in 2006 were accounted for by this study, except in Laos where the proportion was only 27%. The selection of the sample of exporting nations is discussed later. Figure 5.1 below displays the geographical distribution of the countries in the sample. As displayed, the majority of the exporting nations were located in West, Sub-Saharan and Eastern Africa, with four in the Asia-Pacific, four in Latin America and one in the Middle East.

Figure 5.1 Map of the Sample Countries

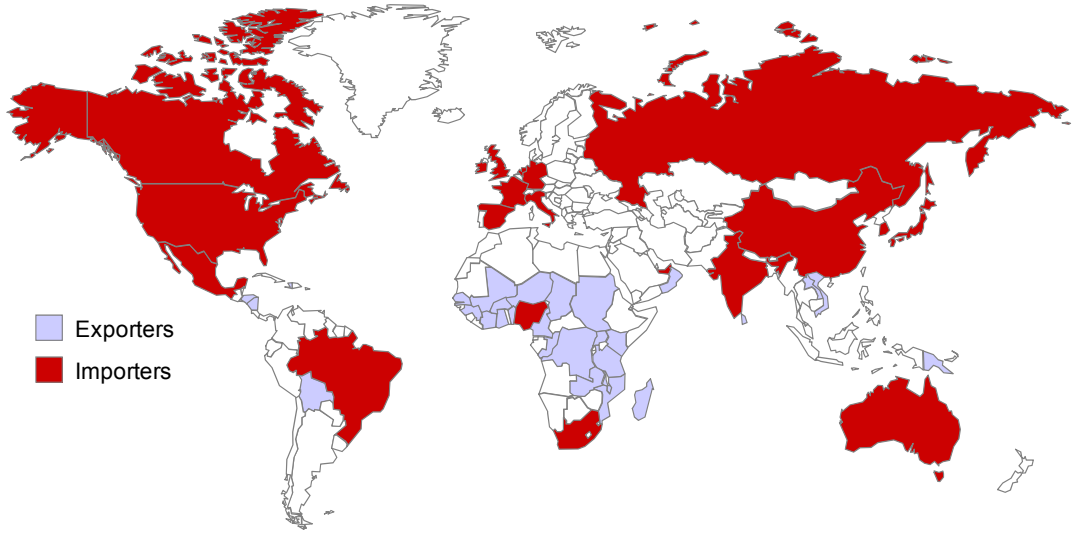


Table 5.3 Exporting Nations: Exports (US$m 2006)

Exporter (code)	Total Value of Exports	Exports Included in Study	Proportion
Benin (BEN)	618	301	49%
Bolivia (BOL)	3,418	2,469	72%
Burkina Faso (BFA)	346	234	68%
Cameroon (CMR)	4,718	4,029	85%
Chad (TCD)	2,456	2,373	97%
Congo, Rep. (COG)	8,500	7,600	89%
Congo, D.R. (ZAR)	1,476	723	49%
Côte d'Ivoire (CIV)	5,936	4,305	73%
Ghana (GHA)	2,697	1,800	67%
Guinea (GIN)	1,546	1,166	75%
Haiti (HTI)	582	547	94%
Honduras (HND)	5,191	4,553	88%
Kenya (KEN)	3,328	1,762	53%
Laos (LAO)	1,044	280	27%
Madagascar (MDG)	1,168	1,049	90%
Malawi (MWI)	574	366	64%
Mali (MLI)	414	298	72%
Mozambique (MOZ)	2,563	1,358	53%
Nicaragua (NIC)	2,087	1,859	89%
Niger (NER)	387	367	95%
PNG (PNG)	4,311	3,750	87%
Senegal (SEN)	912	449	49%
Sri Lanka (LKA)	7,088	5,577	79%
Sudan (SDN)	6,079	5,496	90%
Tanzania (TZA)	1,572	864	55%
Uganda (UGA)	670	339	51%
Vietnam (VNM)	41,026	32,891	80%
Yemen (YEM)	7,529	5,762	77%
Zambia (ZMB)	2,543	1,567	62%
Total	120,779	94,133	78%

Calculated from UNCOMTRADE mirror import data in 2006

5.2 Measuring Export Diversification

As described in section 2.1, this paper adopts a widely used definition of export diversification as being the export of new product varieties to existing or new destination markets, or the export of currently exported product varieties to new markets.

A variety of methods have been employed in the literature for actually measuring export diversification. This paper follows Carrère, Strauss-Kahn, Cadot (2007) by calculating a

simple count of the number of positive (active) trade flows between country pairs in each year. However, such a count indicator is distorted by the presence of a number of bilateral trade flow categories with an only menial value of exports. These small values usually represent one-off trade relationships and are not representative of a longer term exporting capacity. Furthermore, their constant emergence and then disappearance induces a higher level of volatility in year on year counts of active export lines. As a result, I only include export categories with bilateral trade values greater than US$10,000. I adopt the lower export threshold value of US$10,000 from Klinger and Lederman's (2004) construction of a count of "new export discoveries" in which they counted exports of a value of less than US$10,000 as being insignificant. One potential issue with using such a minimum export value cap is that over a long time period, many export categories may move above the cap purely as a result of inflation. I test for this effect by indexing the cap to the US Personal Consumption Expenditures Index and find that the trends, kinks, rates of change, and inter-country differences are not significantly different and thus ignore the effect of inflation on the export value threshold.

One important caveat to my use of a count indicator based on the COMTRADE database is that the HS nomenclature was originally designed for tariff collection purposes and thus by design has an unequal number of product categories between various sectors. The effect of diversification may thus potentially be overstated in sectors such as textiles (where there are many sub-categories) while understated in sectors such as machinery. An important feature of this count data variable is that it is strictly positive and also contains a large number of zero values in the bilateral dataset (some country pairs may not trade at all during a certain time period).

5.3 FDI Data

FDI data is obtained from the World Investment Report compiled by the United Nations' Conference on Trade and Development (UNCTAD)[9]. The UNCTAD definition for FDI is:

"Foreign direct investment (FDI) is defined as an investment involving a long-term relationship and reflecting a lasting interest in and control by a resident entity in one economy (foreign direct investor or parent enterprise) of an enterprise resident in a different economy (FDI enterprise or affiliate enterprise or foreign affiliate). Such investment involves both the initial transaction between the two entities and all subsequent transactions between them and among foreign affiliates. A direct investment enterprise is defined as an incorporated or unincorporated enterprise in which the direct investor, resident in another economy, owns 10 percent or more of the ordinary shares of voting power (or the equivalent). However, this criterion is not strictly observed by all countries reporting".

FDI stock, the variable used in this study, is defined by UNCTAD as *"the value of the share of their capital and reserves (including retained profits) attributable to the parent enterprise, plus the net indebtedness of affiliates to the parent enterprises"*.

All data is presented in USD at current prices. Data on FDI is generally collected by national governments in the host nations and submitted to the UN's databases, raising the issue of measurement error. Many smaller nations, such as those studied in this paper, may not have the ability to accurately account for all FDI activity. Furthermore, the FDI data is aggregated, without any information on the use of FDI (such as which industry it is invested in) and the cause of the FDI.

[9] See UNCTAD, <http://www.unctad.org/Templates/Page.asp?intItemID=1890&lang=1>

5.4 Selection of Sample of Exporting Nations

For the two key variables of interest, exports and FDI, export data was available for all nations. Significant proportions of FDI data were however missing for many developing nations. To ensure a balanced panel, only countries with a full series of FDI data were considered. Furthermore, countries which may have been prone to higher levels of data inaccuracies due to ineffective administration or exceptional circumstances such a prolonged war were also removed (i.e. Zimbabwe, Ethiopia, Iraq, and North Korea). Following these filters, a sample of 29 nations remained. Nevertheless, many of these remaining countries had also experienced some form of turmoil at a point during the sample period.

As the study concentrates on the effects of FDI on export diversification in the poorest countries, a specific range of GDP and GNI per capita was defined from which the exporting sample countries were ultimately chosen. The GDP range was from US$3bn to US$60bn in 2006, while the GNI per capita range was US$700 to US$4,000 (2006 PPP). Table 5.4 below presents a summary of the sample nations' national accounts data which was obtained from the World Bank's World Development Indicators.

Table 5.4 Exporting Nations: GDP and GNI (2006)

Exporter (code)	GDP (US$m)	GNI p.c. (US$ PPP)	Exporter (code)	GDP (US$m)	GNI p.c. (US$ PPP)
Benin (BEN)	4,623	1,260	Malawi (MWI)	3,164	700
Bolivia (BOL)	11,452	3,840	Mali (MLI)	5,866	1,000
Burkina Faso (BFA)	5,771	1,080	Mozambique (MOZ)	6,961	670
Cameroon (CMR)	17,957	2,010	Nicaragua (NIC)	5,301	2,380
Chad (TCD)	6,300	1,150	Niger (NER)	3,597	630
Congo, Rep. (COG)	7,731	2,740	PNG (PNG)	5,579	1,730
Congo, D.R. (ZAR)	8,545	270	Senegal (SEN)	9,277	1,580
Côte d'Ivoire (CIV)	17,367	1,570	Sri Lanka (LKA)	28,281	3,840
Ghana (GHA)	12,715	1,230	Sudan (SDN)	36,401	1,740
Guinea (GIN)	3,204	1,140	Tanzania (TZA)	14,178	1,120
Haiti (HTI)	4,961	1,110	Uganda (UGA)	9,957	960
Honduras (HND)	10,756	3,370	Viet Nam (VNM)	59,835	2,310
Kenya (KEN)	22,479	1,440	Yemen (YEM)	19,082	2,120
Laos (LAO)	3,498	1,870	Zambia (ZMB)	10,886	1,140
Madagascar (MDG)	5,515	870			
Average GDP	12,456				
Average GNI p.c.	1,616				

5.5 Other Explanatory Variables

Data on nominal exchange rates was obtained from Datastream Advance 4.0. The exchange rate of each exporter against the USD was expressed as an index with 1990=1 in both datasets. Country-pair cross rate rates were not calculated for the bilateral dataset due to time limitations. GDP data was obtained from the World Bank's World Development Indicators database in nominal terms in current US dollars.

Data on Trade Agreements between nations was manually complied from the World Trade Organisation's website[10] and used to construct a dummy variable which was set to equal (1) from the year which the trade agreement took effect between a pair of nations. For the aggregated dataset, a count variable was created for each year indicating the number of import partners with which each exporting nation had a trade agreement with.

Distance data was obtained from the Centre d'Etudes Prospectives et d'Informations Internationales[11] (CEPII). The CEPII dataset contains calculations for each country pair of their 'weighted distances', or the distances between the largest cities in each country, weighted by the size of those cities.

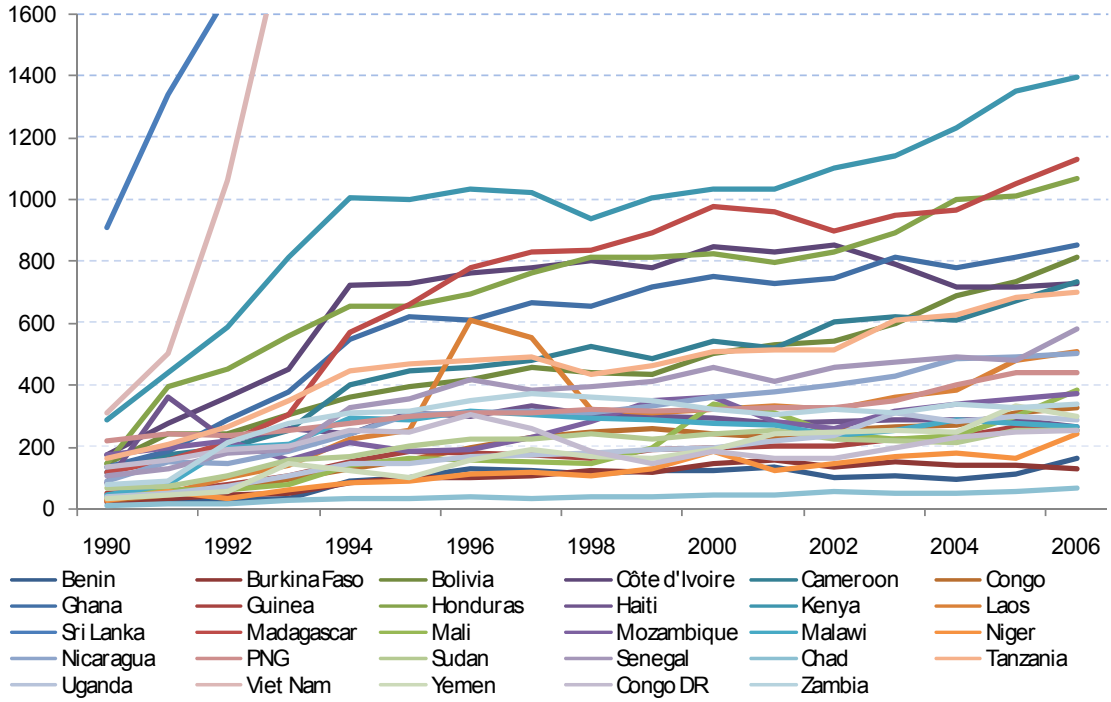
A number of dummy variables were also created. Dummies for all country pairs which shared a colonial history and for those with a common language were also obtained from CEPII. Further dummy variables were created for: all bilateral trade pairs where the importer was a 'north' or 'developed' country, which was set to be a country with GDP per capita greater than US$14,000; for all landlocked nations; and, another two for countries with a high proportion of oil or mineral exports, defined as countries for which oil or minerals accounted for over 40% of exports.

