The Theoretical Determinants of firm size and the firm size-exporting relationship among developing nations

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Abstract

What factors determine the decision of a firm to participate in the export market? This paper looks into the firm level determinants of both size and international trade. A more comprehensive understanding of the forces behind the firm size-exporting relationship is developed. The relationship between firm size and exporting is tested using a cross-country dataset of developing countries to determine the extent of country specific influences on international trade. These theoretical considerations and cross country tests indicate a positive, significant relation between exporting and firm size. This relation is robust across all countries tested and stands up to all the robustness checks examined in this paper. Regional or country specific indicators affect the level of the relationship, but not its nature.

1. Introduction

What are the characteristics that define the nature of the size of an individual corporation and how are these characteristics related to exporting? These two questions are combined in this paper to understand the theoretical determents of firm size and the processes behind international trade at the level of the firm. This combination has been made to deepen the understanding behind the linkages between these two separate fields of economic theory. The linkage is essential in understanding the nature of the relationship between firm size and export participation. Therefore, this essay begins with a review of the existing literature on the development of firm size. Section two examines the processes behind entry into exporting at the micro level. These fields are combined to understand the basis of the observed firm level, size-exporting relationship from a number of developing countries. This is first identified through descriptive statistics of exporting and non-exporting firms.

Section five tests the preliminary results identified in the descriptive statistics through a qualitative dependant variable probit model. The probit analysis confirms the broad relation found in the descriptive statistics, showing an extremely robust, positive relation between firm size and exporting. The results support the literature on the development of firm size, and the theory of the determinants of export participation. Country specific effects do not affect the nature of the relation found between firm size and exporting in the nations tested in this paper.

2. The Theoretical Determinants of Firm Size[1]

The literature on the determinants of firm size can be split into three fields, namely technological, organisational and institutional theories of firm size (Kumar, Rajan, and Zingales, 1999). The categories are based on whether the theory focuses on the production function, the process of control, or environmental influences. This paper delves into the nature of these separate fields, which related to their applicability in the exporting context.

2.1. Organisational Theories

Organisational theories are split into contracting cost, transaction cost and the hierarchical nature of the firm. For the purposes of this paper, the focus will only be on contracting cost and transaction cost theories of the firm. Hierarchal theories of the firm delve into topics that cannot be tested by the data used in this paper, and therefore fall outside the scope of the current study. Organisational theories of economic literature focus on the nature of the costs of transactions in the market and within the firm itself as main determinants of firm size.

2.1.1. Contracting cost theories

Contracting cost theories of the firm begin with identifying the nature of the firm, stemming from Coase's (1937) insight into the nature of the firm. Coase's first focus was to ascertain why a firm exists at all, and his insight was to realise that the firm itself has developed from the costs of transactions in the market. A firm will form when the costs of using the markets to form short-term contracts are higher than producing the good internally. The firm is based on a system of relationships in which it will expand this integration to the point where the marginal cost of an additional transaction equals the cost of carrying out the transaction through the market or another firm. Diminishing returns to transactions and organisation occur, resulting in decreasing efficiency as the size of the firm increases (Coase, 1937). This is due to diminishing returns to management. This insight showed that larger firms would develop if market transactions were more costly. This may be due to a plethora of reasons such as weak property rights, uncertainty in the market regarding regulation, among others. When this occurs, it is more efficient for the firm to expand its scope of production to include these activities the market cannot efficiently provide. For this paper, the important feature is that an increase in the scope of production in the firm would not necessarily mean that the

[1] Throughout the paper, firm size pertains specifically to the level of output/employment, and does not represent the scope (the number of different tasks performed) in a particular firm.

size of the firm increases. It is in relation to an increase in production, which will result in an increase in output, and or employment. There can be a positive relation between the size of a firm, and the range of activities involved in production. The firm size distribution may be expected to be larger in areas where market transaction costs are high, as firms in these markets may produce a larger range of products, or be more vertically integrated in production.

Alchian and Demsetz (1972) take this forward by finding the mechanisms that explain why the cost of managing the resources are low in an organisation relative to the markets' allocation of these resources. There are technological advances that allow for the development of larger, more integrated firms by decreasing the costs of internal transactions, enhancing the benefits of vertical integration. The key tenant in the argument by Alchian and Demsetz (1972) is applying the theory of economic organisation to explain the determinants of the development of the firm. What is the optimal allocation of the gains from specialisation and cooperative production behaviour? Is it the nature of the market, or through the development of a firm, and how does the structure of the organisation evolve (Alchian and Demsetz, 1972)?

Input owners will make better use of their comparative advantages to increase productivity, which is rewarded through the market. This incentive for rewards in the market is what drives separate units of the firm to cooperate (Alchian and Demsetz 1972). The contracts within a firm are similar to those in the market place. However, it is the firm that is the central unit that combines these contracts in a manner with which to produce scale economies of production. The rewards of this increased productivity are what drive cooperation.

The firm can produce more efficiently than the market due to specialisation in the production of a specific good. Over time, the firm learns the more efficient production techniques and technologies, and in particular the best combination of skills and resources to manufacture the good cheaper than the market (Alchian and Demsetz, 1972). The extent to which this can be achieved increases productivity and distinguishes the firm from the market place, and thus allows for the size of the firm to increase.

Therefore, 'conceiving competition as the *revelation and exchange* of knowledge or information about qualities, potential uses of different inputs in different potential

applications indicates that the firm is a device for enhancing competition among sets of input resources as well as a device for more efficiently rewarding the inputs' (Alchian and Demsetz, 1972, pg. 795). The development of the firm can thus often said to be set within an institutional framework with which there are a number of external factors that aid in determining its equilibrium size.

2.1.2. Transaction cost theories

Transaction cost theory is developed from Coase's (1937) insight that organisational costs between firms are not zero (as is often assumed in economic theory) and are needed to explain the development of particular forms of economic organisation. The idea of transaction cost theories of the firm are very similar to the coordination cost theories above, but the focus has now shifted from looking at the internal costs of the firm to the costs between firms. Transaction costs theory looks into the effects of the nature of transaction costs particularly in situations where relation-specific investments have been made by economic actors (Donkers and Verwaal, 2002).

In fact, Alchian, Crawford, and Klein (1978) find Coase's distinction of the various forms of organisation are often too simplistic, and therefore develop a more complete theory of transaction costs and their effects on the development of the firm. It is also noted by Alchian, Crawford and Klein (1978) that the development of transaction cost theory is still too simplistic to accurately portray the complicated real life business relationships. It must be asked what contracts work in which situations to understand the dynamics of transaction costs on firm behaviour. If this does occur, contracting cost theory will take on a very interesting element in terms of international trade. How do these contracting costs change in an exchange between firms of different nations? This could represent a vital link in building the reasons behind possible barriers to trade, especially in terms of the increased relative costs associated with smaller firms.

The first important definition is that firms in equilibrium will undertake an activity if it is cheaper to provide it internally than to purchase the service in the market. Coase (1937) first looked at what constraints to trading that would cause a firm to produce internally (increase its own vertical integration), rather then contract out to the market (interfirm transactions). Alchian, Crawford, and Klein (1978) look at these determinants by exploring the costs of post contractual opportunistic behaviour.

What does this post contractual behaviour entail? This is defined as a serious threat by a party on reneging on a contract if the benefits from reneging outweigh the costs. This occurs because either the supplier or the consumer of the product realises that they have a dominant position in the short run on the contract, and as such, reneging will cost the other party significantly. This is defined as appropriable quasi rents by Alchian, Crawford and Klein (1978).

The appropriable quasi rents can occur in a competitive market, and are thus not defined as the extra rents (or exertion of market power) by a monopolist supplier or consumer of a particular service. There can often be a number of potential suppliers in the market, but once investment has been made in a specific asset for example, this may become so specialised that there now becomes only one real supplier to the incumbent firm (Alchian, Crawford, and Klein, 1978). This creates, to some extent, a monopoly in the supply of that product in the market. This is an important development in the theory of firm size. The consumer and the supplier develop a symbiotic relationship, and can often grow together as the market increases. This opens opportunistic behaviour to both the supplier and the consumer of the product due to the development of a natural monopoly. Links between the nature of the market and increased specialisation are developed further in the technological theories of the firm.

The problem of post contractual opportunistic behaviour can be solved either by the development of stricter or more long-term contracts, or via vertical integration. The assumption made by Alchian, Crawford, and Klein (1978) is that as the assets involved in production become more specific, and the prospects for opportunistic behaviour increase, the probability of vertical integration increases (as the costs of contracting increase by more then the costs of supplying the service internally). How can the risk be decreased or avoided? Firstly, prior experience with the supplier already reduces the risk of post contractual behaviour and the need for governance in the process (Donkers and Verwaal, 2002). Vertical integration as a solution to the production problem is the ultimate avoidance of risk of the opportunistic behaviour by the supplier. This vertical integration is linked to the organisational costs of the firm where this decline in the risk of opportunistic behaviour by a supplier must be weighed against the increased costs associated with commanding a broader range of assets within the firm.

Therefore it is important to distinguish between the costs of reaching an agreement between two parties when vertical integration is considered the better alternative, the division of profits of the work thereof, and the costs of the development of the contract. Of course, these costs will be unique to each particular situation, but if the large portion of the quasi rent is dependant on a particular asset, the benefits of vertical integration often outweigh the costs of intrafirm transactions (Alchian, Crawford, and Klein, 1978).

How does this behaviour shift when talking about dealing with firms and equipment on an international basis? A priori, there can also be an increased risk in exporting due to the possibly increased occurrence of post contractual behaviour. This will especially punish the smaller firms, making them less likely to enter the international arena. A smaller firm will take a much larger gamble on exporting than a large firm. Therefore, the relative cost to the small firm of the international firm (or market) reneging on the small firm is far higher.

Interestingly, there is often a clear distinction between international and local markets. As such, if the symbiotic relationship that is described above develops between an exporter of one nation and its demand in another, this may open up another potential avenue for post contractual behaviour to occur. For example, if the exporter knows that its product cannot be found in the foreign country, it would cost the market (or firm) in that nation a great deal in terms of search costs to find another good supplier. There may be increased opportunity for post contractual behaviour in the international market relation between firms. This will increase the perceived risk in exporting, resulting in a smaller percentage of small firms beginning to export. The larger firm can bear the costs of a potential reneging of a contract through a larger potential income pool with which it can recoup its losses.

Recent advancements in information technology have reduced the costs associated with monitoring firms in different geographical locations. The advancements in communication in particular have allowed owners and managers to be able to more effectively monitor and control businesses in various markets more effectively (Rajan and Zingales, 2001b). This has decreased coordination costs in the firm and has allowed for the increased development of multinational corporations. The very nature of the boundaries of the market is shifting from country specific to a global context.

However, if the costs of vertical integration are inhibitive, the enforcement of a long-term contract is the alternative. The explicit long-term contracts will define all possible contingencies in the presence of any breach of the contract, which is specified with arbitration enforcing the contract. However, not all contingencies can be cheaply specified, therefore firms often revert to an implicit form of long-term contracts. In these contracts, the main 'punishment' for reneging is a market rather than a legal mechanism in that the firm will withdraw it business in the future. Some believe that these long term contracts are therefore a form of vertical integration (Alchian, Crawford, and Klein (1978). It is this implicit long-term contract that is the most popular alternative to vertical integration in the market, and as such, legal action is rarely taken. "Firms are therefore, by definition, formed and revised in markets and the conventional sharp distinction between markets and firms may have little general analytical importance" (Alchian, Crawford, and Klein, 1978, pg. 326).

The relationships needed for the development of exporting often require considerable specific investments due to differences demand, culture, law, etc in the foreign countries (Donkers and Verwaal, 2002). These additional costs, over and above the costs mentioned earlier, often require the supplier to adapt products and alter production techniques to accommodate the foreign market. These costs are positively related to the differences between the partners. There is also increased uncertainty in exporting due to the greater difficulty in enforcing contracts, information asymmetries and larger geographical distances.

Therefore, there are increased risks associated with post opportunistic behaviour in international contracts. This is included in importing products from international companies, as it is more difficult to monitor the performance of the international supplier (Donkers and Verwaal, 2002). The costs of governance are increased with uncertainty in the relationships, which reduces the perception of potential profits in entering export markets. In terms of firm size, larger firms will be less vulnerable to opportunistic behaviour as the risk can be spread over a number of goods and other transactions. However, smaller firms can also exit the export market with lower costs and are more flexible in altering production (Donkers and Verwaal, 2002). Therefore, risk perception affects small and larger firms in different ways. However, the risks demonstrated above are weighed more heavily against smaller firms, forcing the smaller firms to focus on the local market, rather than pursuing exports. A positive

firm size-exporting relationship would be expected, based on the assessment of these post contractual risks alone.

2.2. Technological Theories

The first and most important assumption when understanding the development of technological theories of the firm is that the firm is an adaptive, learning organisation, which responds to environmental shocks based on its objectives and philosophy on achieving these objectives (McConnell, 1979). The basis of which is that the size of the market is a large determinant of the size of the firm. Further developments focus on specialisation within the firm, in which larger markets can support larger firms and thus greater specialisation. Specialisation of individual workers is then proportional to firm size (Kumar, Rajan, and Zingales, 1999). The greater the local market, the more the firm can take advantage of scale economies and increased specialisation, resulting in a more efficient production process. A larger local market can also support a larger number of firms, and thus, increased competition, spurring productivity and efficiency within the firm through specialisation. In terms of international trade, the increase in efficiency gives the firm a greater chance of success in the international market.[2]

However, Becker and Murphy (1992) challenge this view with the use of a combination of technological and organisational theories of the firm. The existence of a number of firms that cater to a variety of markets indicates that simply the size of the market is not a major determinant of firm size. Rather, their theory focuses on the existence of coordination costs limiting the size of the firm before the size of the market becomes a constraint. This is based on the work on principal-agent conflicts, free-riding, and problems with communication within the organisation. These matters imply increasing costs associated with coordinating a larger group of specialised workers. Conflict grows between members of the firm as size increases because individuals have more incentive to shirk, and "hold-up" other members' output. The members of the organisation themselves often have differing goals and conflicting interests (Becker and Murphy, 1992). The main determinants of these coordination costs are thus the extent of trust between co-workers, the extent of enforcement of contracts within the organisation, and the stability and enforcement of government laws and policies.