[10] http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx
[11] http://www.cepii.fr/anglaisgraph/bdd/distances.htm

5.6 Stylized Features of the Data

The measures of export diversification I have constructed for exporting countries from 1990 to 2006 are shown in Figure 5.2. Theoretically, each exporter can have a maximum of 105,000 (5000 product categories x 21 importing partners) bilateral export flows in each year. However, the average is about 615.

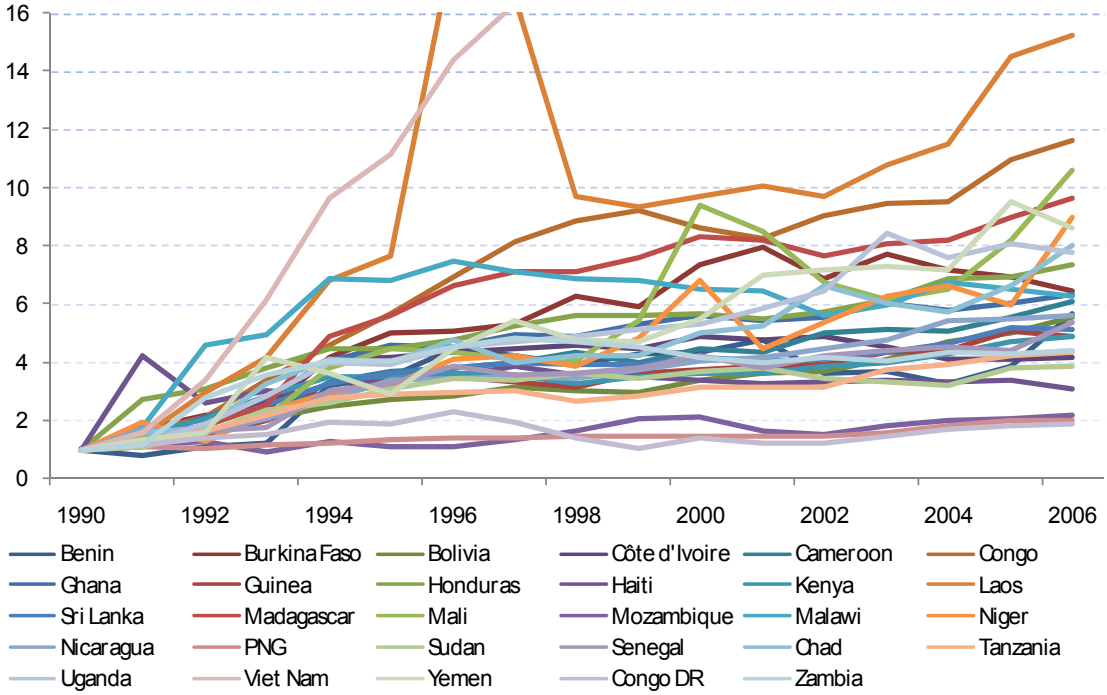
Figure 5.2 Counts of Bilateral Export Lines[12]



From Figure 5.2, it is clear that while most of the countries in the sample have experienced a trend of progressive diversification, the magnitude of their diversification patterns vary greatly. Furthermore, countries seem to diversify at different rates during different periods and there are a number of instances where particular countries experienced sharp rises in their export counts. This trend is even clearer in Figure 5.3 below where export counts are normalised by making the year 1990 equal to one:

[12] The Y-axis was capped at 1600 export lines as only two series went beyond this point, those of Vietnam and Sri Lanka. Vietnam ended with 11,369 export lines and Sri Lanka ended with 4,663 export lines in 2006.

Figure 5.3 Counts of Bilateral Exports (Normalised with 1990=1)[13]



The factors driving the vast observed differences between the patterns of export diversification, and the contribution of FDI towards these patterns, are the key focus of this study.

I next decompose the diversification patterns to observe the evolution of the number of importing partners which each of the sample countries exported to and the overall number of product categories which were exported by the sample nations. These results are presented in Figure 5.4 and Figure 5.5.

In simple numbers, products explain most of the growth in export diversification – after all, there are some 5,000 potential product categories in comparison to only 21 partner nations. This is also true in relative terms with exporter nations experiencing an average 421% increase in the number of products exported compared to an average 166% increase in the number of export partners between 1990 and 2006. Furthermore, most of the growth in export partners occurred between 1990 and 1996. Another notable observation is that there seems to be a lot more potential for diversification, with even the

[13] The Y-axis was capped at 16x the level of 1990 export lines as only one series went beyond this point, that of Vietnam which had a value of 36.6x 1990 levels in 2006.

most diverse exporter in the sample (Vietnam) only exporting 2510 product categories out of a potential 5000 in 2006.

Figure 5.4 Counts of Export Partner Nations

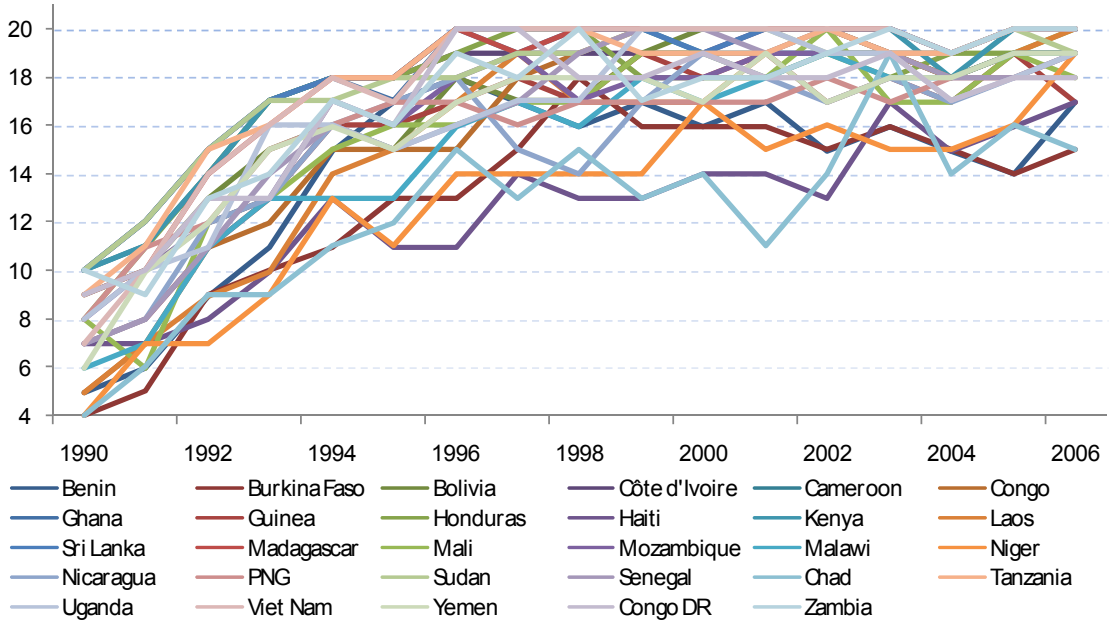


Figure 5.5 Counts of Product Categories Exported

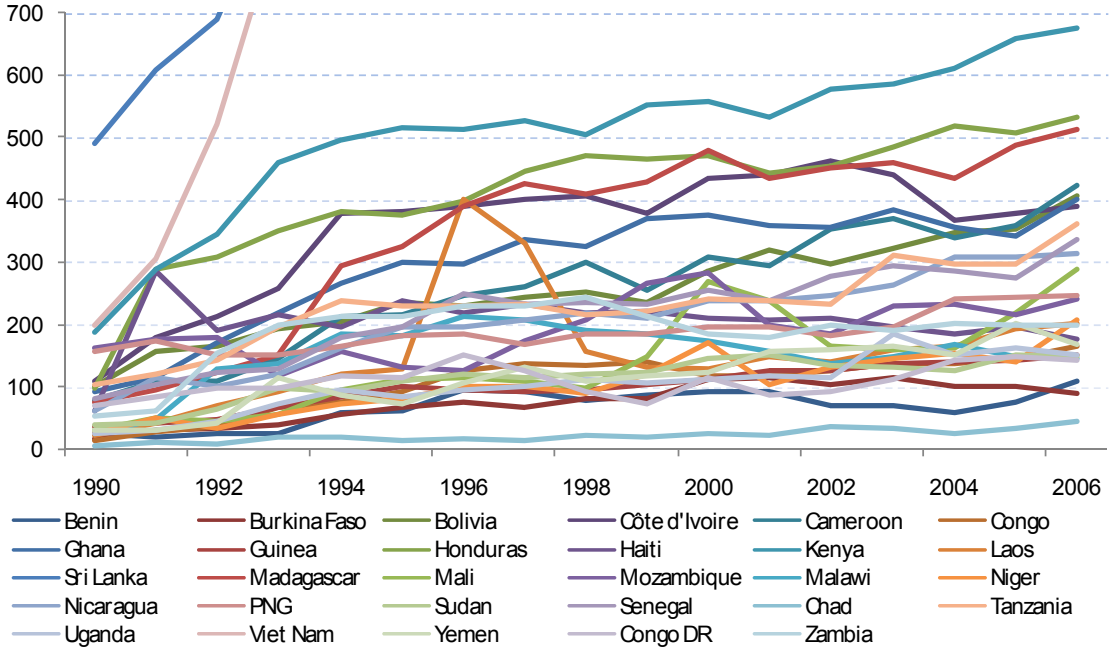
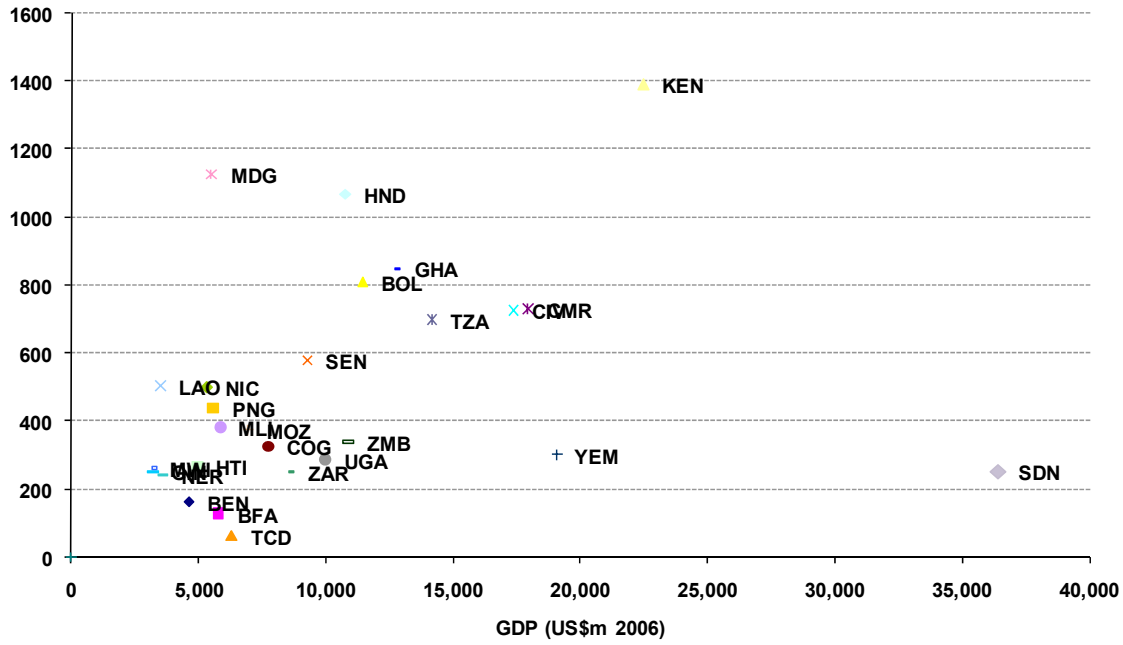


Figure 5.6 below plots the level of GDP against the number of bilateral export counts in 2006 for each of the sample countries. The figure seems to depict a positive correlation where countries with higher levels of GDP also have higher levels of export diversification, possibly confirming the validity of including GDP in the estimation of the model.