[2] The link between efficiency and exporting will be discussed later in the paper.

Becker and Murphy (1992) build a model in which workers are intrinsically identical, and comparative advantage occurs through the extent of individual knowledge accumulation. Productivity of the workers is then a function of this knowledge in a specific sector. The increasing competition in knowledge in a particular sector drives productivity and thus specialisation. Therefore, specialisation is based on knowledge, tying the division of labour to economic progress. Economic progress stems from growth in human capital and technology (Becker and Murphy, 1992). Increased specialisation will continue to occur as long as investment in task-specific skills has a positive effect on marginal productivity. I.e. it can overcome the increase in coordination costs as specialisation increases. In the context of a developing nation, investment in education, and the level of education of the workforce are important determinants of the rate of growth in productivity and specialisation in the economy.

This analysis of the costs of coordination provides insight to industrial organisation. Individuals that form part of a firm are governed by the laws of that firm. The individuals that are employed by other firms, but provide a service to the firm are bound by the laws of the contracts and agreements across the market. The ability of the market and the government to enforce these contracts can therefore be correlated with firm size. An increase in the enforceability of the contracts decreases both the risk of dealing with more parties in the production process and the costs involved with a potential breach in the contract by a client. In the case where contracts are regularly breached, a firm then has an increased incentive to become more vertically integrated to avoid these unreliable inputs from other firms. In this way, where the enforceability of contracts is low, firms may be expected to be larger, on average, as they become more vertically integrated, thus increasing the scope of production within each individual firm.

However, in the modern era, firms producing even simple goods often have many upstream and downstream contacts and inputs to the production process (Becker and Murphy, 1992). This is the result of technological and knowledge progress of the past, investing in education of the workforce to extend development and increase efficiencies through an increase in specific knowledge by individuals in the economy. This has, in part, taken place due to the improvement of the judicial system and in the enforcement of the law. Specialisation will continue until the higher productivity from the increased division of labour is exactly offset by the additional coordination costs of the more specialised workers (Becker and Murphy,

1992). In this case, the size of the firm is dependant on the interplay between increased production costs based on the difficulties in coordination, versus the basis of the technological theory of the size of the firm being limited by the extent of the market and its environmental influences. In relation to exporting, this local interplay between coordination costs and technological theory is important from a competitive standpoint. A country-specific increase in coordination costs (thus keeping firms smaller on average) will make it more difficult for the firm to compete internationally, reducing the probability of exporting. Therefore, a nation's investment in specific knowledge and education in the past can have an effect on the current export propensity of firms in that nation's context.

Lucas (1978) focuses on the neoclassical production function to develop a theory explaining the observed firm size distribution. The model is based on managerial talent, which is stochastically spread across agents in the economy in which firm size is positively correlated with managerial talent. The agent can become a manager or employee. Any agent can become a manager, but in equilibrium, only the most talented individuals become managers due to the correlation between talent and firm size. An increase in firm size increases managers' expected payoff and also salaries to workers within the firm (Lucas, 1978). Therefore, the agents that are not talented managers would have a higher payoff by becoming employees. In equilibrium, each firm has reached the level of capital and labour that minimise average cost (Kumar, Rajan, and Zingales 1999).

Also, the decision of the firm to increase its capital or labour and the levels of this increase is based on the elasticity of substitution between capital and labour. If this is less than one, there will be a higher level of capital intensity for these firms in equilibrium. This increase in the capital-labour ratio increases the wages of the workers in these firms so that the marginal managers are then enticed into working as employees and not owning their own firms (Lucas, 1978). This allows for an increase in the average firm size, with the smaller, marginal firms falling out of the market. Therefore, from this analogy, firms with higher capital-labour ratios should be larger, on average (Kumar, Rajan, and Zingales, 1999). Managerial ability is one of the key factors driving increases in the firm size distribution in a country. In this model, managerial ability is stochastically distributed, but in reality, this can be altered over time through policy decisions focussed on education. Indeed, the educational system of a country has a large effect on the development of the distribution of firm size. In addition, observed differences in educational systems between developed and developing nations will affect the

firm size distribution and indeed competitiveness of firms in these markets. The shortage of sufficiently skilled managers in developing nations could slow down the development of efficient, competitive markets locally, and have an effect on the local firm's abilities to compete in international markets.

Focussing more on the organisational structure of the firm, Rosen (1982) indicates that any increase in productivity at a particular level filters down to successively lower levels within a firm, increasing overall productivity. The distribution of firm size and managerial incomes are based on the market assignments of various workers to different positions. This market alignment is based on the individual's talent and productivity, resulting in a hierarchical structure of employment in a firm (Rosen, 1982). The assignment of persons with increased talent for responsibility allows for greater productivity improvements along the chain of command in a multiplicative manner. A small increase in managerial efficiency at the top level can therefore make a large difference in productivity and efficiency in the firm.

Rosen (1982) also focuses on clarifying the following observable facts that cannot be explained by conventional production theory:

a. The distribution of firm size and earnings are both skewed to the right. This observed distribution of firm size is remarkably stable, with firms not observed to tend towards the size that standard U-shaped cost curve analysis predicts.
b. The salaries of top executives in large corporations are positively correlated with firm size
c. The salary structure within firms is also positively correlated with positions of greater authority.

Technology that is multiplicative in nature within worker productivity is necessary to explain these observations. This is based on the decision-making process where each decision affects the lower level of employees at the firm multiplicatively in a recursive format. It is these multiplicative technology interactions that allow for the development of a stable distribution of firms that is skewed to the right (Rosen, 1982).

The element that stops all production being controlled by one firm is diminishing returns to supervision. A manager has only a limited time to devote to supervision, and as such, shows a loss of control over the production process as the number of employees under the manager is

increased (Rosen, 1982). The more superior the manager, the more workers he/she can effectively oversee. The manager's talent is shown by a more efficient control of the production process through better supervisory techniques, allowing for control over a larger number of workers. A marginal increase in managerial talent can allow for a sizeable increase in the number of workers he/she can oversee. In this regard, this model from Rosen (1982) is similar to the Lucas model in that the most talented individuals are employed at the largest firms and have the highest positions. These individuals have the largest number of workers underneath them. The trade-off between loss of control over supervision and the scale economies in management decisions is what determines the size of the firm (Kumar, Rajan, and Zingales, 1999).

The time spent with each production worker by the supervisor is positively correlated with the skill level of the worker itself. The higher the skill of the worker, the greater the returns to increased managerial time spent with the worker. The distribution of skills in the economy is inherent, and is not based on investment in knowledge, as in the model by Becker and Murphy (1992) above. However, the composition of skills of the workforce is still important, as the productivity of each worker is dependant on the other workers in the firm. This is because there are diminishing returns to management, and due to the existence of complementarities in production, resulting in the manager spending more time with the more able workers to improve production (Rosen, 1982). It pays to assign the most efficient people to those positions that have the greatest responsibility and have the greatest influence on production as these members can significantly increase production efficiencies. This result also indicates that the level of human capital inherent in an economy is thus a partial determinant of the overall size distribution of firms in that country.

The work of Kremer (1993) develops on the technological theories of Rosen (1982) and Lucas (1978) above, and attempts to model worker quality and its effects on production and wage rates. The production function of the firm is based on several stages of production, in which workers specialise in each separate stage, and worker quality is based on the probability of a mistake. A mistake in the production process renders the product damaged to the extent that it can either not be sold, or only sold for a fraction of its worth. In equilibrium, the workers with high skill (based on the fact that their probability of a mistake is much lower) are grouped together in production, and wages and output rise steeply with the skill level. This model differs in that the high skilled workers do not move into supervisory or

managerial positions, but instead, they are grouped together in production of higher value products where mistakes are more costly to the firm (Kremer, 1993).

This is based on what is called the O-ring production function, following a Cobb-Douglas format, but does not allow quantity to be substituted for quality of workers in the production chain (Kremer, 1993). The model exhibits increasing returns to skill in the workforce.

This O-ring production function correctly predicts the large productivity differentials between rich and poorer nations, which are based on increasing returns to skill in production. A small difference in the skill of labourers in a country leads to large productivity and wage differentials. In addition, a higher capital-labour ratio is found among firms (and countries) that employ higher skilled workers. Firms with workers of a high quality in the production chain will then continue to seek workers of increased skill, and will bid higher wage rates for these workers. Workers of similar skill are bundled together in firms, and indeed even in cities or countries (Kremer, 1993). This is also consistent with the fact that smaller firms are found in poorer countries.

In the case where technology is used to produce goods of varying degrees of complexity, the assignment of a worker to a particular technology depends on both the workers own skill level, and the distribution of skills in the economy (Kremer, 1993). This correctly predicts that more advanced countries tend to focus on the production of more complex products since these nations have invested more in education.

This could result in the developing countries exporting products that use simple production techniques to produce. Exporters in developing nations may then employ a lower percentage of skilled workers in the company, and possibly a lower capital-labour ratio as well. Cheaper labour in developing nations will also cause multinational firms to locate in these countries to take advantage of factors of production that are labour intensive.

There is also a link between the complexity of the production process and number of workers in the firm, which then follows the fact that firms tend to be larger in more advanced nations (Kremer, 1993). This is linked to increased managerial efficiency in the Rosen (1982) and Lucas (1978) models as well. The Kremer (1993) model focuses on the workers themselves and not at the extent of the market as a determinant of firm size. This particular theory

suggests that in a nation where little has been invested in education, there will be a much lower capital-labour ratio. Instead, if one follows the model by Becker and Murphy as above, it is also the decline in coordination costs that allow for the development of larger firms in developed nations. As an extension to this, increased managerial talent in the Rosen (1982) model also allows for the decline in coordination costs due to the use of more effective means of supervision. The linkages shown in this section demonstrate that each of the theories above has some bearing to the observed firm size distribution in reality. This is the problem though, because they all have some bearing in real life, but something from each model is needed to fully explain the factors that affect the size of the firm.

The positive association between the complexity of the production process and firm size then results in firm size and the wage rate also being positively correlated (Kremmer, 1993). Firms in less developed nations will have a much smaller pool of highly skilled workers to choose from, and thus will use less advances technologies to produce their products. If the correlation between the complexity of the production process and firm size is correct, then the less developed nations will tend to have smaller firms on average (Kremer, 1993). Therefore, if there is a positive association between firm size and exporting, developing nations will export less on average then developed nations.

Therefore, from an international trade perspective, nations with poor education systems will focus on developing products that are labour intensive, and will specialise accordingly. This increased specialisation will allow for increased efficiency in production of these labour intensive products. These companies that are able to specialise as such will then be able to enter the international arena. This is also dependant on the extent of the legal system, and enforceability of contracts mentioned before. The observed composition of exports from developing nations should be skewed to goods produced using labour intensive means of production.

This O-Ring production theory also predicts that trade restrictions cause large welfare losses. Trade restrictions can paralyze production by allowing bottlenecks to develop in key sectors that would normally be bypassed with international trade (Kremmer, 1993). It is these bottlenecks to production that can alter the extent of the local market and hamper the efficient development of competition within a country. This is due to the lack of development of

sufficient supporting industries and efficient upstream and downstream firms to support increases in competitive practices.

In sum, technological theories of production are all based on attempting to explain that small institutional, organisational and technical changes can actually make large differences to the production function. The results will impact on the evolution of firm size in a given industry and even in different economies. The idea is also to explain the large differences in firm size between developing and developed nations on the back of fundamental changes in each regime.

2.3. Institutional Theories

Institutional theories focus on the effects of the macroeconomic environment and institutions on the nature of firm size (Kumar, Rajan and Zingales, 1999). This section is split into two subsections, focussing on financial and regulatory theories as institutional barriers to firms. These theories can be seen as complimentary to the technological and organisational theories of the firm and taken together aid in the development of a solid theory of the development of the size of the firm.

2.3.1. Regulatory theories

Regulatory issues associated with the firm vary in different markets and economies. For example, the issues surrounding environmental impact assessments vary from one nation to another. Furthermore, a significant increase in regulatory compliance is often seen with a small increase in firm size (as the firm expands from one size category to the next in governmental legislation). Thus, as is the case in many industries, even though the firm has not changed structurally, the increased regulatory costs and restrictions will have a significant negative impact on the competitiveness of the firm (Kumar, Rajan, and Zingales, 1999). These increased costs therefore fall disproportionately on medium sized firms. The smaller firms then have an advantage in this area in which the regulatory compliance issues then forms a barrier to expansion on both the financial and regulatory compliance fronts. I.e. a firm that is seeking to expand may be limited by an environmental impact assessment, which can take up to a few years to complete. By this time, market dynamics and even technologies in production may have been significantly altered.

Other regulatory compliance issues such as product laws often favour the creation of separate legal entities for different products to allow for the protection of limited liability (Kumar, Rajan and Zingales, 1999). High corporate taxation can also drive many firms into the informal sector, which will lend to these firms staying small to keep off the government radar. This increased incidence of small firms in the market limits the gains from competition in efficiency and productivity. In addition, these firms will not export due to the organisational issues that come with selling internationally.

Taxation in any form creates distortions and alters incentives. High company taxation decreases the returns on investment, lowering the optimal output of the firm. As such, small firms that do not pay tax benefit in this regard. Corporate taxation is therefore another barrier to expansion to small firms. These increased regulatory barriers cause a larger number of firms to stay small and cause them not to consider the possibility of entering international markets. To stimulate formal participation in the economy, countries often offer a minimum size threshold, below which firms do not have to pay tax. This threshold may represent a significant barrier to expansion.