Figure 5.6 Export Counts and GDP (2006)[14]



Using the bilateral dataset, further patterns can be observed. Figure 5.7 below plots the GDP for importing partner nations against the count of bilateral export categories being exported to each of them from five of the exporting nations[15]. Consistent with previous studies, larger importers import a more diversified range of products resulting in higher export counts.

Figure 5.8 then plots the bilateral distance between exporter and importer pairs against the count of export categories exported between them for the same five countries. The

[14] Again Vietnam and Sri Lanka were not included on the chart as their values were much larger than the other nations and their inclusion would distort the scale clustering most of the other nations together. Nevertheless, their values followed a consistent pattern in line with the countries displayed portraying higher export counts for higher levels of GDP.

[15] Five of the largest exporters in the sample were used to construct this chart including Kenya, Madagascar, Honduras, Ghana and Bolivia.

figure depicts a negative relationship between the distance from the export market and the number of categories exported consistent with the results in Amurgo-Pacheco and Pierola (2008).

Figure 5.7 Export Counts and Export Partner GDP (2006)[16]

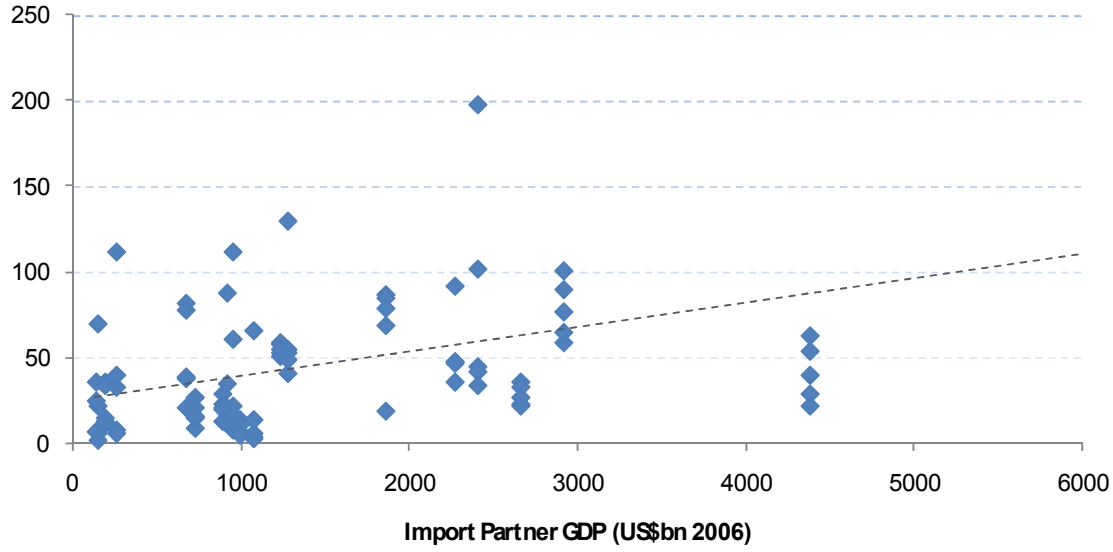
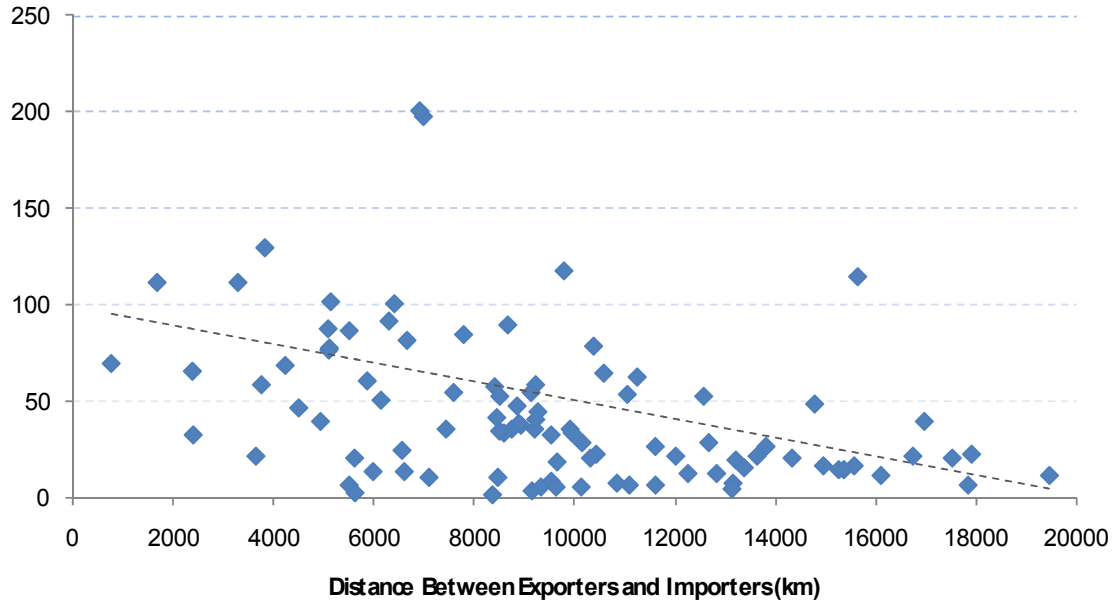


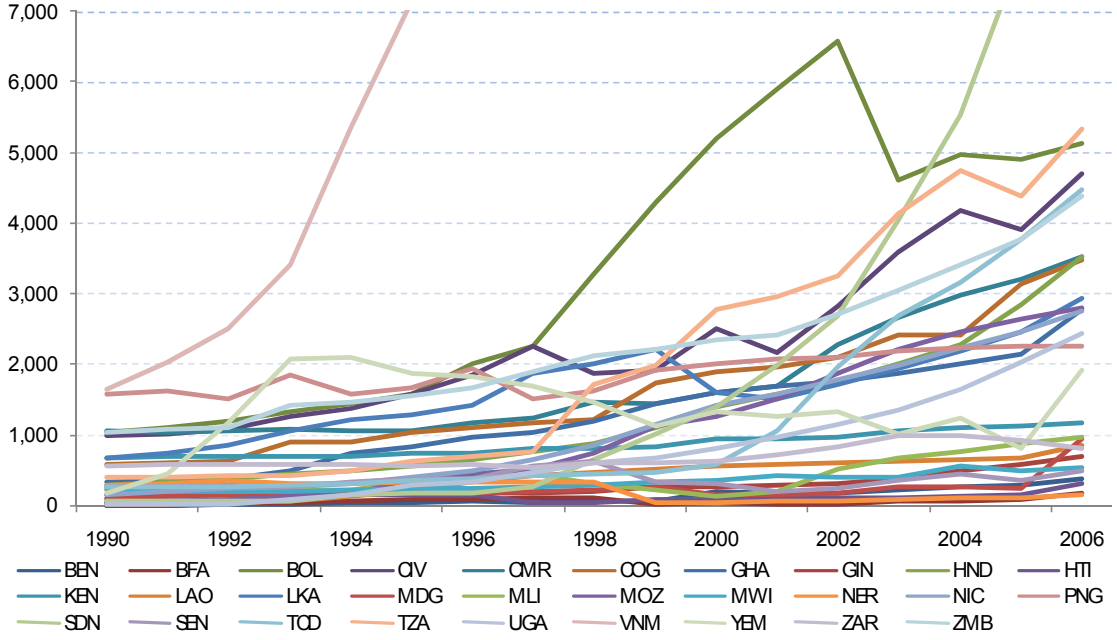
Figure 5.8 Export Counts and Bilateral Distance



[16] The only importing partner excluded was the US as their GDP was much larger than the other partner nations. Including the US would have led to clustering of the other nations making it difficult to interpret the charts. The trendline displayed includes the US data.

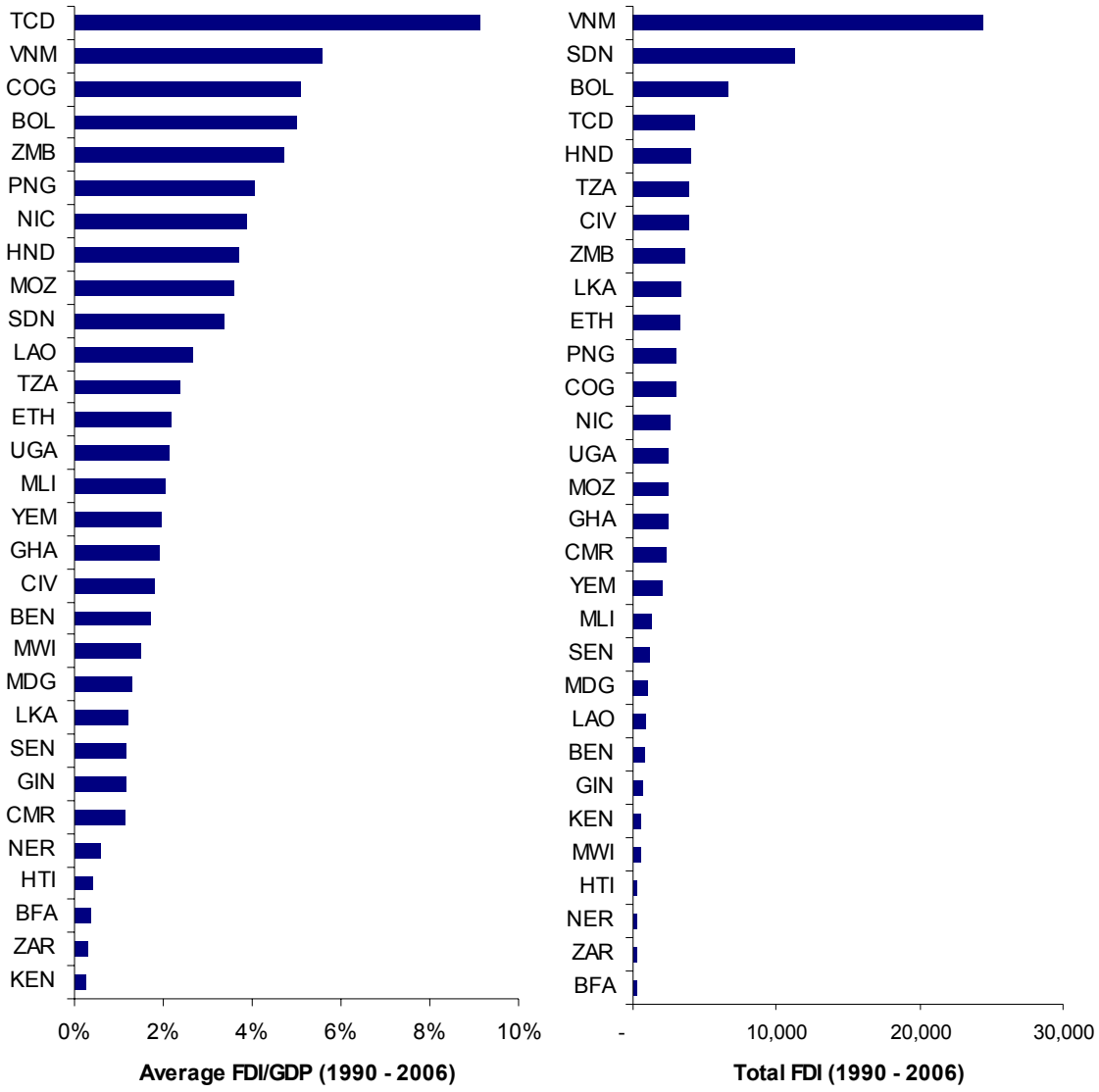
This paper next explores the stylised features of the FDI data and potential relationships with the export data discussed earlier. Figure 5.9 depicts an increasing trend in FDI stock over the sample period in most nations. Two notable observations are immediately clear, firstly that some nations experience a fair degree of volatility in their FDI stock and secondly, there seems to be a fair degree of variation between the countries in terms of the overall level of FDI received during the period 1990-2006.

Figure 5.9 FDI Stock (US$m)



These observations are clearer in Figure 5.10 where I present a comparison of the sample countries ranked by their average FDI inflow/GDP ratio over the period and their total FDI inflows. It is thus clear that there is considerable heterogeneity between the sample nations in both absolute and relative terms.

Figure 5.10 Average FDI/GDP (%) and Total FDI Inflows (US$m) 1990-2006



Having explored the key stylized features of the data, I next turn to observe any preliminary patterns in the data when comparing the two key variables of interest for this study. Figure 5.11 plots the log of the FDI stock for each country in each time period against the log of the total number of export counts. The chart presents evidence of a positive association between these two variables. However, this aggregate data does not allow for an interpretation on whether there exists any causality between increased FDI and export diversification over time.

Figure 5.11 Comparing Log FDI Stock and Log Export Counts

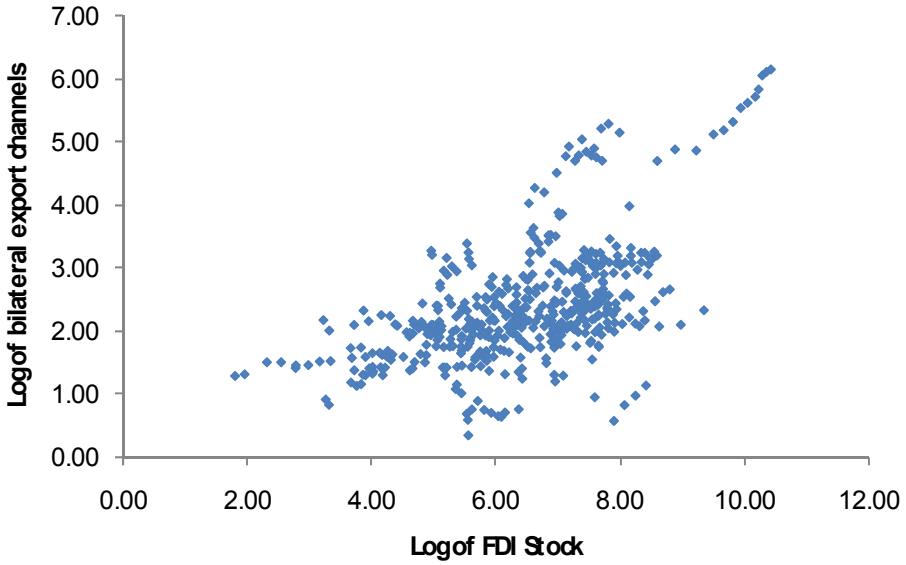


Figure 5.12 then splits the data for each time period by country, for selected countries, and displays that a positive association is still evident where in any given year, higher FDI stock levels are associated with higher levels of export diversification.

Figure 5.12 Comparing Log FDI Stock and Log Export Counts on a Country by Country Basis

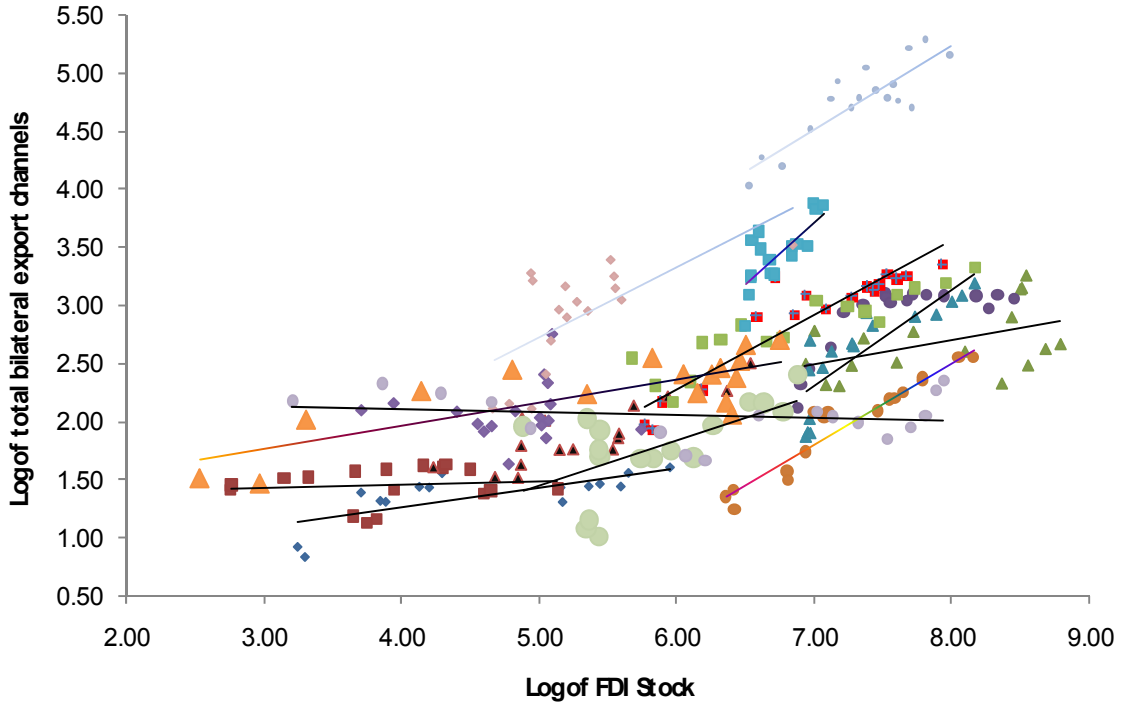


Figure 5.13 presents evidence that those countries which experienced a higher change in their overall FDI stock between 1990 and 2006 (relative to 2006 GDP), also experienced higher growth in bilateral export channels. On a comparative basis, this could potentially suggest that countries which attracted more FDI also diversified faster.

Figure 5.13 Comparing the Growth of FDI Stock and the Growth of Bilateral Export Channels[17]

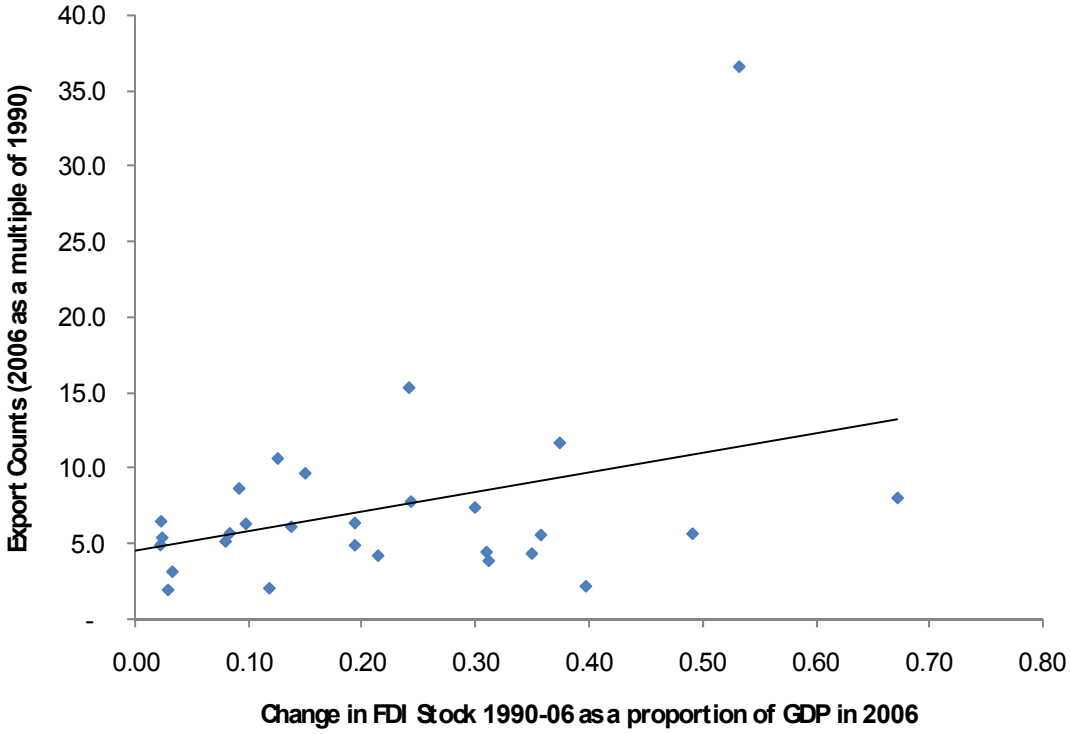
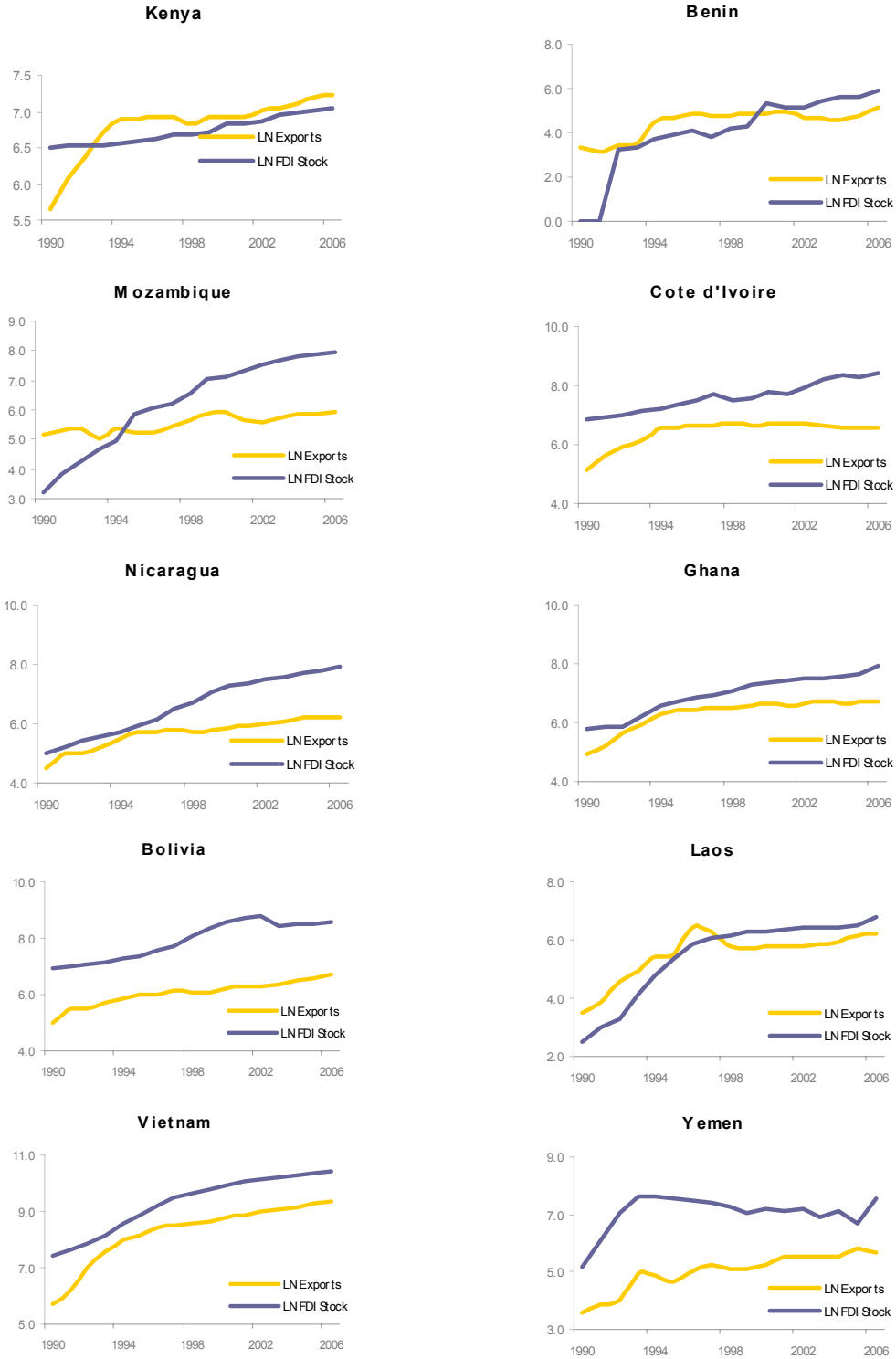


Figure 5.14 displays the time trend effects of log FDI stock on the log of bilateral export channels for 10 of the sample nations. Overall, a positive correlation is observable consistent with my theoretical argument, however a thorough econometric investigation is needed before the significance of this relationship and its causality could be statistically established and quantified.