Large firms can also use their market share in lobbying and employing extra staff to decrease the costs of taxation (through measures such as creative cost accounting) and thus gain an advantage in this regard. Therefore, the incidence of high corporate taxation is ambiguous on the effects of the distribution of firm size within a market (Kumar, Rajan, and Zingales, 1999). This may lead to a large number of small firms competing with a few large firms in a particular industry. The increased incidence of regulatory issues will specifically hamper the growth of smaller firms. The increased costs due to compliance and taxation may also decrease export propensities as the additional regulatory costs will decrease external competitiveness. Furthermore, a number of small firms that could potentially export in the future do not due to the bureaucratic problems that come with growing into a medium sized firm.

Hopenhayn (1992) looks into the dynamics of firm size, and entry and exit through a stochastic model of competition and firm evolution. A key tenant of Hopenhayn's (1992) paper is that barriers to entry play a significant role in determining firm size. Increased barriers to entry raise output prices and allow firms in the market to increase their size in that sector. The decrease in competition in the market also allows for the increased incidence of

smaller, less efficient firms to stay in the market, decreasing average firm size. Once equilibrium is reached, the dynamics of firm size are then dependant on firm specific productivity shocks and their effects on efficiency. This is the only source of uncertainty in the model, and it is on these productivity shocks which cause firms to enter or exit the industry. The probability of a positive shock (in comparison to the other firms in the industry) can be increased by the incumbent firm via investment in productivity. This productivity shock also determines the size of the firm's output, and its ability to compete in the market. The implication of the model by Hopenhayn (1992) is that larger firms tend to be older and stay in the market longer. This links into the fact that the larger firms therefore tend to be more productive. This increased stability in the market and enhanced productivity are two important links in the firm size and exporting equation.

Hopenhayn (1992) also finds that firm destruction and creation rates are industry specific. Therefore, one of the largest determinants of variation in entry and exit dynamics is the industry, and the existence of exporting firms can also vary from industry to industry. Hopenhayn (1992) noted that there are high and low turnover industries.

Therefore, regulatory issues affect the development of competition through barriers to entry in the market, and through their effects on firm size. There is an interesting interplay between these forces on the market. The increased regulatory issues and barriers hamper firms from entering the market, thus decreasing competitiveness. This will tend to increase the average size of the incumbent firms in the market, potentially raising productivity and efficiency. However, the lack of competition will also stimulate inefficiencies in the market. Therefore, based on the proposed positive relation between firm size and exporting, increased regulatory costs and barriers may actually stimulate exporting through these larger firms. However, external competitiveness of the sector may be poor due to high regulatory costs and taxation, and due to the lack of local competition. A decline in export propensity would then be expected.

Therefore, regulatory issues and costs have a significant impact on the potential development of the local industry, affecting the nature of the firm size and exporting relationship. An unstable regulatory environment may also act as a deterrent to investment (as the regime may reduce potential long run gains). Within this field, the stability of the marcoeconomy plays a role in supporting the effective and efficient development of an industry within a particular

country (Tybout, 2001). As such, country specific effects, a priori, will cause a variation in the observed relationship between firm size and exporting.

2.3.2. Financial theories

The ability of firms to find external financing is an impediment to increasing size and even entering the market in the first place. If this is the case, there should be a positive correlation between firm size and the availability of finance (or the cost of finance) or factors that promote the development of the financial services sector within a country. "A country with a common law judicial system, and having strict enforcement of this law, has a more developed financial system. This would suggest that there is an additional, indirect, channel through which sound laws and judicial efficiency affect firm size - through their effect on financial development" (Kumar, Rajan, and Zingales, 1999, pg. 8).

Even though more developed financial markets allow for firms to expand, this also allows for a greater number of firms to receive finance to start up. Financial markets are positively correlated with both the size and number of firms in a given market. A decline in the costs of external finance will allow for a greater number of smaller, less efficient firms to enter the market (Rajan and Zingales, 2001b).

There have been a number of developments in the recent past to allow for finance to be more readily available encompassing both technological and regulatory changes. Financial institutions now hold an array of instruments with which risk can be analysed and spread (Rajan and Zingales, 2001b). A greater competition within the financial markets themselves has brought about better prices of finance and individual packages that are tailored to the individual companies needs.

With financial development, capital is now far easier to come by, having two opposing effects on firm size. The first is increasing firm size through allowing firms to expand, and the second is to decrease average firm size by allowing more firms to enter the market. However, the effects of this are skewed in favour of the smaller firms, as many of the larger firms already have access to finance, both internally and externally.

With the increased availability of finance, assets such as plant and equipment are no longer unique to a specific firm. In the past, the managers of the firm were trapped within the parent

company because the company owned the assets. Now, the managers who have had access to the production techniques of the firm have increased access to external finance, which can be used to open a new firm and increase competition in the market (Rajan and Zingales, 2001b). This in itself gives rise to enhanced competition in the market where, in the past, the development of these new companies would not have occurred. This increased access to external finance has given a new interplay of interfirm and intrafirm dynamics to the market. This is an important link to the contracting cost theories from above, especially in terms of problems with post contractual behaviour and the extraction of appropriable quasi rents (Alchian, Crawford and Klein, 1978).

Rajan and Zingales (1998) argue that an increase in financial development stimulates growth through decreasing the cost of external finance to firms. This is especially evident in sectors that are more in need of external finance, and as such, these sectors should develop disproportionately faster where the financial markets had been more developed. Financial development also decreases the cost of raising funds externally relative to internal sources, because financial markets aid in overcoming the problems of moral hazard and adverse selection. This increase in the transparency of investments decreases the cost of finance, as the outsiders are more aware of the risk of the project.

In terms of this relation to firm size, Rajan and Zingales (1998) find that the development of the financial system has a much larger effect on the number of establishments, rather then their size. Therefore, these financial markets influence growth by disproportionately improving the prospects of younger firms, which typically are innovators. Older firms in a given industry are less dependant on external finance, supporting the notion that the development of financial markets benefits new firms disproportionately (Rajan and Zingales, 1998).

These findings also have important implications for the development of the pattern of trade. This access to finance in specific countries will lead to different levels of specialisation dependant on the nature of financial development and its associated costs. I.e. the access to cheap external finance gives an industry that is heavily dependent on this finance a comparative advantage, allowing these firms to more effectively compete in international markets (Rajan and Zingales, 1998). Access to external finance is often needed for the firm to afford the costs of developing international linkages, or increasing productive capacity to

compete internationally. The advent of external finance allows for the development of more effective competition within a particular country, as the managers of the incumbent firms who have access to the processes and technology of the firm can then leave and start their own firms.

Alternatively, a lack of external finance in a particular nation will support the existing firms, allowing for these firms to exert more dominance in the local market. Thus, one would expect to find a higher concentration of firms, with a larger average size in these nations. The ability of new, smaller firms to enter the market and effectively compete is severely diminished.

The effects of the development of financial markets on firm size are again dependent on the enforcement of law. La Portia, et al. (1997) look into the costs of external finance in countries with different legal environments and find that capital markets are dependant on the character of legal rules on financial development (or investor protection) and the quality of law enforcement. This applies to both the debt and equity markets. In fact La Portia, et al. (1997) show that legal rules and law enforcement differ systematically across nations. Countries that have poor laws regarding investor protection have industries with more concentrated ownership. Better legal protection allows for investors to offer budding entrepreneurs finance at a lower rate therefore allowing for a more effective financial sector to develop and higher valued capital markets that reach a larger array of firms in a country (La Portia et al. 1997).

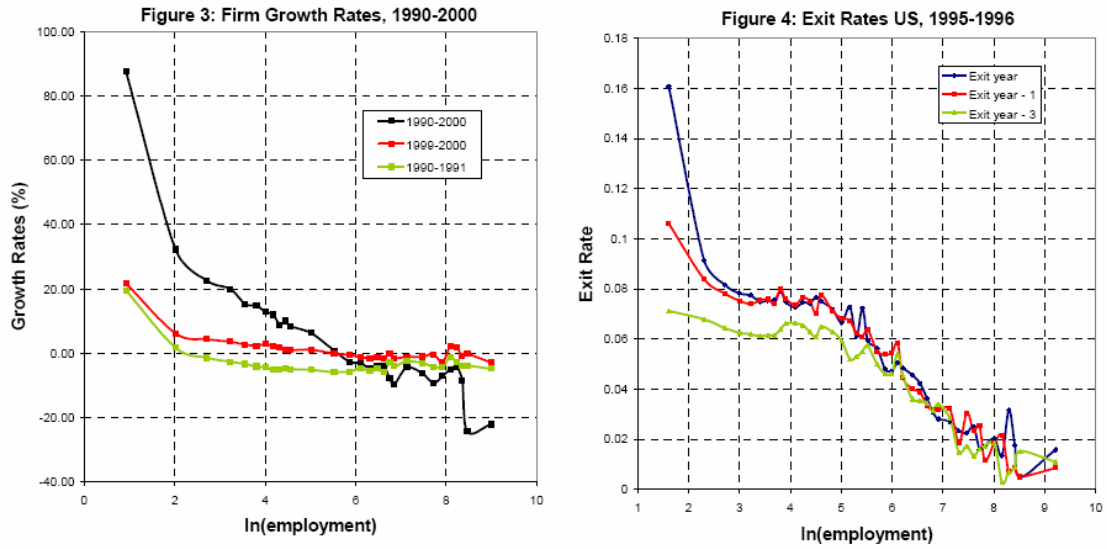
Indeed, a number of authors find that the firm size distribution is right-skewed (which evolves over time to a lognormal distribution). Indeed Cabral and Mata (2003) show that financial constraints are the main determinant of the evolution of the distribution of firm size within a market, and that selection contributes little to the size of the firm. However, one would believe that selection has a large role to play in this because the smaller firms have much higher failure rates. Interestingly, Cabral and Mata (2003) find that the firm's initial size is a function of the entrepreneur's wealth constraint and the minimum efficient scale for production. As the firm ages, financial constraints become less of an issue, with firm size and growth then based on other factors as described earlier. Cabal and Mata (2003) also find that the firm size distribution is relatively stable over time, even with entry and exit taking place in the market.

In the long-run, the entrepreneur's level of education is found to be a determinant of size in that the more educated entrepreneurs tend to grow their firms into larger corporations (Cabral and Mata, 2003). This is consistent with the contracting cost and organisational cost theories noted earlier. Therefore, it can be seen that the level of education can also be an important determinant of whether the firm enters the export market or not. The larger firms with more educated and efficient individuals will therefore tend to seek to enter the international market rather than the smaller firms that focus their production on the local market.

2.4. Aggregate firm size dynamics

What is the link between firm size and growth, entry, and exit rates? How do these linkages relate to the propensity to export? Hall (1987) commented that smaller firms are more volatile, making entry, exit and growth rates larger amongst this group of firms. In fact, Rossi-Hansberg and Wright (2004) note that this relation between firm size and growth is significant throughout the distribution of firm size. There is a significantly larger degree of turbulence among the survival of small firms, as is demonstrated in figure 1 below. The graph on the left is the growth rate among firms between 1990 and 2000 in the US, and the graph on the right demonstrates exit rates among firms in relation to size. The graph follows firm size in the exit year, one year before exit and three years before exiting. It is interesting to note that only the small firms decline in size in the years before the exit. There is no significant difference in the change in firm size for larger firms in the three years before they exit (Rossi-Hansberg and Wright, 2004). This figure clearly demonstrates that smaller firms are more volatile.

Figure 1: The difference in growth rates and exit rates for a sample of firms in the US in the 1990's from Rossi-Hansberg and Wright (2004)



There may be a link between these growth rates and the size-exporting relationship. Smaller firms are still focussing their production at the local market and looking to find their optimal production strategies and efficiencies. The larger firms on the other hand may be reaching the extent of the local market and have to start looking internationally to continue to expand their production. They may also have diseconomies to managing the production as discussed earlier, and have reached an efficient point on their cost curves. The growth rate of the larger firms is more based on the growth of the local demand and improvements in technology rather than the improvement of the process of manufacturing.

2.5. Innovation and firm size

Symeonidis (1996) extensively surveys the literature on the links between innovation, market structure, and firm size, based on the Schumpeterian point of view that market power and large firms stimulate innovation. Symeonidis (1996) finds that research and development spending rises proportionately with firm size. Large firms have an advantage in research and development and innovation when there are large sunk costs to research. The intensity of research and development and the opportunity for innovation are also industry specific, and depend on a number of unique factors such as the existing technology, demand characteristics, institutional differences, and the interaction between different firms (Symeonidis, 1996). Furthermore, strong competitive forces within an industry may spur

research and innovation. In a highly competitive industry, a firm that can effectively find methods of reducing costs or increasing productivity can reap significant gains by undercutting its competitors. The potential gains may be very large in this case. With the inclusion of the development of product law that protects the incumbent once new additions to existing technology have been introduced, the large potential pay offs from such an improvement will spur development and efficiency in the use of new technology and production techniques.

This may allow for the small firm to develop faster or allow for the bigger firm to spend more on research and development to stay at the top. In this case the theoretical evidence is mixed, as the smaller firms can adjust their production techniques more easily, but the larger firms can spend more time and effort on research and development into new production techniques. Larger firms may also have a better knowledge of the limits to the current technology, making potential improvements in the technology more beneficial. These firms can also recoup the cost of research easier.

This literature on innovation and firm size was brought to the fore by Schumpeter (1942), who argued that a large firm in a concentrated market is the main driver of technological change, and as such, the rate of innovation within a particular sector increases with average firm size. Schumpeter states several reasons for this, including (based on Symeonidis, 1996):

1. Research and development often involves large fixed costs, making it difficult for the small firm to make a return on investment.
2. Economies of scale in innovation.
3. Larger firms are more diversified and are therefore in a better position to take advantage of new opportunities.
4. The focus of research and development can extend to more then one project for larger firms, diversifying the risk of research.
5. Improved access to finance.

In addition, market power and innovation are positively correlated because:

1. These firms are likely to have larger markups, and thus can more easily finance projects through retained earnings and profits.

2. Firms with greater market power have more incentives to innovate as they can appropriate increased returns to investments through sales of new products (there is little threat of competition copying the innovated product).

The main tenant of these arguments is that the speed of technical progress and innovation is dependant on market structure. If this is the case, it is very important for the link to exporting. Firstly, if the large firms are making more discoveries, it is probable that these new discoveries have not been found internationally, representing an opportunity for the firms to begin to export. Second, the larger firms have the production capacity to enter international markets. Third, large firms are more likely to have the financial backing to take the risk in exporting the newly innovated product. This is especially the case with access to external or internal financing to cover the costs involved in entering other markets.

Innovation may simply be an improvement of the production process or the modification of an existing product. This has implications for costs and the potential for exporting. A larger firm will be in a better position to take advantage of the innovation, both financially and through effective use of the export market. A smaller firm may just be looking locally to exploit the technological change, when the potential gains from this technology can be further exploited in international markets, significantly increasing expected returns. This further spurs research and development in larger companies, as there is a larger probability of gaining returns to the new technology.

In instances where smaller firms are innovators, they do not necessarily have the capacity to start exporting and will build a base of local customers from which they develop over time (and indeed overcome the hurdle of financial constraints) to increase productive capacity. In time, this base of local demand can then be used to start exporting. Often, the firm will only look to export once the growth potential of the local market has been reached. This hypothesis also links back to the technological theory of the firm size in that the size of the firm is often based on the size of the local market. By this time, the firm is much larger, indeed confirming the fact that larger firms have a higher export propensity. As McConnell (1979) noted, no industry will look to export when the domestic demand is still able to sufficiently absorb the firm's increasing production.

However, there have also been counterarguments to the Schumpeterian firm size and innovation theory. An important caveat is based on organisational theory of the firm. There is a loss of managerial control over the innovation process, causing diminishing returns to research and development. Larger firms also have increased bureaucratic issues that can decrease returns to research (Symeonidis, 1996). However, this may also start to decline as the threat of competition declines. It is often seen in industries with natural monopolies. The large incumbent has little incentive to innovate unless there is a credible competitive threat. The lack of effective competition allows the firm to "get comfortable" in its production process and does not continue to look for new innovation and increased technological efficiency. This has been seen in a number of instances, where the incumbent monopolist will take advantage of its dominant position in the market (Symeonidis, 1996). The threat of competition may spur technological develoments, as the full extent of the monopolist's power may be spent on research and development to stay ahead and continue its profitable reign as a monopolist. Again, the potential gains for research and development to stop incumbents from entering the market will be significant.

However, evidence on the connection between innovation and firm size is disappointingly inconclusive, with research being plagued by many methodological issues bringing further conflict to the discussions on the topic. Indeed, the literature does not look into the specific mechanisms driving innovation in relation to firm size (Symeonidis, 1996). The focus is on a one way direction of causality from firm size to innovation, and the role of finance or appropriate conditions in the development of innovation. This causality is focussed on structure and its effects on research and development. However, innovation and firm size are both endogenously determined within a complex system of fluctuating demand and opportunism. The methodological issues of the reporting of research and development at the firm level must be ironed out of the data collecting process (especially with regard to small firms under-reporting the extent of their research and development activities) before an adequate attempt can be made at understanding the complexities of this process (Symeonidis, 1996). As such, there has been little progress made on understanding the processes behind these relationships.

Nevertheless, support has been found for some of the Schumpeterian views. This is especially the case with smaller firms facing disproportionately larger problems in terms of procuring external finance for research and development projects (Symeonidis, 1996). This finding ties

in well with the firm size and financing literature reviewed above. However, the literature also shows considerable decreasing returns to research and development, as is evidenced by the fact that large firms have proportionately less innovative products entering the market. This finding is also plagued by many econometric issues.

So, is there any consensus on the relationship between firm size and innovation? With regard to financial issues, the vast majority of small firms do not even engage in any form of research and development. This conclusion is plagued with measurement issues that could underestimate the innovative propensities of smaller firms. There does seem to be a positive relationship between firm size and research and development above a certain size threshold, but there are significant cross industry, time and even country variations in this finding (Symeonidis, 1996). There are industries which are intensively focused on research.

An interesting feature here is the variability between countries. There could be a positive correlation between this variation and the propensity of firms to export in different nations. A significant lack of research in a given nation could also see a low propensity to export by the firms of that nation. The lack of research may also stem from the industrial structure of the nation, and the degree of competitiveness in local production. An industry that has developed under the protection of an import substitution policy may be based on inefficiencies and not striving towards increased competitiveness locally. The industry itself may have developed under this premise of protection, thereby not dynamic efficiency and competitiveness. Indeed there could be a close relationship between the extent of innovative activity and the degree of openness of a particular nation, and the ways in which its industrial structure has developed.

2.6. Findings from Rajan, Kumar, and Zingales (1999) on firm size

Rajan, Kumar, and Zingales (1999) looked into the determinants of firm size, with careful attention paid to the fact that there are a number of exogenous factors that are country and even industry specific which affect firm size development. The main findings of their paper are discussed below:

The two main findings of the study are that firms in capital-intensive industries and firms in countries with better judicial systems tend to be larger (Kumar, Rajan, and Zingales, 1999). The positive relation between the judicial system and firm size is in line with the arguments proposed by the critical and co-ordination cost theories of firm size. This is also consistent

with some aspects of the financial cost theories. A more efficient judicial system allows for a greater and more effective control of the production process other than physical resources, facilitating firm growth through better protection of property rights, increased financing, and reducing legal co-ordination costs. However, when going into further detail on these, the increase in size in capital-intensive industries is not linear when the judicial system is improved (Kumar, Rajan, and Zingales, 1999). The gap in size between differing industries narrows as the judicial system improves. Financial constraints also affect firm size. The results from the cross-industry regressions follow the technological theories.

The relative strengths of these conclusions will vary according to industry. For example, in industries that are highly resource based and have larger value added per worker, human capital is of more importance. In this case where there is a greater depth in human capital in a country, the firms in these sectors tend to be larger.

The cross-country results are more mixed. In contrast to the technological theories, per capita income seemed to have a negative impact on firm size after correcting for institutional variables. Therefore, this association found in other research is possibly a distinction between the developing and developed nations, where market size and competitive effects are different (Kumar, Rajan, and Zingales (1999). Previous theories by Rosen (1982), Becker & Murphy (1992) and Kremer (1993) all proposed that there is a positive correlation between human capital and average firm size. However, this variable was not significant after controlling for individual judicial efficiencies in Kumar, Rajan, and Zingales, (1999). Breaks from the technological theories can be expected as these often abstract from the institutional features that govern firm formation and growth.

Kumar, Rajan, and Zingales (1999) look at going into more depth on the implications of the technological theories by examining the influences on the dispersion of firm size within a particular industry. Kremer (1993) found that a greater inequality in human capital would lead to a greater dispersion in firm size due to the matching of human capital to potential growth rates of individual firms. In addition, an increase in institutional development at the country level would level the playing field for firms to enter the market and allow for these firms to reach their optimal levels of production. This is found in the data, where increasing judicial efficiency lowers the dispersion of firm size within a particular sector (Kumar, Rajan, and Zingales, 1999). This also decreases the effects of human capital within a country. Therefore,

an increase in judicial efficiency decreases the size spread of firms within a sector and reduces the human capital variable to become insignificant (Kumar, Rajan, and Zingales, 1999).

One problem with the regressions is that a number of the variables are highly correlated. However, this is a traditional problem with cross-country regressions (all measures of institutional and human capital development tend to be highly correlated with one another), which makes it difficult to separate the effects. These cross-country results must also be taken with caution because they are very sensitive to differences in the definition of an enterprise in different nations, and there are few degrees of freedom (Kumar, Rajan, and Zingales, 1999).

However, there is one issue about the development of these theories in relation to the nature of the countries investigated in this paper; the firm size theories all take into account the effects of a stable economy on firm size. The nations in this sample are developing countries and thus cannot be considered as 'stable' economies. Many of these nations are still in a state of transition, and therefore a large number of exogenous factors will affect the development of the size of the firm. It is still important to delve into the theory, as it still provides a thoughtful insight into the workings of the individual firm and how its size develops over time. In addition, the data also includes a large number of industries, and therefore the use of varying degrees of technology in differing industries gives a good insight to the effects of production technology on firm size (Kumar, Rajan and Zingales, 1999).

2.7. Conclusion

The literature has shown that there are a vast number of direct and indirect factors that determine the nature of the firm and the firm size distribution in a particular industry or country. The plethora of theories on the determinants of the size of the firm is a fastidious example of this. Importantly, when looking at the differences between firms of various sizes, these different theories must all be taken into account, as each brings a different aspect of the understanding of the processes behind firm formation. It is the combination of all of these theories that will ultimately enable us to understand the complexities of the processes that define the nature of the firm.

The forces affecting firm size formation are constantly in flux, depending on institutional and market related factors. In particular, increased access to finance over the recent past has been

one of the many forces transforming the nature of the firm (Rajan and Zingales, 2001b). The move toward increased deregulation of industry and technological change has also allowed firms more freedom to grow. However, there are still a number of other aspects that restrict firm growth, particularly in developing nations. A particular example of this is the shortage of skilled labour that many countries are facing. The ability of a firm to find skilled labour can be a significant bottleneck to expansion. Firm growth increases issues surrounding management and supervision. A shortage of labour can present challenges to growth throughout the chain of potential firm development and hamper the optimal firm growth rate. Forces on the firm will continue to change into the future, and will constantly present different challenges to understanding the underlying causes of the size of the firm.

3. The Theoretical Determinants of Exporting

The emphasis now turns to the theoretical determinants of exporting at the firm level. In particular, trade occurs and specific industries export due to differences in technology, productivity and endowments (Bernard, Jensen and Lawrence, 1995). Much research has been focussed on industry level trade determinants, which conceals the potentially important firm level heterogeneity in production. What factors go into the firm's decision to export and more importantly for this paper, how do these factors relate to the firm size-exporting relationship and indeed how do these affect the size of the firm? It will be shown that as with the determinants of firm size, there are a plethora of interrelated factors to take into consideration on the development of this literature. The combination of the determinants of export decisions at the firm level with the main determinants of firm size will give a greater understanding to the drivers of international trade.

The first question to be addressed is why does a firm begin to export? The firm will start exporting if the present value of the stream of profits for the exporting markets is greater than what the firm will receive locally (Tybout, 2001). Therefore, decision to export can be seen as a behavioural act by the firm's decision makers in response to either external or internal environmental shocks. This response to environmental shocks varies across time and indeed different firms may reflect differences in managerial organisation in terms of objectives and performance goals, access to information channels and learning experiences, and attitudes to entrance into the international arena (McConnell, 1979). This is all in relation to the firm's beliefs and attitude to the local market. Furthermore, the actual incidence of exporting varies significantly across industries and countries (Bernard, Jensen and Lawrence, 1995).

Two opposing theories dominate the debate in terms of explaining the dynamics behind why firms enter the export market (Bernard, Jensen and Lawrence, 1995). The first theory assumes that export markets do not differ substantially from local markets, and therefore, exporters should not have much difficulty in breaking into export markets or find many additional advantages in international trade. The alternative hypothesis supposes that breaking into the international market is difficult and therefore firms that export are those that have an advantage in production (Bernard, Jensen and Lawrence, 1995). If it is this alternative hypothesis that stands, there will be substantial differences between exporting and non-exporting firms, once all other factors have been accounted for. If the international markets

are able to provide benefits to plants, these benefits should then be seen in differences between exporting and non-exporting firms such as growth rates and changes to productivity and efficiency. However, this can actually be seen as a country-specific phenomenon, as each nation has its own set of competitive forces, institutional linkages and productivity curves. This perhaps would lend more weight to the second set of theories represented above, as at an institutional level, there are a range of differences between countries.

Bernard and Jensen (2001) find that among US firms, exporters are larger, have proportionally more white-collar workers, pay higher wages to their workers, and thus have more efficient employees and higher productivity levels. These results have been found in a number of other countries (Tybout, 2001, Bernard, Jensen and Lawrence, 1995). Exporting companies are also found to have a higher capital-labour ratio, and make more use of technology in production (Tybout, 2001). These firms have higher investment rates in machinery and equipment per employee. This is especially the case for larger firms, where the disparity in the capital-labour ratio between exporters and non-exporters is at its largest (comparing firms of similar size). Moreover, these observed differences between exporters and non-exporters are seen to hold over time and across industries. These results tend to lead one to believe that the alternate hypothesis from above is a better explanation of the determinants of exporting. However, there is a caveat; it is not known whether exporting itself causes these differences between firms, or whether the more efficient firms themselves tend to self select into the international arena. Certainly, however, the evidence is in favour of self-selection (Bernard and Jensen, 2001, Clerides, Lach and Tybout, 1998).

3.1. Firm Level Exporting Models

The development of firm level theories in trade performance and the propensity to export has been extensively researched. Bernard and Jensen (2001), Bernard, Jensen, and Lawrence (1995), and Clerides, Lach, and Tybout (1998), have discovered a number of stylised facts that characterise the differences in the nature of firms that export from those that do not. Interestingly, there are a relatively small number of firms that actually export, and of these, they tend to export only a small portion of their output.

Traditionally, international trade theory has focussed on industry or country level exporting and its determinants and there has conventionally been very limited focus on the firm level evidence of trade related policies and their effects on exporting. Within this, theory focussed

on understanding factor content and specialisation within different industries, but not focussing on the reasons for specific producers entering the export market and others falling out of the market altogether (Bernard et al. 2000). Therefore, a model of international trade is developed based on the individual firm (based on Bernard et al. 2000).