[17] The change in FDI stock over the period was divided by the level of GDP in each country at 2006, to generate a comparable figure between the countries.

Figure 5.14 Country Level Time Trends: (Log FDI Stock and Log Export Counts)



6 Econometric Estimation

As discussed throughout the preceding sections, this paper aims to investigate whether FDI helps low income nations to diversify their export bases. While to my knowledge, no studies have explicitly explored this link empirically providing a precedent for my econometric analysis, a number of econometric studies have been conducted on export diversification patterns from which I draw upon for the building of my estimation strategy. All estimation was conducted using Stata 9.0.

6.1 Data Considerations

A number of features of the data need to be considered around which the econometric methods can be introduced. The first of these considerations is the large presence of zero export values (23% of all observations) in the bilateral dataset discussed earlier and the strictly positive nature of this count data variable, both which are commonly seen in studies on exports. The high level of zeros results in another problem for specifications using the logarithmic form of the dependent. I adopt the following conversion which has been widely used in similar studies, $LN\_Exports = \ln(\text{exports} + 1)$, however this may induce bias in the results. As such, a log-log specification is only trailed for the aggregate dataset where no zero values exist and the above conversion of adding one is not needed. Secondly, the number of time periods, although rich from a cross-sectional perspective can prove potentially limiting to the use of sophisticated panel data methods. Thirdly endogeneity needs to be considered carefully, as the key independent variable (FDI) intuitively may also be driven by the dependent variable (export counts), similar to many of the other independent variables.

Finally, the prospect of non-stationarity also needs to be considered. I conduct the t-test for unit roots in heterogeneous panels with cross-sectional dependence, also known as the Cross Sectionally Augmented Dickey Fuller test (CADF) proposed by Pesaran (2003)

which is based on the Im, Pesaran and Shin (2003) test also known as the IPS test. While panel unit root testing procedures are still an evolving area of econometrics, this test has gained reasonable acceptance. It should also be noted that the IPS test may have a low power for smaller panels even where $T = 25$ (de Silva, Hadri, and Tremayne, 2009), however Pesaran finds that the CADF test has satisfactory power and size even for small samples. As such, the results which I have included in Table 6.1 below should be interpreted with caution.

A-priori, based on the descriptive statistics, non-stationarily was suspected. The results suggest that the null of non-stationarity cannot be rejected for most of the key variables in the aggregate dataset, with only exports, log-exports and FDI being rejected when no trend is included. The results from the tests carried out using the bilateral dataset are different with the null rejected for exports, and log-exports. The null is also rejected for FDI and log-FDI if no trend is included. The differences in the results between the bilateral and aggregate datasets could potentially be attributed to the construction of the variables. The exports variable in the bilateral dataset contains a large number of zeros as described earlier and there may be little year on year movement in many of the 609 panels. As the CADF test is based on the mean of t-statistics calculated at the individual panel level, the presence of many zeros and panels with little variation may explain the rejection of the null of non-stationarity. One possible explanation for contrasting results for GDP and log-GDP in the bilateral dataset could potentially be attributed to the fact that the GDP numbers were expressed in USD. As a result of the exchange rate effects, some of the trends in the data were less obvious or interrupted for periods of time.

Table 6.1 P-Values from Pesaran's CADF test

	Bilateral		Aggregate	
	Trend	No -Trend	Trend	No -Trend
Exports	**0.000**	**0.000**	0.110	**0.020**
LN Exports	**0.000**	**0.000**	0.068	**0.049**
FDI Stock	1.000	**0.000**	0.886	**0.039**
LN FDI Stock	0.329	**0.000**	0.988	0.099
GDP (Origin)	1.000	0.800	0.915	0.573
LN GDP (Origin)	0.981	0.417	0.675	0.482
GDP (Dest.)	1.000	0.966	1.000	1.000
LN GDP (Dest.)	**0.000**	**0.000**	1.000	1.000

Note; Ho: Non Stationary

The presence of non-stationary processes suggested by this test needs to be taken into consideration to ensure that estimates are not spuriously generated.

6.2 Estimation in Levels

I firstly estimate a simple linear levels relationship using a fixed and random effects model. By construction the model allows for an analysis of the level of FDI and the extent of export diversification. The fixed effects model can be estimated as follows where the over-bars represent the average value of the variable over time, where the prime represents a vector of explanatory variables and where a_i are the unobserved fixed effects as described by Wooldridge (2006),

$$y_{it} - \bar{y}_i = \beta_1 \left(x_{it} - \bar{x}_i \right)' + u_{it} - \bar{u}_i .$$

As the a_i are constant over time, the time-demeaning transformation above effectively eliminates them. The model can then be simplified to,

$$\ddot{y}_{it} = \beta_1 \ddot{x}'_{it} + \ddot{u}_{it} . \tag{6.1}$$

Time dummy variables were also included to control for any year specific effects. The model can then be estimated using pooled OLS. Stata also reports the average value of the individual fixed effects as an intercept. The fixed effects model has a number of advantages which has led to its wide use in the literature. Firstly, time-demeaning allows for the removal of any unobserved fixed effects or time invariant explanatory variables from the error term thus reducing the potential of omitted variable bias. In cross sectional studies like this, there are likely to be numerous unobserved country specific characteristics which may be time invariant. Thus, this is a significant advantage. As noted by Wooldridge (2006), the fixed effects model allows for arbitrary correlation between the unobserved fixed effect a_i and the other explanatory variables. For a cross-sectional study like mine, there is a high chance that a number of country specific factors

could be correlated with the chosen explanatory variables such as GDP and FDI. While the elimination of the a_i controls for some endogeneity, some of the other independent variables may also be potentially endogenous including FDI and GDP. Studies including Bebczuk and Berrettoni (2006) suggest controlling for this by regressing the lagged values of each of the independent variables instead of their contemporaneous values against the contemporaneous value of the dependent. Fixed effects also require the errors to be homoskedastic and serially uncorrelated.

I also estimate a simple random effects model. The random effects model is similar to the fixed effects model, but assumes that the unobserved effects a_i are uncorrelated with the explanatory variables. The model can be estimated as follows (Wooldridge, 2006),

$$y_{it} - \lambda \bar{y}_i = \beta_0 (1 - \lambda) + \beta_1 (x_{it} - \lambda \bar{x}_i)' + v_{it} - \lambda \bar{v}_i , \tag{6.2}$$

where, $\lambda = 1 - \left[\sigma_u^2 / (\sigma_u^2 + T\sigma_a^2)\right]^{1/2}$, and where the composite error term is defined as $v_{it} = a_i + u_{it}$.

Time dummy variables were also included to control for any year specific effects. The random effects model is estimated using a pooled OLS procedure after a GLS transformation to eliminate serial correlation of the composite error terms. The resulting equation involves a regression of quasi-demeaned data which subtracts a fraction of the time average (λ) of each variable from its value rather than the actual average as subtracted under the fixed effects process. The fraction depends on σ_u^2, σ_a^2 and the number of time periods T. An advantage of the random effects model is that it allows for the inclusion of time invariant variables, however, none of these variables are of primary interest to my analysis. The assumption that the unobserved effects are strictly exogenous is also very restrictive and unlikely to hold in reality which leads to many studies preferring the fixed effects model. Nevertheless, the random effects model is often

estimated along side the fixed effects model. I conduct a Hausman (1978) specification test[18] to compare the models as well.

Fixed and random effects models have been used in studies on export diversification by Bebczuk and Berrettoni (2006) and Imbs and Wacziarg (2003). Carrère, Strauss-Kahn and Cadot (2007) also employed a random effects model as a robustness check for their regression which analysed diversification using a count variable similar to this study.

A significant shortfall in using the fixed and random effects models described above is that cointegration must be assumed for the results to be valid given that evidence of unit roots were found in many of the variables. Although cointegration may be theoretically justified, it cannot be explicitly assumed. Furthermore, it is difficult to test for but strong evidence of serial correlation may be an indicator of a lack of cointegration. Heteroskedasticity may also be a problem and the Huber-White sandwich estimator of variance is also employed in both models to ensure heteroskedasticity-consistent standard errors.

A further limitation of these models is that they do not account for the censored nature of the data and thus negative counts of exports may be predicted despite this not being possible in reality.

The final limitation I discuss relates to an extension to the model. Due to the persistent nature of the export count data, it may also seem intuitive to include a lag of the dependent variable as an explanatory variable such as in the following dynamic panel data model,

$$y_{it} = \gamma y_{i,t-1} + \beta x'_{it} + c_i + \varepsilon_{it}, \tag{6.3}$$

where c_i represents the unobserved individual heterogeneity which may or may not be correlated with the other explanatory variables. Greene (2008) describe that in such a case, the error will be correlated with the lagged dependent variable rendering OLS, GLS

[18] The Hausman specification test can be applied to test the appropriateness of the random-effects estimator against the fixed-effects estimator.

and fixed effects inconsistent especially with small T. Judson and Owen (1996) also caution against such an approach. Anderson and Hsiao (1981) propose an instrumented approach for resolving this problem. Their approach is also useful for addressing the non-stationarity issues discussed earlier and has been employed in empirical studies.

6.3 Estimation in Differences

Anderson and Hsiao (1981) proposed expressing the lagged dependent variable model in differences and then instrumenting the differenced lagged dependent to solve the inconsistency problem. Kiviet (1995) and Judson and Owen (1996) find that the Anderson-Hsiao estimator performs similarly in terms of efficiency to Generalised Method of Moments (GMM) approach which is also used commonly in panel studies on exports. This method was also advocated in Greene (2008) for addressing the problems with dynamic panel models. Judson and Owen summarise the literature on this procedure and caution also that it may result in large variances for the estimators. The model can be written as follows,

$$y_{it} - y_{i,t-1} = \gamma\left(y_{i,t-1} - y_{i,t-2}\right) + \beta\left(x_{it} - x_{i,t-1}\right)' + \left(\varepsilon_{it} - \varepsilon_{i,t-1}\right), \tag{6.4}$$

where $y_{i,t-2}$ or $\left(y_{i,t-2} - y_{i,t-3}\right)$ are commonly used to instrument $\left(y_{i,t-1} - y_{i,t-2}\right)$. These instruments should be uncorrelated with the disturbance in the differenced dynamic model.

The first differencing allows for a unit root process to be expressed as a weakly dependent process thus addressing the non-stationarity issues discussed in the simple fixed and random effects models earlier (Wooldridge, 2006). Furthermore, differencing also eliminates the time invariant omitted variables reducing the potential for omitted variable bias.

This technique was adopted by Dollar and Kraay (2004). Carrère, Strauss-Kahn and Cadot (2007) also note that they would have used this technique if they had a suitable

instrument. Bebczuk and Berrettoni (2006) noted that an instrumented approach towards their estimation would have been advisable if it was computationally feasible.

The interpretation of the results will now be in terms of differences rather than in levels as in the simpler models introduced earlier. Thus the relationship being studied would now represent a story of the impact of a change in FDI stock on the change in the number of export categories, which is still fitting in line with my primary research question of whether increased FDI stock results in increasing the number of exported categories.

An important consideration is also the sample size which remains small but loses a further time period due to the effect of differencing. Furthermore, due to the smaller period-on-period differences and the large number of zero trade flow strings, in the bilateral dataset, estimation may be subject to large variances. However, this should not be a problem in the aggregate dataset.

Stata's *xtivreg2* command allows for the model to be estimated with heteroskedasticity and autocorrelation-consistent (HAC) standard errors. The Newey–West (Bartlett kernel function) is used for the generation of HAC estimators of the covariance matrix with a bandwidth of $T^{1/3}$ as commonly used in the literature (Baum, Schaffer and Stillman, 2007). Stata also reports a number of regression diagnostic statistics which will be discussed in the results chapter following.

7 Results

Both the levels and differenced models estimate a positive association between FDI and the count of exports as proposed in my theoretical discussion. Furthermore, the signs on the coefficients of the other key variables are mostly as expected following the theoretical discussion and the outputs from the Melitz model discussed earlier.

The levels model must however be interpreted with caution as post-estimation diagnostics suggest that the estimated relationships may be spurious. As a result, I only discuss the levels model briefly. A key motivation for conducting the differenced model was to control for non-stationarity, and diagnostics conducted on this model find it to be sufficiently robust. Due to its robustness, I present an in-depth discussion of this model. A number of specifications were trialled for each model including polynomial and logarithmic versions. The models below were found to fit the data the best in terms of goodness of fit and significance of the included regressors. The alternative specifications are not reported. Summary statistics from each dataset are displayed below.

Table 7.1 Summary Statistics – Aggregate Dataset

	Units	Mean	Std. Dev.	Min	Max
Export Channels	Counts	615.19	1268.20	8.00	11369.00
GDP (Origin)	US$ Bn	6.81	6.69	0.87	59.84
GDP^2 (Origin)	US$ Bn	91.12	271.37	0.75	3580.25
GDP (Importers)	US$ Bn	2.67E+04	5.91E+03	1.84E+04	3.99E+04
GDP^2 (Importers)	US$ Bn	7.46E+08	3.44E+08	3.39E+08	1.59E+09
FDI Stock	US$ Bn	1.62	3.59	0.00	33.50
FDI & High Oil	US$ Bn	0.40	1.14	0.00	11.39
FDI & High Mins	US$ Bn	0.32	0.76	0.00	5.34
Exchange Rate		0.48	0.33	0.00	1.20
Trade Agreement	Counts	0.41	0.76	0.00	3.00

Notes:

GDP (Importers) is the sum of the GDPs of the 21 importing partner nations

FDI & High Oil and FDI & High Mins are the interaction terms of FDI stock multiplied with the High Oil and High Minerals dummy variables

The exchange rate was calculated as an index against the USD with 1990=1

Trade agreements are a count of the number of the 21 import partner nations with which the exporting nation had a trade agreement with

Table 7.2 Summary Statistics – Differenced Aggregate Dataset

	Units	Mean	Std. Dev.	Min	Max
Export Channels	Counts	55.09	150.93	-228.00	1086.00
GDP (Origin)	US$ Bn	0.49	1.27	-4.89	9.02
GDP^2 (Origin)	US$ Bn	16.52	70.15	-109.95	792.00
GDP (Importers)	US$ Bn	1.35E+03	1.18E+03	-1.60E+02	3.72E+03
GDP^2 (Importers)	US$ Bn	7.85E+07	7.99E+07	-8.58E+06	2.45E+08
FDI Stock	US$ Bn	0.20	0.49	-1.96	3.54
FDI & High Oil	US$ Bn	0.06	0.29	-1.96	3.54
FDI & High Mins	US$ Bn	0.03	0.12	-0.42	0.95
Exchange Rate		-0.05	0.12	-0.63	0.37
Trade Agreement	Counts	0.05	0.22	0.00	2.00

Notes:

GDP (Importers) is the sum of the GDPs of the 21 importing partner nations

FDI & High Oil and FDI & High Mins are the interaction terms of FDI stock multiplied with the High Oil and High Minerals dummy variables

The exchange rate was calculated as an index against the USD with 1990=1

Trade agreements are a count of the number of the 21 import partner nations with which the exporting nation had a trade agreement with

Table 7.3 Summary Statistics – Bilateral Dataset

	Units	Mean	Std. Dev.	Min	Max
Export Channels	Counts	29.29	78.54	0.00	1113.00
GDP (Origin)	US$ Bn	6.81	6.69	0.87	59.84
GDP (Importer)	US$ Bn	1246.48	2025.89	21.35	13132.90
FDI Stock	US$ Bn	1.62	3.59	0.00	33.50
FDI & High Oil	US$ Bn	0.40	1.14	0.00	11.40
FDI & High Mins	US$ Bn	0.32	0.76	0.00	5.30
Exchange Rate		0.48	0.33	0.00	1.20
Trade Agreement	Counts	0.02	0.14	0.00	1.00
Distance	Km	8537.33	3937.86	475.88	19446.26
North	Dummy	0.71	0.45	0.00	1.00
Landlocked	Dummy	0.28	0.45	0.00	1.00
Colonial History	Dummy	0.18	0.38	0.00	1.00
Common Language	Dummy	0.05	0.21	0.00	1.00

Notes:

GDP (Importer) is the GDP of the import partner nation

FDI & High Oil and FDI & High Mins are the interaction terms of FDI stock multiplied with the High Oil and High Minerals dummy variables

The nominal exchange rate was calculated as an index against the USD with 1990=1

Trade agreements are a count of the number of the 21 import partner nations with which the exporting nation had a trade agreement with

Distance is the distance in kilometres between exporter and importer pairs

North is a dummy variable which equals '1' if the importing partner is a developed nation

Landlocked is a dummy variable which equals '1' if the exporting nation is landlocked

Common language is a dummy variable which equals '1' if the exporting and importing nations share a common official language and colonial history is a dummy variable equal to '1' if the nations share a colonial history

7.1 Levels Model

The fixed effects and random effects levels models are estimated using both the aggregate dataset (Table 7.4) and the bilateral dataset (Table 7.5) using heteroskedasticity-consistent standard errors. The signs on the coefficients are broadly as expected and the coefficients from the aggregated dataset are roughly 21 times larger than those from the bilateral dataset as expected (due to the aggregating of the 21 importers).

The coefficient on the exporter's GDP is positive as predicted by the theory and as found in other empirical studies. The coefficients are statistically significant at 1% in all cases. These figures are also economically significant with a US$1bn higher GDP associated with 39 more export lines in the fixed-effects model using the aggregate dataset. The result is roughly 21 times smaller in the bilateral dataset reflecting the disaggregation between the 21 importing nations. However, in all the levels models, the coefficients on the destination nation's GDP are economically insignificant as they are very small, a result that differs to other empirical work. The coefficient on the sum of all the importer's GDPs in the aggregate dataset models was statistically insignificant and negative while the coefficient on the importer's GDP in the bilateral dataset models was slightly positive and significant at 1%.

The first lag of FDI is positive and significant at 1% in all cases. However, the 2nd lag is negative and the 3rd lag is mildly positive and both are not statistically significant in all cases. The fourth lag of FDI is then strongly positive and statistically significant at 5% in all cases. The four FDI lagged variables are jointly statistically significant in all cases. These findings support the theoretical suggestions that FDI may help develop new export channels initially through the establishment of export platforms or through improving the competitiveness of host nation businesses. The finding of positive lagged effects also supports the theoretical suggestion that spillovers associated with FDI may over time help other local businesses to improve their competitiveness and learn about foreign markets and then build further new export relationships. The results are also economically significant, with an increase of US$1bn in FDI stock associated with approx. 232 new

export lines including the lagged effects using the fixed effects model and aggregate dataset.

The coefficients on the variables interacting FDI and the "high oil" and "high minerals" dummies are both strongly negative and statistically significant at 1% in all cases as expected as commodity rich nations may focus on attracting FDI for only a narrow base. The net effect of an increase of US$1bn in FDI for such nations is much lower at 44 and 18 new export channels respectively using the fixed effects model and aggregate dataset.

The exchange rate variable is negative and statistically significant in all cases. This is expected as a higher exchange rate would raise the relative price of the nation's exports. The trade agreement variable is strongly positive and statistically significant at 1% in all cases as expected. Year dummy variables were included to control for any year specific shocks. These dummies were all individually imprecisely estimated in the aggregate dataset but were jointly significant. They were mostly individually and jointly significant in the bilateral dataset. The negative sign on these dummy variables was unexpected and potentially a result of the time growth effects being captured through the other variables.

While these results seemed promising, the null of no first order autocorrelation was rejected in the Wooldridge test for autocorrelation in panel data indicating the possibility of spurious regression results. Pesaran's (2003) cross-sectionally augmented Dickey Fuller test was run on the residuals from these regressions and the null of non-stationarity could not be rejected. As a result, not much emphasis could be placed on the results from the levels models as their results are likely to be spurious or their may simply not be a causal relationship between the two variables. The differenced model (results presented in the following section 7.2) addresses many of these issues to arrive at a robust estimation of a positive effect of FDI on export diversification.

The Hausman (1978) specification test was also conducted to test the appropriateness of the random-effects estimator against the fixed-effects estimator where under the null, there are no differences between the random-effects and fixed-effects estimates. However, the model failed to meet the asymptotic assumptions of the test and thus its

results are difficult to interpret and may not be applicable. A possible reason for this could be due to the presence of non-stationarity in the errors. P-values from the Hausman tests are also presented in the results tables.

A further regression was carried out using random effects and including the extra dummies “landlocked”, “common language”, and “colonial connection”, and the variable “distance” and the results are reported in the appendix (Table 10.1). While the signs of their coefficients were as predicted and statistically significant, they did not make a significant influence on the coefficients of the key variables of interest FDI. Furthermore, the residuals from this regression shared the same problems as those of the other levels models, that they were non-stationary. Logarithmic specifications were also trialled however with no significant improvements over these results.

Table 7.4 Levels Model Results – Aggregate Dataset

	Dependent: Count of Export Channels			
	Fixed Effects		Random Effects	
	Coef.	*P-values*	*Coef.*	*P-values*
GDP (Exporter) - Lagged	39.008***	0.00	43.835***	0.00
GDP (Importers) - Lagged	-0.003	0.93	-0.004	0.86
FDI (Lag1)	130.701***	0.00	144.182***	0.00
FDI (Lag2)	-28.895	0.53	-34.384	0.51
FDI (Lag3)	27.638	0.56	25.405	0.66
FDI (Lag4)	102.267**	0.01	92.430**	0.04
FDI & High Oil - Lagged	-187.513***	0.00	-196.484***	0.00
FDI & High Min - Lagged	-214.161***	0.00	-222.926***	0.00
Exchange Rate	-180.820*	0.08	-192.968***	0.06
Trade Agreement - Lagged	104.484***	0.00	117.727***	0.00
1996	34.315	0.66	34.067	0.61
1997	19.299	0.82	16.993	0.81
1998	-39.354	0.62	-44.320	0.50
1999	-40.219	0.61	-45.844	0.47
2000	-12.939	0.90	-16.500	0.84
2001	-59.310	0.63	-63.051	0.53
2002	-54.829	0.64	-57.605	0.55
2003	-52.317	0.72	-56.537	0.64
2004	-59.552	0.80	-62.058	0.75
2005	-45.744	0.90	-47.890	0.87
2006	-115.899	0.78	-122.813	0.71
Constant	396.931	0.53	411.117	0.46
Obs	377		377	
T	13		13	
F-Stat	69.52		-	
Prob > F	0.0000		-	
Wald Chi2	-		1959	
Prob > Chi2	-		0.0000	
R-Square (overall)	0.8742		0.8801	
Rho	0.9677		0.902	
Std. Errors	Robust		Robust	
FDI Lags Joint Sig. Test	P-value: 0.000		P-value: 0.000	
Time Dummy Joint Sig. Test	P-value: 0.034		P-value: 0.081	
Pesaran's Test	P-value: 0.966		P-value: 0.998	
Hausman's Test	P-value: -0.76			

Notes:
**** Significant at 1%; ** Significant at 5%; * Significant at 10%*
All lags are for one period unless otherwise specified
Robust standard errors are heteroskedasticity consistent