The model is based on three key foundations:

1. Firms are heterogeneous
    a. This is introduced in the model through a Ricardian differences in technology framework, where the level of efficiency varies across firms and nations.
2. The explanation of the coexistence of firms that cater specifically to the domestic market and those that export in the same industry in a given nation
    a. This is done by adding the assumption of iceberg costs to exporting
3. The model must also incorporate imperfect competition with variable markups.
    a. Bertrand competition is added into the framework for this

The firm exports only when it still has a cost advantage over firms in the import-competing nation after geographic barriers and iceberg costs have been overcome (Bernard et al. 2000). Therefore, the exporting firm has to be more efficient than import-competing firms of the reciprocal nation. The theory developed by Bernard et al. (2000) link a plants technological efficiency to its productivity.

In the model by Bernard et al. (2000), imperfect competition is assumed. The price of the lowest cost producer is therefore dependant on the price of the second lowest cost producer in the market (Bernard et al. 2000).

3.1.1. Implications for Productivity, Exporting, and Size

This section closely follows the work of Bernard et al. (2000). The model demonstrates the link between measured productivity and underlying efficiency. The results of this model are that exporting firms tend to be larger with higher underlying productivity.

First, consider a firm producing good *j*, but this good is produced only for the domestic market. There is no exporting or trade framework for now. Therefore, from a given bundle of inputs $I(j)$, efficiency ($Z_1(j)$) can be determined by output $Y(j)$:

$Z(j) = Y(j)/I(j)$

However, this is not a useful measurement of efficiency because it all depends on how one unit of output is measured. Therefore, a measure of the value of output can be used to measure plant productivity (y):

$$y(j) = P(j)Y(j) / I(j)$$

Under perfect competition, the price level is based on the cost of input prices and the relative measure of efficiency, $P(j) = w / Z_1(j)$ so that $y(j) = w$, where ω is the price index for the input bundles. Therefore, measured productivity will be the same for all the firms considering that all firms face common input bundle pricing. This is seen regardless of their relative efficiency. Therefore, when there is perfect competition in the market, this value based approach of measuring productivity does not capture any underlying differences in efficiency.

Under imperfect competition, the more efficient producers will be able to sell their product with an increased markup. Therefore, the price of good *j* will now also be based on the level of the markups by the individual firms, $P(j) = M(j)w / Z_1(j)$ where *M(j)* represents the markup and ω is the price index for the input bundle. Measured productivity is now represented by $y(j) = M(j)w$ (which is the cost of the inputs, scaled up by a producer specific markup). Differences in productivity can now only be measured through markups, which are more of a representation of the strength of monopoly power rather then differences in efficiency.

The model, however, implies that firms that are more efficient are able to charge larger markups. In addition, firms that are employing more advanced production techniques can charge larger markups due to increased underlying technological efficiency. The conditional expectation on productivity (allows one to show a plant with higher productivity) is also proportionately more efficient. One caveat is that if the company is able to charge monopoly rents, then the expected efficiency rises with the same change in productivity.

Under imperfect competition, the heterogeneity across measured efficiency in firms in a sector or country can capture the changes in relative productivity. From here, the link between

productivity and exporting must be made, and then the focus must turn to the correlation between size and exporting. So far the link between productivity and efficiency has been shown in the domestic market only. Adding the international market to the mix makes things far more complex, indeed because firms can choose different markups in their export destinations. This is based on the extent of competition in the local and global markets. A firm that is able to extract monopoly rents in the local market may have to significantly reduce markups to compete internationally. However, the basic assumption still stands that the more efficient firms still charge higher markups in any market.

3.1.2. Efficiency and Exporting

What is the correlation between efficiency and exporting considering the fact that is has been shown that an increase in efficiency allows a firm to increase its markup? This section follows from the last and follows closely from the work of Bernard et al. (2000).

To start, consider the best possible producer in country *i* for good *j*. This producer typically has the largest markup in the domestic market, but now faces potential competition in international markets with efficiencies $Z_{1k}(j)$ for $k \neq i$. Where each *k* represents a different nation and each nation has a different set of observable firm efficiencies (distribution of efficiencies). In order for the firm to sell its product at home, it must be more productive then the international producers (including some iceberg costs to trading for the international firms),

$$Z_{1i}(j) \geq Z_{1k}(j)\frac{w_i}{w_k d_{ik}} \forall k \neq i$$

Where d_{ik} is the so-called iceberg cost to trading. Therefore, the local firm can be less productive then the international firm, but can still sell its product locally due to the additional costs incurred to the international firm to be able to export (or sell the product in the domestic firm's market). However, if the local firm wants to export its product, it must then incur these additional "iceberg" costs to trading. Therefore, for the local firm to sell in some other *n* market requires,

$$Z_{1i}(j) \geq Z_{1k}(j)\frac{w_i d_{ni}}{w_k d_{nk}} \forall k \neq i$$

This results in a so-called triangle inequality in which $d_{nk} \leq d_{ni} d_{ik}$ or that $\frac{w_i d_{ni}}{w_k d_{nk}} \geq \frac{w_i}{w_k d_{ik}}$.

This cost to exporting adds an additional hurdle to selling the product in an international country. Therefore, any company that is able to sell its product internationally is also efficient enough to sell to at home (by default), but there are only a small number of firms that participate in the local market that are efficient enough to export.

The more efficient firms therefore have a higher probability of entering the export market, as these firms have greater cost advantages in more markets. This model is a demonstration of the fact that the more productive firms tend to export the most and allows for the existence of firms selling to both local and international markets.

3.1.3. The model by Melitz and Ottaviano (2005)

Melitz and Ottaviano (2005) develop a monopolistically competitive model of trade with heterogeneous firms and differences in the degree of competition in different nations. The degree of competition is endogenously developed through a linear demand system with horizontal product differentiation.

Increased trade linkages tend to decrease markups and increase productivity. Therefore, this model represents a dynamic system in which linkages to international markets affect the nature of local firms and overall productivity.

To begin with, the model is formed in a nation without trade. The domestic market size has an effect on the distribution of firms and their respective performances. As such, the larger markets have a higher overall productivity, in which firms also have lower markups and offer a larger variety of products. This theoretical assumption can be linked to the technological theories of firm size. The technological theories predict that the larger market can support larger firms with increased specialisation of workers. These larger markets can hold a larger number of firms, strengthening competitive forces and increasing productivity. The improvements in productivity stem from a larger demand base, which allows for scale economies in production, increasing specialisation and driving competition. To confirm this linkage, Melitz and Ottaviano (2005) also predict that in larger markets, the firms are also bigger on average and show higher profit levels, but the probability of survival in this market

is smaller. This is indicative of the higher productivity amongst surviving firms in the market, and the toughness of the market in not allowing smaller firms to survive.

The model is extended to a two country case with trade flows. This can easily be extended into a multiple country framework with asymmetric markets across regions. The costs of trade allow for endogenous differences across countries to remain to some extent, with the larger markets before trade still showing bigger firms with higher levels of productivity. Trade causes the least productive firms to exit the market, with the more productive firms expanding and increasing their market share. It is only the more productive firms that begin to export, with the comparatively less efficient firms focussing exclusively on the local market. These more productive firms are also larger prior to exporting due to their large local market share. The model further delves into the dynamic effects of trade liberalisation on competition. Trade liberalisation leads to a reduction in markups among firms.

Evidently, there are a number of similarities in the two different models. The key tenant running through both models is that the larger and more efficient firms are those that are able to export. This makes sense considering theories of firm size discussed above. Firms that want to begin exporting have to be more efficient and productive on average. The Barnard model builds on efficiency through the extent of local competition. In the Melitz model, it is built up through scale economies (based on the size of the local market). As such, both models are built on differences in efficiency and productivity

There is a degree of comparability in these models, as the extent of competition can also be based on demand linkages, with a larger market being able to support more firms, which may increase the strength of local competitive forces. The extent of local competition all depends on the structure of the market. A larger market may also be dominated by a few large producers, where scale economies have allowed these firms to block entry for smaller firms. In this case, one would expect a larger export propensity of firms in this market, based on the Melitz model. In the Barnard model, however, it is also dependant on how the extent of competitive forces locally has affected productivity and efficiency.

3.2. Observed Firm Level Exporting Results

The section above demonstrates a few examples of the theoretical results and predictions of exporting at the level of the firm. However, what does the evidence say about the accuracy of the theoretical literature?

Surprisingly, the number of firms out of the general population that actually export is comparatively small, yet these firms accounted for dominant production within an industry or country. For example, in the US, only 10.4 per cent of manufacturing plants in 1976 and 14.6 per cent of manufacturing plants in 1987 were exporters (Bernard, Jensen and Lawrence, 1995). This observation follows the Melitz and Ottaviano (2003) model from above. Furthermore, the majority of exporting firms only sell a small portion of their output in the global market. Baldwin and Gu (2003) also find that entry into exporting is also infrequent and that a large number of firms also fail in the exporting market.

However, the problem is the fact that the direction of causality is unknown. I.e. are the larger firms bigger because they export or do they export because they are larger? A number of studies have suggested that the correlation runs both ways and is dependant on a plethora of firm and industry-specific factors (Tybout, 2001, Roberts and Tybout, 1997). As shown above, it is the more efficient firms in theory that start to export. In this case, the increased efficiency means that the firm can become dominant in the local market, and thus also become larger in the process. Indeed, the correlation does not simply run linearly one way or another, and in many cases, the effects are both determined endogenously within a complex system.

A number of authors have therefore focused on firm specific effects to explain the relationship between firms and export behaviour. Bernard and Jensen (2001) include a variety of plant specific variables such as past success, labour quality, the ownership structure of the firm to help explain part of the role that plant specific characteristics have on the decision to export. These attributes play a large role in determining firm decisions with past export behaviour is the most significant determinant of the current decision to export. This is in part due to the presence of large entry costs to exporting, but these costs vary significantly across regions and industries. A number of expgenous factors must also be considered, such as the exchange rate, government subsidies and spillover effects of locating in an “exporting cluster”, which are built into the model along with the firm-specific effects.

The probability that the firm will begin to export is also based on its organisational structure and its ability to correctly identify and obtain information regarding the foreign market. Firms with increased access to any information channels will have a higher probability of becoming exporters as these firms are more likely to be exposed to opportunities from the international market. In addition, the ability of the firm to adapt to different environments and shocks and to learn from previous experiences is closely related to its ability to secure and correctly assess information about potential international markets (McConnell, 1979).

3.2.1. Economies of agglomeration

Interestingly, spill-over effects resulting from industry clustering can help firms export by reducing the costs associated with entry through being close to other exporters in the same industry, and establishing commercial linkages. Geographical concentration of firms allows for the development of specialised transport infrastructure such as ports, or can improve access to information about international markets. Bernard, Jensen and Lawrence (1995) find that geographic concentration of exporters can explain part of the premium in wage rates seen amongst exporting firms. The added agglomeration economies that reduce costs and increase the availability of suitable labour may also help firms start exporting on efficiency grounds. These spill-overs imply that there are external economies that are specific to a given location, which can be associated with the propensity to export (Aitken, Hanson, and Harrison 1997). These externalities to production and exporting by locating in a cluster decrease the costs and risks involved with entering foreign markets, allowing for smaller firms to start exporting.

However, Bernard and Jensen (2001) find these spill-over effects to be insignificant and in some instances actually negatively correlated with exporting at the firm level. These findings are consistent with the work of Aitken, Hanson, and Harrison (1997) who show that firms locating in a specific “exporting zone” are not more likely export, after controlling for firm and region specific characteristics. However, evidence of positive externalities with respect to the location of multinational corporations is found. Multinational firms already have information on the international market (or a multi-market presence) and can provide, either directly or indirectly, information about the nature of the foreign market, and can serve as a conduit for international technology transfer to the domestic market.

3.2.2. Foreign ownership

Foreign firms are significantly more likely to export then locally owned firms (Baldwin and Gu, 2003). However, these firms tend to focus on their owner's market and do not tend to export their products into other regions. This is evident in Canada, where foreign controlled firms are responsible for the bulk of exporting activities. These firms have a higher propensity to export and also tend to export a higher percentage of their output (Baldwin and Gu, 2003). In fact, as Canada increased its outward orientation from the 1970's, the gap in export propensity between domestic and foreign controlled firms became more pronounced. These foreign controlled firms have higher success rates in international markets and are more likely to remain exporters than locally owned firms. The success of foreign owned firms links to knowledge processes about international markets and the development of linkages easing the transition to these markets for the incumbent firms. However, significant entry costs must still be overcome for the firms to start exporting to other countries (Baldwin and Gu, 2003).

Furthermore, foreign controlled firms tend to be larger, on average. A foreign firm looking to set up a subsidiary or buy out a company in the local market would choose or set up a firm of significant size, where possible. It is expected that the foreign firm would pass on knowledge about processes and efficiencies to further enhance the local firm's competitiveness. A small firm would not necessarily carry the size to reach scale efficiencies required by the international firm for returns on investment. If a small firm is purchased by the international company, it is likely the international company has earmarked the domestic firm for expansion. Therefore, as a topic for further research, is foreign ownership of a firm followed with significant changes in the firm's production techniques, efficiencies, and changes in size and the rate of growth? Certainly, the links to the international market that the foreign firm represents would increase the scope of market probabilities for the local company. A priori, faster growth and increased productive efficiencies may be expected. The subsidiary will inherit the foreign firm's product and production efficiency knowledge. The firm would not have to spend important resources and time on finding the correct product mix for increased efficiency and productivity.

Indeed, in terms of the firm size and exporting relationship, smaller, foreign controlled firms may be expected to export. The size threshold for firms exporting may be lowered with the incidence of foreign ownership.