Table 7.5 Levels Model Result – Bilateral Dataset

	Dependent: Count of Export Channels			
	Fixed Effects		Random Effects	
	Coef.	*P-values*	*Coef.*	*P-values*
GDP (Exporter) - Lagged	1.875***	0.00	2.146***	0.00
GDP (Importer) - Lagged	0.008***	0.00	0.008***	0.00
FDI (Lag1)	5.964***	0.00	6.611***	0.00
FDI (Lag2)	-1.247	0.58	-1.508	0.53
FDI (Lag3)	1.492	0.56	1.411	0.60
FDI (Lag4)	5.061**	0.02	4.599**	0.03
FDI & High Oil - Lagged	-9.122***	0.00	-9.641***	0.00
FDI & High Min - Lagged	-9.658***	0.00	-9.987***	0.00
Exchange Rate	-8.104***	0.00	-8.646***	0.00
Trade Agreement - Lagged	52.814***	0.00	53.403***	0.00
1996	0.167	0.89	-0.101	0.93
1997	-0.706	0.49	-1.120	0.28
1998	-3.491***	0.00	-4.043***	0.00
1999	-3.474***	0.00	-4.044***	0.00
2000	-2.706**	0.01	-3.256**	0.01
2001	-4.999***	0.00	-5.540***	0.00
2002	-4.659***	0.00	-5.147***	0.00
2003	-4.897***	0.00	-5.496***	0.00
2004	-6.781***	0.00	-7.556***	0.00
2005	-7.947***	0.00	-9.016***	0.00
2006	-11.863***	0.00	-13.232***	0.00
Constant	8.426***	0.00	7.390**	0.01
Obs	7917		7917	
T	13		13	
F-Stat	47		-	
Prob > F	0.0000		-	
Wald Chi2	-		1139.54	
Prob > Chi2	-		0.0000	
R-Square (overall)	0.5571		0.5602	
Rho	0.90553		0.88808	
Std. Errors	Robust		Robust	
FDI Lags Joint Sig. Test	P-value: 0.000		P-value: 0.000	
Time Dummy Joint Sig. Test	P-value: 0.000		P-value: 0.000	
Pesaran's Test	P-value: 1.000		P-value: 1.000	
Hausman's Test	P-value: -24.08			

Notes:

**** Significant at 1%; ** Significant at 5%; * Significant at 10%*

All lags are for one period unless otherwise specified

Robust standard errors are heteroskedasticity consistent

7.2 Differenced Model

The estimates from the differenced IV model are presented in Table 7.6 together with the p-values generated from heteroskedasticity and autocorrelation robust standard errors. The rationale behind this model was outlined in section 6.3 and as described in equation 6.4, this model used $(y_{i,t-2} - y_{i,t-3})$, the twice lagged difference in export counts, to instrument for $(y_{i,t-1} - y_{i,t-2})$ the lagged difference in export counts. This model could only be implemented using the aggregated dataset as the bilateral set contained too many zero trade flows and little year on year variation in some panels leading to imprecise estimators.

The coefficients mostly behave as predicted a-priori with an overall regression F-statistic of 74.30 which indicates that they are jointly significant at the 1% level. The coefficient on the lagged dependent is positive and also statistically significant at the 1% level. This indicates that an increase in exports in the previous period is associated with an increase in exports in the current period.

The coefficient on the exporter's GDP is negative and not statistically significant, however the coefficient on the square of the exporter's GDP is significant at 5% and positive. To assess economic significance, the marginal effects need to be considered. The marginal effects of the exporter's GDP are slightly more difficult to interpret as the model is estimated in differenced form but can be expressed as follows,

$$\frac{\partial Y_{it}}{\partial X_{it}} = \beta_1 + 2\beta_2 X_{it}, \tag{7.1}$$

where $Y_{it} = y_{it} - y_{i,t-1}$ (the dependent variable), and $X_{it} = x_{it} - x_{i,t-1}$ (exporter's GDP). One of the implications of this derivation is that the rate of change of the dependent, depends on X_{it}, the change in the independent. Overall, the model estimates a negative association between exporter GDP and diversification. Keeping other factors constant, a

$1bn increase in the exporter's GDP results in a reduction to the number of export lines of 8.66. This result is contrary to other studies, possibly due to the fact that this paper considers only extremely small exporters, where increases in GDP over the period of study may have been small in absolute terms. However, the coefficient on the exporter's GDP is statistically insignificant and thus little emphasis can be placed on this result.

The coefficient on the sum of the import partner's GDPs is positive and the coefficient on its square is negative and both are statistically significant at 5%. Similarly, when aiming to determine their marginal effect, from equation 7.1, the rate of change of the dependent also depends on the change in the sum of importer's GDP. In this case however, the non-linear variable has very little effect as it is extremely small. Nevertheless, applying equation 7.1 estimates that a one-of, US$1,000bn increase in the combined GDP's of the importing nations is associated with an increase in export lines of 50. This result is highly economically significant considering that the average annual change in the combined GDPs of the importing nations was $1,346bn over the period. This result is consistent with other studies including Amurgo-Pacheco & Pierola (2008)[19], and the theoretical model, reinforcing that import partners may import a greater variety of goods as their economies grow.

The FDI stock coefficients are easier to interpret as there are no squared variables. The coefficient of the first differenced FDI variable is strongly positive and significant at 5%. The coefficient suggests that a US$1bn increase in FDI results in 96.32 new export counts in the current period. While the three lags of the FDI stock variable are not individually statistically significant, the four FDI variables are jointly statistically significant at 5%. The 1st lag of FDI is strongly negative, while the 2nd and 3rd are positive. This could potentially suggest that some of the new export channels established in the first year may discontinue, and then as time progresses, the spillover effects suggested in the literature emerge assisting to build new export channels. As described in section 3.2, these spillovers may be in the form of foreign market knowledge, learning of new techniques and also improvements in productivity which take time to emerge.

[19] While the signs on the coefficients can be compared, the magnitudes cannot as Amurgo-Pacheco & Pierola (2008) estimate the impact of the importer's GDP at the bilateral level using separate regressions for each nation and using a very different technique.

Adding the FDI coefficients together results in a long run propensity of 83.5 new export channels for every US$1bn increase in FDI stock, an economically significant result.

A surprising feature is the size of the first FDI stock coefficient. As some FDI projects may take months to establish, I expected the most significant impacts to be seen in the lagged values of FDI. However, the results may be a consequence of the way the data is gathered. Government records may only register the FDI after completion of a project or investment, and thus the effect on exports may occur sooner than previously expected. Furthermore, the FDI data I use was not disaggregated. A large component of FDI may have been allocated towards investments in existing enterprises (rather than establishing new greenfields projects) with the aim of growing and improving them, in which case results indicating a faster impact on export channels could be expected.

The coefficients on the FDI interaction variables are negative as expected and significant at 5%. The long run net impact of FDI is thus estimated to be negative for nations with a high proportion of oil or mineral exports with a US$1bn increase in FDI resulting in 10.67 and 19.22 fewer export lines respectively. This is consistent with the findings of Bebczuk and Berrettoni (2006) and the literature on 'Dutch Disease' in papers such as Lederman and Maloney (2007) where the presence of significant oil and mineral resources is associated with export concentration as Governments and investors focus on investment in those sectors only.

Each trade agreement is estimated to result in 37.78 new export lines, a result that is both economically and statistically significant. This result is consistent with studies including Amurgo-Pacheco & Pierola (2008) which portray the how trade agreements can help increase exports from developing nations. The coefficient on the exchange rate is positive, converse to expectations, however it is statistically insignificant. It is possible that the short time period, or the use of nominal instead of real exchange rates may have led to this unexpected outcome. The coefficient on the constant was expected to be positive due to the increasing nature of the export data in levels, but was estimated to be negative. However, the estimate of the constant was statistically insignificant.

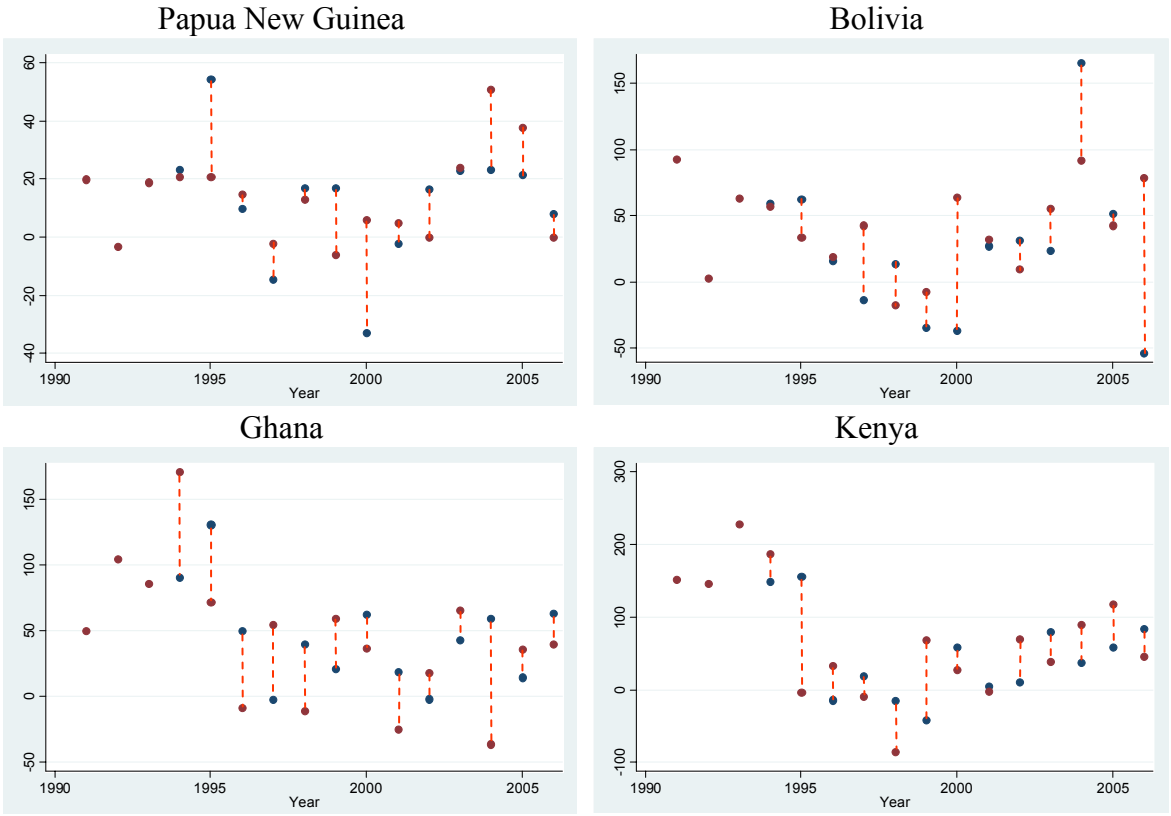
Table 7.6 Differenced Model Results – Aggregate Dataset

Dependent:	*Export Counts (Differenced)*	
	IV Regression	
Differenced Variables	*Coef.*	*P-values*
Export Counts (Lag 1)	0.629***	0.00
GDP (Exporter)	-9.323	0.13
GDP^2 (Exporter)	0.329**	0.04
GDP (Importers)	0.050**	0.02
GDP^2 (Importers)	-0.000**	0.03
FDI	96.316**	0.03
FDI (Lag 1)	-48.927	0.16
FDI (Lag 2)	2.291	0.91
FDI (Lag 3)	33.829	0.19
FDI & High Oil	-94.186**	0.04
FDI & High Min	-102.731**	0.02
Exchange Rate	56.778	0.20
Trade Agreement	37.781*	0.05
Constant	-4.166	0.36
Obs	377	
T	13	
F-Stat	74.30	
Prob > F	0.0000	
Centered R2	0.7221	
Uncentered R2	0.7495	
Std. Errors	HAC Robust, bw=3	
FDI Lags Joint Sig. Test	P-value: 0.018	

Notes:
**** Significant at 1%; ** Significant at 5%; * Significant at 10%*
Standard errors are heteroskedasticity and autocorrelation robust (HAC). The bandwidth was specified to equal three based on the discussion in section 7.3

As an initial diagnostic, the fit of the model was tested in Figure 7.1 by comparing its fitted values with the actual values over each year. Overall the model performed strongly in terms of fitting the actual observed data of the dependent variable.