3.2.3. Entry costs

What are the effects of entry costs on exporting behaviour? Entry costs can be seen as sunk in nature in the process of beginning to export because they typically involve establishing links to the international market, assessing the demand conditions, and the costs of establishing a system to distribute the goods (Bernard and Jensen, 2001). Typically, a firm will continue to export for an extended period once the trade link has been established. Exporting for more then one period is often required to recoup the costs of establishing the trade link. This is often built into the firm's expected returns in developing the export route. Therefore, the number of exporters in the market today is a function of the types as well as the number of exporters in previous periods. However, "one problem with empirical tests at this level is that a number of forces including changes in expectations, adjustment costs, and pricing-to-market behaviour that have nothing to do with sunk costs can generate apparent asymmetries" (Roberts and Tybout, 1997, pg. 546).

Nevertheless, the incorporation of entry costs in the model as sunk costs gives the firm an additional incentive to wait and therefore increases the region in which the firm decides not start exporting. In addition, sunk costs help to explain persistence in exporting. Bernard and Jensen (2001) find that once the firm starts to export in one period, the probability that it will export thereafter is significantly increased. Transitory changes in the macro environment or policy can have long-term consequences in the market structure; for example, an exchange rate devaluation increases the number of exporters, but a number of these will then remain in the foreign market long after the currency has returned to its original level once more. This is known as hysteresis in trade flows (Roberts and Tybout, 1997). A great deal of uncertainty in the market (in terms of present and future conditions) will cause a large number of firms to not export when conditions are favourable due to the presence of these sunk entry costs.

This is an important feature for the South African dataset, because at the time of the data collection, South Africa's exchange rate was extremely volatile, making the future stream of cash flows by local firms tremendously difficult to predict. Therefore, firms will likely to be more hesitant in starting to export, this is especially the case with small firms, in which the sunk costs to entry will take a disproportionately large part of their income to cover. The risks to enter a foreign market are also much greater for smaller firms who might not turn a profit out of exporting and who could battle to recover the losses more than a larger company.

However, Tybout and Roberts (1997) find that firms that stop exporting for a period of three years or longer incur full re-entry costs into the foreign markets once more. The hysteresis factor of trade declines rapidly for those companies that stop exporting. After a few years, the firms' probability of exporting in the next period is similar to that of a comparable firm that has never exported before.

The extent of the costs borne by the firm is also dependant of a number of external and internal factors. Firms in developing nations that attempt to export to developed countries often have to incur quality upgrades of the product and indeed an upgrading of the productivity of the plant, substantially increasing sunk costs. A lack of supporting infrastructure from access to efficient transport routes to mediating companies aiding the links to the export process also substantially increases costs and barriers to entry. This occurs through significantly increased transport and logistics costs. In this case, larger firms again fare more favourably both in terms of being able to recoup the sunk costs and are more likely to have more efficient modes of production. Large firms may also sell goods directly to the final buyers, and thus can circumvent the need from intermediaries to aid in the export process and find markets for the firm. This lack of an effective trading services sector was seen to affect only certain sectors and producers in Columbia as evidenced by Roberts and Tybout (1997).

There is also a large amount of "noise" to exporting in that the yearly number of firms entering and exiting international trade, as a percentage of total firms exporting, is significantly larger than expected. There are a large number of firms that enter and exit the market on regular occasions in subsequent periods. These shifts in the firms exporting status do not follow changes in the exchange rate regime, or other external competitive shocks, strengthening the evidence that sunk costs play a major role in determining the firms export decision (Bernard and Jensen, 2001). The observed noise by Bernard and Jensen (2001) certainly indicates the complex nature of the firm's decision to export, and the constantly changing dynamics of this process. A number of unobserved dynamics may also play an important role in the decision to export or not in a given period by the firm.

The persistence found in exporting might also be caused by plant heterogeneity. The profitability of exporting is heavily correlated with characteristics such as size, age and

ownership (Roberts and Tybout, 1997). Bernard and Jensen (2001) find that unobserved plant heterogeneity to be a major contributing factor influencing the firm's decision to export.

3.2.4. Productivity differentials

Bernard and Jensen (2001) used firm size and productivity to proxy as measures of a "good" firm in testing the claim that good firms tend to be exporters. It was consistently found that exporters are larger on average across industries and regions. Exporters tend to sell higher quality goods, and thus workers earn higher salaries in exporting firms, as these firms hire higher quality labourers (Bernard and Jensen, 2001). One caveat to the findings is that labour quality might be correlated with firm size. Empirical evidence on firm size (as noted above) has found that larger firms tend to hire labour of higher quality, which introduces an endogeneity bias to the model.

Exporters pay better salaries to both the production and non-production (managers, etc) workers than their counterparts that do not export. Part of the wage differential between exporters and non-exporters is the comparatively higher number of non-production workers hired in exporting firms (Bernard and Jensen, 2001). This is indicative of the fact that exporters have higher productivity workers and a greater use of technology in production, decreasing the need for lower paid, low skilled workers in the firm. There is a significant, positive relationship between exporting and productivity, as the percentage of plants involved in exporting increases dramatically with an increase in productivity. Evidence of this productivity gap has been found by Baldwin and Gu (2003), where over time, the productivity gap between exporters and non-exporters actually increased. The major proportion of the divergence in productivity stems form an increase in labour productivity and capital deepening by exporting firms (Baldwin and Gu, 2003). This can also be due to the fact that access to international markets allows the firm to learn more advanced means of production. The complexities involved in export participation could also require the needs of extra managerial skills and this is partly reflected in exporters having a relatively larger number of non-production workers in the firm. Following the Lucas model (1978), workers that show increased managerial talent work in larger firms and have increased control over production will aid in increasing productivity and efficiency in the firm. More talented managers will inherently have an increased expected pay off within the firm, and may be able to further exploit export linkages.

Plants that start exporting in a given period have correspondingly higher growth in employment and wages, and those firms that exit in the same period have poor wage and employment growth (Bernard, Jensen and Lawrence, 1995). This could be evidence of a positive productivity shock to new exporters or the new access to larger markets. In contrast, firms that exit the market are often found to be in a negative productivity spiral, where the size of the firm often declines at the time of leaving the international market. There is a great deal of transformation occurring for a particular firm in the short-run when it begins to export, this can be seen by a variety of changes in the production structure. However, this is not seen in the long run. Bernard, Jensen and Lawrence (1995) find that current exporter status is not a good indicator for future competitiveness and success. Firms that start exporting have been successful in the recent past, and tend to grow rapidly once exporting has begun, but this is not a long-term correlation.

3.2.5. Learning-by-exporting and self-selection

What is the direction of causality between exporting and productivity? Do more productive firms "self-select" themselves into the exporting market, or is there evidence of firms "learning-by-exporting" to become more productive after trade linkages have been established? Productivity growth itself can also result from a number of factors, most importantly, capital accumulation, new technology, and changes in the actual organisational structure of the firm (Baldwin and Gu, 2003). Therefore, it is difficult to disentangle the effects of productivity growth and specifically point to the effect that exporting does have on the firm.

Firms that begin to export have access to new markets, ideas and technologies. These can be a significant source of gain for the incumbent firm, and thus productivity improvements can accompany a firm's entry into a foreign market. Buyers in the foreign market may also actively take part in the production process at home, giving advice and assistance on improving productivity and on the production process in general. These externalities from exporting are the basis of the argument for learning-by-exporting. This is also very important for the size of the firm on many levels. First, an increase in productivity will allow for the firm to decrease its selling price for its goods, both locally and internationally, allowing for the firm to expand its position in both markets. The firm's optimal levels of production may be shifted outward, allowing for an increase in production, and corresponding firm size. The increased efficiency of workers can also allow for enhanced managerial efficiency, decreasing

the costs associated with increasing the size of the firm, increasing the optimal size of the firm itself.

Support of this argument has been widely documented by the fact that exporting firms are, generally, more efficient than firms focussing on the local market (Clerides, Lach, and Tybout, 1998). However, this causality can run both ways. As explained above, foreign markets are often represented via tough competition, and with significant start-up and transport costs, the local firm has to be relatively efficient to enter into the foreign market. Therefore, more efficient firms self-select into the foreign markets. It is only these more efficient firms that have lower marginal cost curves that can profitably overcome the significant costs to entry and begin to export (Clerides, Lach and Tybout, 1998). This is especially the case in developing nations where the nature of competitive forces in the local market may not be as strong as in developed nations, or fully functioning markets. This extends to the local procurement of inputs to production for exporting firms. Exporters in developing nations can be at a disadvantage due to inefficient input suppliers, increasing the costs of external factors of production.

To strengthen the argument, exporting firms have consistently lower variable costs, yet firms quitting exporting have the highest costs and lowest corresponding efficiencies. Clerides, Lach and Tybout (1998) also find that these quitting firms experience a decline in variable costs after they stop exporting. This is evidence of either substantial costs incurred by the firms when exporting or possibly a reduction in firm size or focus or more niche product markets to reduce their variable costs after leaving the international market. Exporting firms are also evidenced to have higher labour productivities in which Clerides, Lach, and Tybout (1998) do not attribute to correspondingly higher skill intensity, again relating to more effective production techniques and access to increased technical assistance from international buyers.

However, Clerides, Lach and Tybout (1998) find that exporting history has no significant effect on marginal costs in manufacturing firms in Mexico, Morocco, or Columbia. However, the weakness in this statement from this paper is that they are not measuring total costs, and thus even though variable costs are increasing with exporting, total costs and thus productivity could still be improved. The finding has, however, been supported in a number of other studies focussing on exporting and productivity. In these papers, previous exporting does not

ultimately affect the productivity of the firm, where self selection into the export market is customary (Le Heron, 1980).

However, as mentioned earlier, Baldwin and Gu (2003) find the gap in productivity between exporters and non-exporters in Canada is continuing to widen. Entrants to international markets have the highest productivity growth rates. New entrants are more successful in acquiring knowledge from breaking into new markets. "A threshold or discontinuous learning effect appears to exist that favours recent arrivals to export markets, perhaps because they have more catching up to do" (Baldwin and Gu 2003, pg. 646). Firms with higher rates of growth in productivity were seen to be more likely to start exporting in the forthcoming periods. Young and domestic controlled plants in the Canadian sample benefited the most from international exposure with the highest corresponding growth rates after beginning to export. Foreign controlled firms were not seen to benefit from exporting. This finding suggests that the changes in productivity from beginning to export are firm specific and dependant on a variety of unobserved effects. However, it could also suggest that foreign controlled firms had access to international technology and production knowledge from the outset, and therefore would not significantly gain from exporting. There is a high probability that the foreign controlled firms would export to the country of ownership of the firm, decreasing the likelihood that the firm would benefit technologically from exporting.

The probability of a firm experiencing learning by exporting effects may also be dependant on the nature of competition in the local market and the corresponding foreign market. The results above indicate that the development of the firm itself and the extent of competitiveness in local and foreign markets are the major determinants of whether learning-by-exporting occurs or not (Baldwin and Gu (2003). This could also be a result of differences in managerial competencies to accessing and using information from foreign markets to develop and alter production techniques and even change input suppliers from local to foreign firms. Baldwin and Gu (2003) also find the differences in productivity growth between exporters and non-exporters decreases after controlling for firm size.

Exporters contribute a disproportionately large amount to productivity growth. A large proportion of export productivity growth in plants in Canada is actually from those plants that increased aggregate export intensity (Baldwin and Gu, 2003). The increased outward orientation of Canadian firms has also lead to the increased relative importance of exporters to

productivity growth in manufacturing. Firms that do not export are contributing less to aggregate productivity growth over time. This could also be due to the decreased market share by non exporting firms in the Canadian sample. Therefore, trade seems to serves as a channel for the transfer of knowledge.

There are still a large number of firm specific effects that are unaccounted for. Firm heterogeneity still plays a key role in the determinants of wage rates. For example Bernard, Jensen and Lawrence (1995) find that the majority of the differences in wages between exporting and non-exporting firms can be explained differences in plant characteristics, location of the firm and its industry. The actual composition of the workforce within a particular firm also plays a significant role in the changes in the wage rate between exporting and non-exporting firms. This does lend to the fact that exporting firms can hire better workers due to increased technological efficiencies. It pays the exporting firms to hire better workers as the costs of mistakes are higher with increased technology used in production. However, these differences in observed effects indicate that more research is needed in the development of theoretical models of the firm.

3.2.6. Other effects

The exchange rate also has a key role to play in export determination. The exchange rate is negatively correlated with exporting in that an unexpected depreciation of the currency sees an increase in firms entering in international trade. However, due to the persistence aspect of exporting, many of the firms that entered as a result of the exchange rate devaluation stay exporters long after the currency has returned to its previous level. Bernard, Jensen, and Lawrence (1995) find that the majority of responses to a favourable exchange rate movement from exporters is current exporters increasing their trade rather then a number of new entrants beginning to export. In the case of new firms beginning to export, hysteresis in exporting can be explained in part by an increase in productivity of these firms. Access to the international market allows for technological and knowledge transfer, and therefore allows the firm to stay competitive in the international market after the exchange rate has appreciated once more. This may have interesting size implications for the firm. The increased efficiency as a result of knowledge and technology transfer may allow the firm to increase its local market share, and also its size. In this instance, the external shock has given rise to increased firm size and productivity.

3.3. Conclusion

A vast number of factors must be taken into consideration when determining the firm-specific effects related to exporting. The question of what causes a firm to start exporting can thus be explained by a number of separate, yet interrelated effects that create a unique probability in each observation. The overall reasons why firm size matters in terms of exporting however be summarised by the following observations, amongst others:

1. Larger firms are more able to spread the risk involved in international trade (in terms of exporting), and are therefore more likely to enter into international markets than smaller firms.
2. Large firms are more able to deal with the entry costs associated with begging to export. In a small firm, relatively high entry costs, as a portion of total revenue may be prohibitive, and thus force a given size threshold upon the firm before exporting can occur.
3. Large firms are more productive, and are therefore more able to overcome the barriers to exporting, and more able to compete in the international market.
4. Increased access to international markets and competing in the global market enhances efficiency and firm growth – firms that export grow faster than those that focus solely on the domestic market.
5. Linkages with international markets may allow for an increase in returns to management, and thus lead to productivity and efficiency gains for the firm, and will ultimately increase the size of the firm.