Figure 7.1 Scatter Plots of the Fitted Values from the IV Regression compared to the Actual Observations



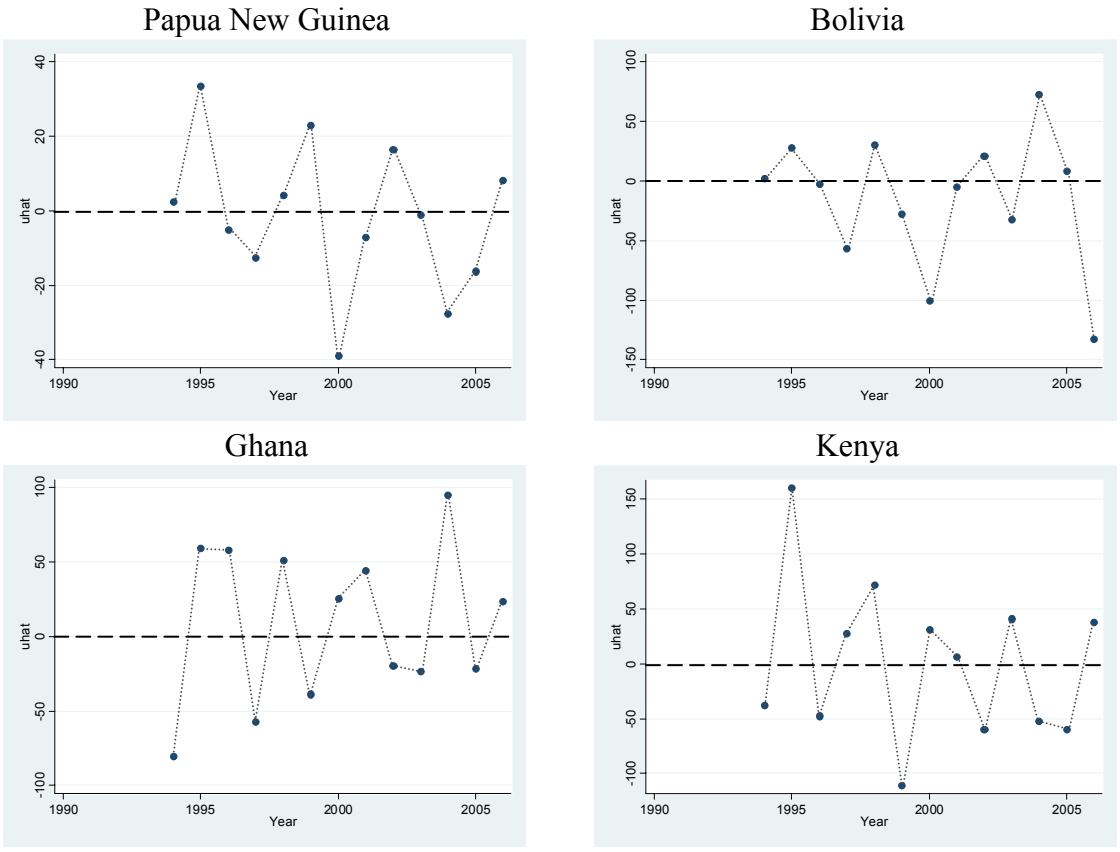
Note: The red dots indicate actual observations and the blue dots are the fitted values from the regression. Fitted values are not available for the first three observations due to the use of three lags of the FDI variable.

A number of other diagnostics were also carried out including a test on instrumental relevance which tests for the presence of correlation between the instrumental and endogenous variable. If this correlation is only weak, then the standard errors of the IV estimators may be very large (Wooldridge, 2006). I test for instrumental relevance using Shea's (1997) partial R-squared statistic obtained through a regression of the endogenous explanatory variable and the instrument vector. Stata automatically reports this statistic to be 0.1705 with a regression F-statistic of 10.39 and p-value of 0.001 indicating instrumental relevance. For an instrument to be valid, it must also be uncorrelated with the error term from the 'structural' equation (equation 7.4). Unfortunately it is difficult to test this as this error is unobserved (Wooldridge, 2006). Furthermore, a suitable test was not found for testing the endogeneity of the lagged difference in export counts which was appropriate for use in panel IV models using first differences. Nevertheless, the rationale

for employing the IV technique stemmed from Anderson and Hsiao's (1981) method which allowed for the estimation of a dynamic panel model as discussed in section 6.3.

Finally, one of the prime motives for using this model based on first differences was to control for the non-stationary nature of the data and ensure that regression results were not spurious. The procedures for testing for unit roots in the residuals of the instrumental variables and two staged least squares first differenced regression models are in their infancy and no established tests were found. However, a simpler, less formal technique is possible. Brooks (2008) suggests that when plotted, stationary residuals would cross their mean value regularly and not exhibit 'long swings' from the mean. Figure 7.2 plots the residuals from the IV regression for four of the panels over time.

Figure 7.2 Scatter Plots of the IV Regression Residuals



Note: These charts were generated using Stata following the regression. The error values are on the vertical axis and the years are along the horizontal axis.

The residual plots appear to have a mean close to zero and cross this mean value a number of times indicating no signs of persistence as desired. This indicates that it is likely that they are well behaved and stationary adding validity to the regression results.

The model was also estimated using the logarithmic values of GDP as an alternate method of accounting for the scale effects of increasing GDP over time. The coefficients on the other variables changed little while the coefficient on the exporter's GDP also remained negative and statistically insignificant and the coefficient on the importer's GDP was positive and statistically significant. Overall the model did not provide any improvement over the results presented in Table 7.6 and its results are presented in the appendix (Table 10.2).

7.3 Extensions

A number of extensions are possible to this study. Firstly significant improvements can be made to the quality of the data if it were available. More time periods would improve the accuracy of the estimation techniques. Furthermore, disaggregated FDI data would allow for certain types of FDI to be excluded (i.e. investments in the hospitality industry which may not generate new export channels besides increasing export earning in that industry). Disaggregated FDI data would also allow for comparing the differences in the effect of FDI in different industries.

Another noteworthy extension stems from the estimation techniques. The key variable of interest is in the form of discrete counts and furthermore, it is strictly positive in its levels form. Estimation techniques which directly address this nature of the data could also be trailed in future studies. The Tobit model, the Pseudo-Poisson Maximum Likelihood Estimation Technique and the Negative Binominal technique were considered however time constraints did not allow for their implementation. Models such as the negative binomial may also be useful for dealing with the large proportions of zero export flows in the data.

A final extension could involve considering different measures of export diversification as a robustness check. While the count of export channels method employed in this study may pick up even the slightest change in diversification, it may contain bias towards certain sectors by its very construction (see discussion in section 5.2). Alternative methods such as concentration indicis could also be trialled in future studies.

8 Conclusion and Policy Implications

A number of low income nations have sought to attract increased FDI flows to assist them in developing new and existing export industries and diversifying their export bases. In this paper, I have outlined the theoretical case for an association between increased FDI and export diversification. FDI may result in a direct positive effect on diversification through the establishment of export platforms while also resulting in indirect inter and intra-industry spillovers to host nation firms which improve their productivity and reduce the fixed costs associated with exporting, thereby increasing the number of firms which are export competitive.

This thesis was then tested empirically using a rich panel dataset comprised of 29 low income nations and it was found that increases in FDI stock are positively associated with subsequent increases in export diversification. The bulk of this effect is experienced in the year that the investment is recorded followed by a drop in diversification in the next year and an increase in the 2nd and 3rd years after the year that the investment was made. While it is difficult to isolate the magnitude of the direct and indirect effects of FDI on these changes in export diversification, the pattern seems consistent with the argument of FDI resulting in strong direct effects on export diversification in the first year, followed by spillover benefits in future years. Overall, holding other factors constant, the cumulative effect after four years of a US$1bn increase in FDI is estimated to be the creation of 83.5 new export lines.

The findings presented in this paper have a number of potential implications for policy in low income nations. Firstly, the findings lend some support to government policies which have aimed to increase FDI flows to help diversify and expand the production and export bases of low income nations. Secondly, a related point this paper highlights is that the longer term spillover effects associated with FDI may contribute significantly to its export diversifying potential. Government policies should thus aim to maximise these spillovers. Competition should not be restricted, backward linkages should be

encouraged, and informational spillovers (such as those pertaining to awareness on foreign market preferences) should be encouraged within the local business community. The enhancement of such spillovers may assist local businesses in improving their productivity and learning about foreign markets, potentially helping them to begin exporting.

Presently, many neighbouring governments are engaged in fierce competition for the attraction of FDI and many often offer significant incentives such as tax-free periods to foreign multinationals to win their FDI. This paper sheds some light on the potential benefits of FDI and governments should carefully consider these benefits when negotiating to attract FDI, to ensure that the benefits exceed the total costs of any investment incentives offered. A further significant finding was the importance of free or preferential trade agreements which were found to have a significantly positive effect on export diversification.

Finally, another notable point of interest is that for nations which have a high proportion of oil or mineral exports, the results showed that increased FDI is associated with an increase in the concentration of the export base. These governments thus face a policy dilemma in choosing between fostering the development of their resources while also facing the potential side effects of a more concentrated export base and the 'Dutch Disease' effects discussed in section 3.3. Governments in such nations should potentially consider investing in promoting a broader variety of FDI opportunities to investors, while also developing other sectors of their economy, if they are to diversify their exports in the long term.

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10 Appendix

Table 10.1 Levels Model Result – Extended Bilateral Dataset

Dependent: Count of Export Channels	Random Effects	
	Coef.	*P-values*
GDP (Exporter) - Lagged	2.144***	0.00
GDP (Importer) - Lagged	0.008***	0.00
FDI (Lag1)	6.667***	0.00
FDI (Lag2)	-1.533	0.52
FDI (Lag3)	1.398	0.60
FDI (Lag4)	4.597**	0.03
FDI & High Oil - Lagged	-9.671***	0.00
FDI & High Min - Lagged	-9.959***	0.00
Exchange Rate	-8.598***	0.00
Trade Agreement - Lagged	53.018***	0.00
North Import Partner	19.796***	0.00
Landlocked	-1.867*	0.05
Colonial History	-10.762**	0.01
Common Language	57.516***	0.00
Distance	-0.003***	0.00
1996	-0.090	0.94
1997	-1.112	0.29
1998	-4.035***	0.00
1999	-4.039***	0.00
2000	-3.249**	0.01
2001	-5.531***	0.00
2002	-5.137***	0.00
2003	-5.490***	0.00
2004	-7.545***	0.00
2005	-8.998***	0.00
2006	-13.200***	0.00
Constant	19.024**	0.01
Obs	7917	
T	13	
Wald Chi2	1271	
Prob > Chi2	0.000	
R-Square (overall)	0.599	
Rho	0.876	
Std. Errors	Robust	
FDI Lags Joint Sig. Test	P-value: 0.000	
Time Dummy Joint Sig. Test	P-value: 0.000	
Pesaran's Test	P-value: 1.000	

Notes:
**** Significant at 1%; ** Significant at 5%; * Significant at 10%*
All lags are for one period unless otherwise specified
Robust standard errors are heteroskedasticity consistent

Table 10.2 Differenced Model, Alternate Results – Aggregate Dataset

Dependent:	*Export Counts (Differenced)*	
	IV Regression	
Differenced Variables	*Coef.*	*P-values*
Export Counts (Lag 1)	0.725***	0.00
Log GDP (Exporter)	-36.151	0.16
Log GDP (Importers)	238.040**	0.01
FDI	83.863*	0.06
FDI (Lag 1)	-49.897	0.20
FDI (Lag 2)	1.147	0.96
FDI (Lag 3)	44.849	0.13
FDI & High Oil	-72.649*	0.09
FDI & High Min	-98.817**	0.03
Exchange Rate	26.695	0.53
Trade Agreement	33.329	0.10
Constant	-7.395	0.15
Obs	377	
T	13	
F-Stat	40.92	
Prob > F	0.0000	
Centered R2	0.694	
Uncentered R2	0.724	
Std. Errors	HAC Robust, bw=3	
FDI Lags Joint Sig. Test	P-value: 0.033	

Notes:
**** Significant at 1%; ** Significant at 5%; * Significant at 10%*
Standard errors are heteroskedasticity and autocorrelation robust