While some of these can be controlled for, there will always be an element of unobserved effects that alter the firms' decision to export. This literature has given some insight to the complexities involved in export decisions, and has highlighted the key determinants of firm specific export participation. The combination of these theories with that of the development of the size of the firm aid in developing a unique export function based on firm size.

4. The Observed correlation between firm size and the probability of exporting

The theories on firm size and on exporting are widely spread, with a host of different themes attempting to first explain the development of the size of the firm, and also trying to understand the dynamics of firm behaviour at the level of the firm. There are, of course a number of different effects that cause variations in results across industries, regions, and even countries. However, what amongst all these theories can be found to run through the core of each dataset, from the macroeconomic, to the level of the firm? It is these concurrent themes that we are seeking to be found within this preliminary research into the relation between firm size and exporting. What parallels are there to be found in firms that exist in entirely different environments?

This section now turns to the relation between firm size and exporting using a World Bank dataset.[3] Firm size and exporting theories will be used in tandem as much as possible to explain the observed correlations. In other areas, the correlations have provided the basis for further research in this area, so that a more accurate model of the relation between firm size and exporting can be developed.

Seven countries have been used in the analysis from the World Bank dataset. The countries reviewed in the sample are South Africa, Bangladesh, Brazil, Cambodia, Madagascar, Tanzania, and Thailand. These countries have been selected as they are all in the same "peer group", that is, these nations have similar economic characteristics. All these nations are classified as developing nations, and have been selected to represent different regions across the globe, namely Africa, South America, and Asia. Table 1 demonstrates a summary of the main economic indicators of each nation. The average inflation rate across each nation in the sample has been on the decline, even though they remain variable. Therefore in every nation, with the exception for Thailand, has inflation averaged above 5 per cent per annum between 1995 and 2007. Interestingly, the average GDP growth rate has been on an increasing trend with all the nations in the sample. Average GDP growth rate was higher between 2000 and 2007, than for 2995-2007. As such, all nations, with the exception of Brazil averaged above 4 per cent in the growth stakes between 2000 and 2007. Large differences can be seen in the current account balances of the different nations in the sample. For example, in 2007, the

[3] World Bank Private Enterprise Survey, Productivity and the Investment Climate

current account balance, as a percentage of GDP reached -13.9 for Madagascar, while Thailand had a trade surplus of 6.4 per cent. However, Thailand was the only nation that recorded a large current account surplus in 2007, with three other nations, namely South Africa, Cambodia, and Tanzania all recording current account deficits.

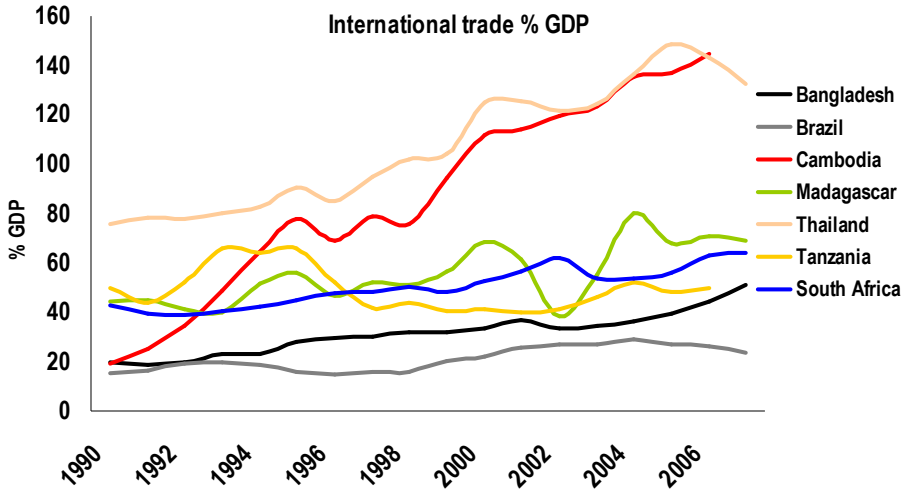
Table 1: Selected macro-economic indicators

	Inflation 1995-2007	Current account balance 2007	Pop growth rate 1995-2007	Average GDP growth rate 1995-2007	Average GDP growth rate 2000-2007
Bangladesh	5.78	1.06	1.94	5.24	5.79
Brazil	11.96	0.13	1.47	2.48	3.43
Cambodia	5.23	-3.60	2.12	7.72	9.57
Madagascar	13.36	-13.87	2.91	2.81	4.30
South Africa	6.10	-7.26	1.39	2.67	4.26
Tanzania	9.63	-8.97	2.33	4.75	6.76
Thailand	3.50	6.43	0.84	4.77	5.01

Source: International World Economic Outlook (IWEO)

Figure 2 demonstrates that since 1990, international trade (imports and exports) as a percentage of GDP has been on the increase. Cambodia and Thailand, in particular have increased their relative openness to trade quite considerably since 1990. For Bangladesh, Madagascar, South Africa, and Tanzania, international trade represents approximately the same percentage of GDP. Brazil seems to be rather protected, with international trade only representing a relatively small proportion of the composition of its GDP.

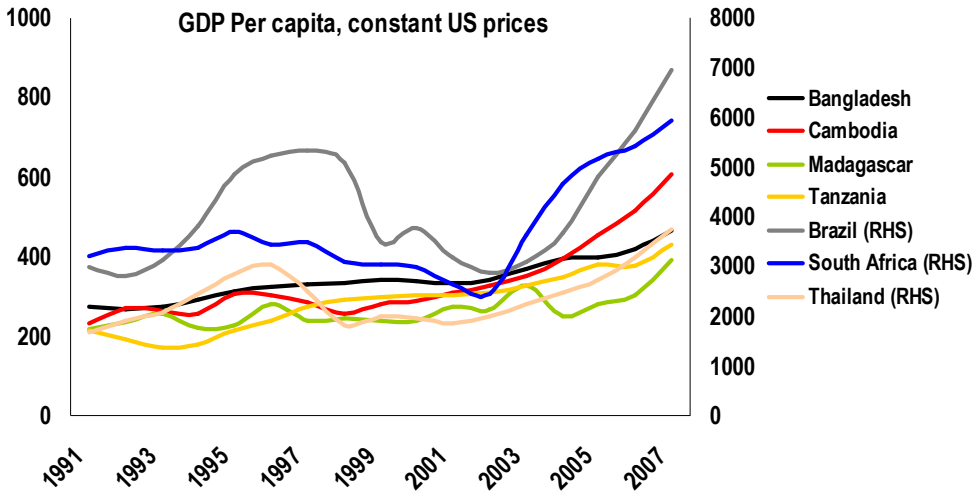
Figure 2: Trade as a percentage of GDP between 1990 and 2007



Source: World Bank, world development indicators

GDP per capita, in US dollars, has been on the increase in each respective nation, especially since 2003. In South Africa, Brazil, and Thailand, GDP per capita is considerably higher than the other nations in the sample. Therefore, the nations can be split into two groupings, with people in Tanzania, Cambodia, Madagascar, and Bangladesh incurring relatively similar but much lower GDP per capita rates. Nations with larger GDP per capita in this sample may represent larger and more sophisticated market structures that advocate competitive forces more strongly, and may allow firms in these nations to enter international markets more easily. These nations may also have the advantage of more developed infrastructure, decreasing transport and logistics costs associated with exporting. An interesting dynamic with respect to these nations lies with the fact that while Thailand is relatively open to trade, Brazil does not seem to be so.

Figure 3: GDP per capita in US dollars (constant prices)



Source: IWEO

The focus now turns to the behaviour of the firms in the individual datasets, bearing in mind the general macroeconomic indicators demonstrated above. The analysis will be focussing on identifying any defining characteristics of a particular region. For example, do the Asian nations have a larger propensity to export? Does the theorised firm size-exporting relationship hold across the developing nations in the different regions?

The following section begins with some summary statistics the characteristics of the firms in each dataset. Once a cursory analysis is complete, further testing of the relationship between firm size and exporting is done through a probit model.

4.1. Summary statistics

Some basic analysis of the characteristics of the different datasets is done to find any observed differences between firms that export and firms that cater solely to the local market. Firstly, as is shown in table 2 below, the datasets themselves vary quite considerably in terms of the number of firms interviewed in each country. For example, Brazil has 1640 observations while Madagascar has only 290.

The average firm size in each dataset also varies quite considerably. In terms of firm size, the World Bank dataset has information regarding the number of temporary and permanent employees in each establishment. To provide a fair measure of firm size using employment indices, these figures have to be combined. However, since a temporary employee is not as entrenched in the workings of the firm itself, the number of temporary employees in the firm is then divided by two when measuring employment. This total employment measure is the first gauge of firm size used in determining the firm size-exporting relationship. This measure is also useful as it can be compared across nations and sectors. By looking at the number of employees, for example, firms in South Africa, Bangladesh, and Thailand all have over 300 workers, on average.[4]

South Africa has the highest percentage of firms that participate in international trade, with 58 per cent of the firms in the dataset exporting, and an even higher 60 per cent importers. Interestingly, South African firms are also largest, on average, using the measure of the number of employees. The three countries with the smallest firms, on average, namely Brazil, Cambodia, and Madagascar also have the least number of exporters, as a percentage of the total population. A small number of firms in Cambodia and Brazil also import, suggesting that there is a link between importing and exporting, overall. Other than Cambodia, the average age of each firm is at least 18 year, indicating that a large proportion of the firms interviewed are well established, which may increase their probability of becoming exporters. A factor that may lower the export propensities of firms in Brazil and Bangladesh is the low foreign ownership seen in both of these countries, which can be explained through limited technological transfer from foreign nations into these two countries.

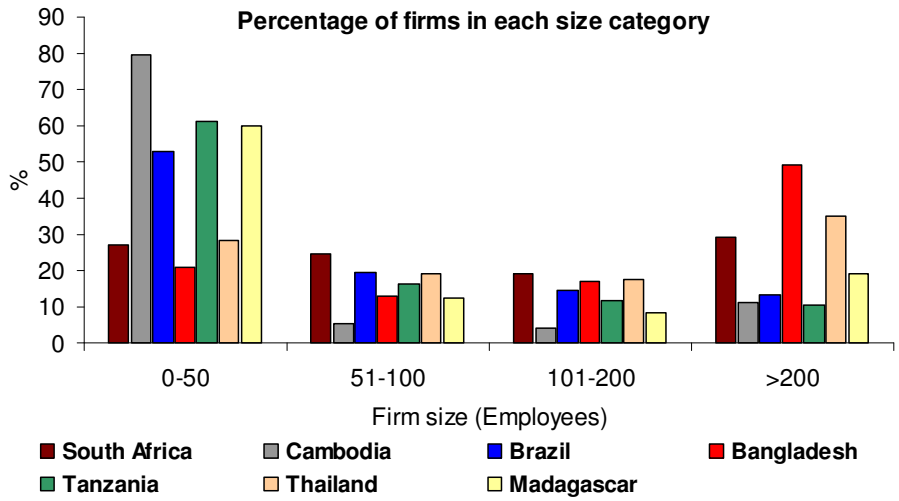
Table 2: Summary statistics of the different datasets

	Number of firms	Number of employees	Age	Foreign Ownership (%)	Export (%)	Import (%)
South Africa	585	344	26	20	58	60
Cambodia	503	168	10	18	13	25
Brazil	1640	121	19	5	27	16
Bangladesh	1001	305	18	5	38	54
Tanzania	276	96	22	23	23	41
Thailand	1385	340	18	27	54	35
Madagascar	290	186	16	39	30	42

[4] While it will be shown that the distribution of firm size in the datasets is skewed, this is an indication of the differences in average firm size among the different samples.

Overall, there is still a good distribution of firms in each dataset. This is demonstrated in the different size group ratings amongst the different countries in figure 4. The first grouping represents firms with less than 50 workers. Group 2 represents firms with 50-100 workers, with group 3 firms having 100-200 workers and the last group representing firms with more than 200 workers. Although the size distributions from each nation provide an indication of the underlying size distribution of the firms within the economy, they are a guide to, rather than an accurate representation of the population given the different sampling techniques used across countries.

Figure 4: The firm size spread across the different countries in the sample

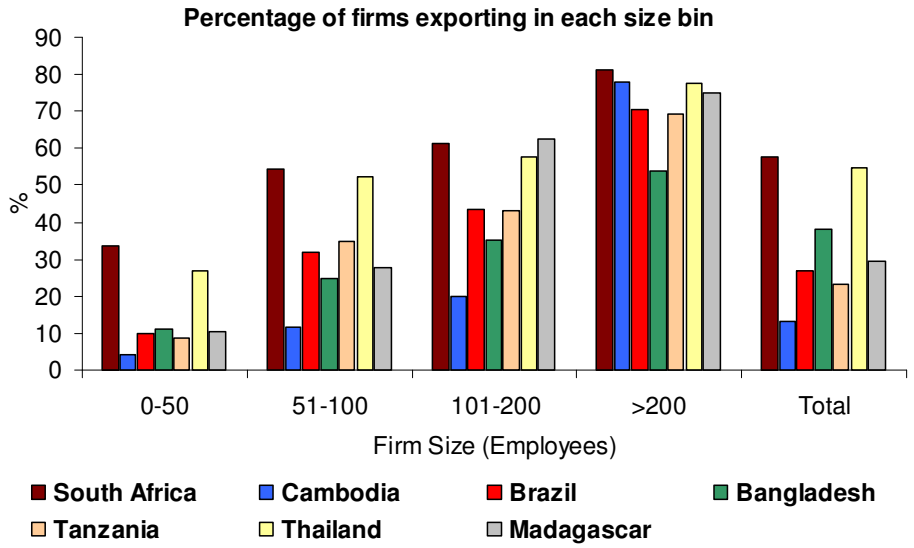


In Cambodia, Brazil, Tanzania, and Madagascar, the number of small firms in the sample significantly outweighs any other size category. In South Africa, Tanzania, and Bangladesh, the distribution is more evenly spread across size categories. An interesting feature about the Bangladesh data is the large number of firms sampled with more than 200 workers.

Now, the attention turns to the exporting firms themselves. Specifically, what is the percentage of the total number of firms on each size bin that export? Figure 5 below shows the number of exporters as a percentage of all the firms in each size bin, and percentage of exporters of the total for each country. There is a clear relationship between exporting and firm size. The probability of being an exporter in this sample is positively related to firm size With the exception of South Africa and Thailand, less than 10 per cent of the firms in the first size category (less than 51 workers) are exporters. It is interesting to see that such a trivial

number of small firms actually participate directly in the international arena. There is a steady increase in the percentage of exporters moving from firms with less than 51 employees to firms with more than 200 employees. These results indicate, in line with expectations, that there is a positive correlation between firm size and exporting,

Figure 5: Export Propensities in each Country, based on Firm Size



Therefore, the increase in export propensity is robust across all the countries in this sample. With the exception of Bangladesh, it is evident that at least 70 per cent of the firms in each country export when they employ more than 200 employees. In every country, there is a marked increase in export propensity with each progressive firm size bin. Interestingly, the country with the largest export propensity in this sample is South Africa, with close to 60 per cent of the firms in the sample actually exporting. Thailand has the second highest propensity to export within this sample. Furthermore, from figure 4, these two nations actually had the most even distribution of firms across the size range. Both South Africa and Thailand have a proportionately smaller number of firms with less than 50 workers. These two nations also have the highest percentage of exporters in the small firm size category. It is possible that the dynamics that allow for a larger number of smaller firms to enter the export market from South Africa and Thailand also allow for an overall increase in the export propensities from these nations. Indeed, the conditions that stimulate smaller firms to start exporting from South Africa and Thailand may continue to increase exporting throughout the sample. The

Cambodian sample indicates a lower overall export orientation with a comparatively small percentage of firms exporting. Even in this sample, there is a positive correlation, as a large proportion of firms with over 200 employees export. In addition, Cambodian firms are the smallest, on average in comparison to all the other nations in the sample.

In South Africa, as with any other nation in this dataset, there could be a large number of firms exporting regionally. The regional market would typically include countries that form a part of the Southern African development community (SADC). Exporting to these nations would represent far lower barriers to entry due to similar demand and supply conditions with markets that are much closer to home than exporting to first world countries such as in Europe. Often, regional preferential trade agreements are designed specifically to stimulate trade within that particular region through mechanisms such as deceased import barriers. In fact, regional exporting can often be used as a stepping stone to further export development to other regions (Baldwin, 2004).

However, regional exporting cannot explain the observed differences in export propensities seen within this dataset. If the regional exporting theory could explain differences in export propensity one could expect a close correlation between Cambodian and Thailand exporting firms, for example, as both these nations are bundled within the same region (the countries share a border).[5] Firms in Madagascar (smaller firms in particular) may then face increased barriers to trade, as it is a country surrounded by ocean, making regional trade more difficult. Madagascan firms in figure 5 do not stand out as those with relatively low tendency to export. As much as regional integration must play a part in aiding exporting, the data above suggests that this is only a small part of the firm size and export story.

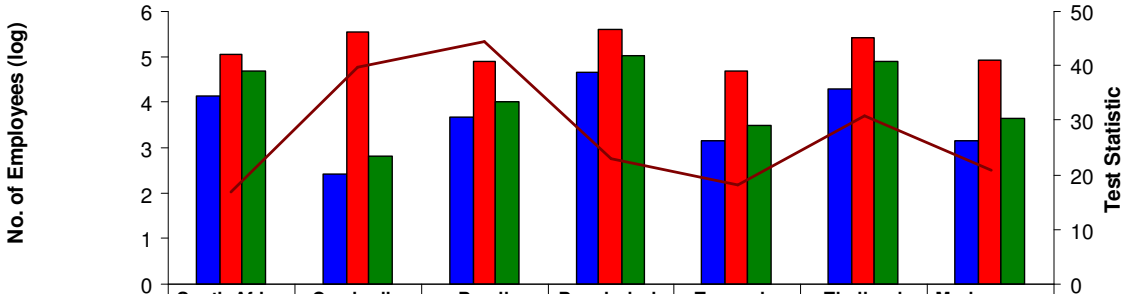
Turning the focus to the observed differences between exporting and non-exporting firms using summary statistics such as the number of employees, capital-labour ratios, productivities, output, firm age, and foreign ownership, among others[6] show a definite distinction in exporting firms. Total employment has again been used as a measure of the size

[5] To fully test the idea of regional exporting, all the firms in the various datasets could be combined to calculate the aggregate firm-size exporting relationship. This would therefore encompass the firms from different regions (and would probably confirm in aggregate that there is indeed a link between firm size and exporting). This could then be compared to the exporting propensities of firms in different regions. The aggregation, however, has not been added into this study.

[6] These summary statistics can be found in Appendix 1.

of the firm because of its ease in comparability across country datasets.[7] Firms that export are larger on average then those that cater solely to the domestic market. When using total employment, in almost every country, exporters have at least twice as many employees than non-exporters. Figure 6 below demonstrates the difference in size between exporting and non-exporting firms, on average. However, figure 6 uses the log of employment, rather than absolute employment, as the distribution of employees across firms in the datasets is not normal, but skewed to the right. To deal with this, logs on total employment have been used. Furthermore, a test of significance demonstrates that the difference in the log of employment between exporters and non-exporters is significant across all the countries in the dataset. This feature stands out in the data and is robust across all years of every country dataset. The gap remains large across the years tested in the data.[8] Why is this occurring? Is it that larger firms are more able to enter into international markets and will therefore self-select into exporting or is it the fact that the international market allows the firm to grow and thus become larger through exporting?

Figure 6: The log of the average number of employees in exporting and non-exporting firms



	South Africa	Cambodia	Brazil	Bangladesh	Tanzania	Thailand	Madagascar
Non-exporters	4.13	2.41	3.67	4.66	3.14	4.29	3.15
Exporters	5.06	5.54	4.89	5.61	4.68	5.41	4.94
Total	4.67	2.82	4.00	5.01	3.50	4.90	3.64
Test Statistic (RHS)	16.73	39.91	44.45	23.08	18.11	30.86	21.00

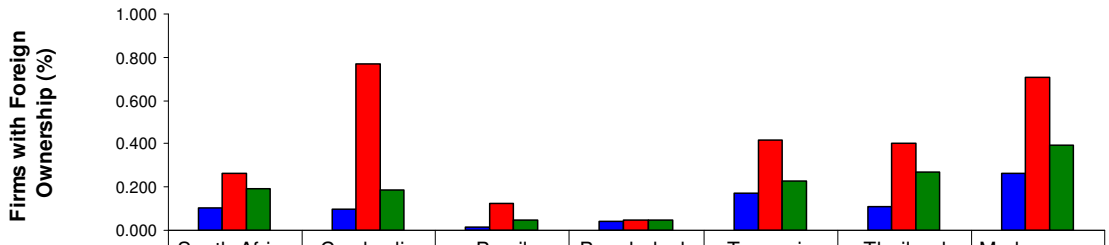
A deeper look at the summary statistics is still required. It may be that the observed relation between firm size and exporting is driven by a correlation with other variables. Firstly, a question on expatriate staff was not asked in every country in the dataset, but in those that it is, this variable may linked to the probability of exporting. Firms that export are more likely

[7] The measure of total employment is the same as above, with the number of temporary workers (divided by 2) added to the number of permanent workers to calculate total employment within a firm.
[8] This can be seen in Appendix 1, where the summary statistics of each country are included.

to have expatriate employees. Expatriate staff can aid in collecting information about foreign demand and supply and in the development of linkages between the firm and the international market. The fact that the firm employs expatriate workers may indicate that international linkages already exist, and it is through these linkages that the firm is able to recruit expatriate workers. It could also be that exporting companies are more dynamic in their approach, which has broadened their search for suitable skilled labour. This may be the case in developing countries that face the constant challenge of a shortage of skilled labour. Therefore, the process of employing expatriate staff and exporting may be interlinked. The two processes unfortunately cannot be separated by this cross sectional dataset alone. However, this observation may be superfluous. This result may be due to the correlation between firm size and expatriate staff, and the larger percentage of larger firms being exporters. Larger firms may employ expatriate workers.

A question that is linked to the idea of expatriate workers being employed in a firm is that of foreign ownership. Firms that have any foreign ownership are found to have a higher probability of exporting. Figure 7 below demonstrates that a larger percentage of exporters have some foreign ownership. Interestingly, this is particularly the case in Cambodia and Madagascar, where over 70 per cent of exporters in both of these nations have some foreign ownership. In the case of Bangladesh and Brazil, regulatory barriers may have prevented foreign entry into these nations, giving a small percentage of firms that have some form of foreign ownership.

Figure 7: The percentage of firms that have some foreign ownership



	South Africa	Cambodia	Brazil	Bangladesh	Tanzania	Thailand	Madagascar
Non-exporters	0.106	0.096	0.015	0.044	0.171	0.108	0.263
Exporters	0.264	0.773	0.127	0.048	0.419	0.400	0.709
Total	0.197	0.185	0.045	0.046	0.228	0.268	0.395

This finding is linked to the literature above in that Baldwin and Gu, (2003) find that foreign ownership significantly increases the probability of exporting, especially to the home country of the owner/s. Foreign ownership can aid in the establishment of links to the export destination, and in the understanding of the differences in demand to the local country.

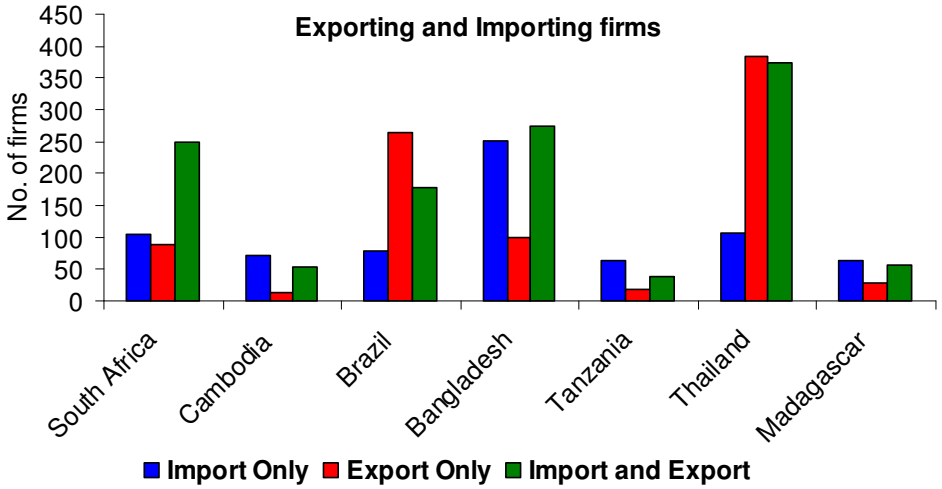
Technical links to international markets can also be established through foreign ownership thereby allowing the incumbent firm access to technology and ideas for production that may not have occurred if the firm were locally owned. In addition, foreign firms may be setting up plants specifically for export purposes in the countries studied in this paper. A multinational corporation could be taking advantage of cheaper methods of production. This can stem from a variety of sources such as access to cheap labour, or raw materials inputs. These firms set up by foreign companies will probably also be large. Thus, there could also be a correlation between foreign ownership and the size of the firm. For example, energy intensive means of production have been set up in South Africa in the past to take advantage of the reliable supply of cheap electricity. Furthermore, this may be the case in Cambodia and Madagascar, where foreign companies set up companies in these countries to export, taking advantage of cheap labour, for example. On the other hand, the low foreign ownership may decrease the export propensity of firms in Bangladesh and Brazil.

There is also a link between exporting and importing. As is demonstrated in figure 8, there are a number of firms that both export and import goods. Firms that export also tend to import. In fact, except for Thailand, and Brazil, the number firms that both export and import is significantly larger than the number firms that only export. Once a firm starts to export (import), this allows for greater access to the international market. This access then gives the incumbent firm a greater opportunity to source technology and products from the foreign nation to use in local production. Again, this linkage can work both ways, in that importing creates a linkage for the firm to begin to export. Also, in South Africa for example, there are a number of duty drawback schemes to give incentives to firms to export. Once the firm begins to export, duties on importing are significantly reduced, allowing the firm to effectively turn to international producers. This is particularly relevant in the motor industry in South Africa, where the Motor Industry Development Programme (MIDP) is designed to aid exporters. The value of the firms' exports is then turned into an import rebate (which is tradable between companies) where the company can import products duty free and gain a competitive advantage in the local market (Flatters, 2005). Multinational firms that set up subsidiary

companies aimed at exploiting local conditions may also import raw materials directly to export the finished product.

In Thailand and Brazil, the number of firms that export significantly outweigh the number of firms that import goods. In fact, very few firms in both these nations actually just import. This may be due to policy in Brazil and Thailand, focussing on increasing barriers to entry from international firms and competition. In the past, Brazil implemented a number of protectionist measures in its own industrial policy. These were based on import substitution measures that were aimed at stimulating local industry and develop exports (Marconini, 2005). However, this has changed in the recent past, and one could expect to see an increase in the number of firms actively importing in Brazil.

Figure 8: The Number of exporters and importers in each country



The statistics above provide some insight into the fact that there seems to be considerable linkages between exporting and importing, foreign ownership and indeed size effects. These measures all seem to be intertwined in the firm exporting equation. Firm size and exporting literature demonstrates that larger firms can more easily overcome costs and barriers as the costs can spread over a larger number of products and items sold both locally and internationally. These firms also have better access to external and internal finance to afford the start-up costs involved in exporting. Larger firms are also more likely to have international contacts, through importing or foreign ownership, easing the transition of starting to export.

Now the focus turns to efficiency and productivity differentials between firms. No discernable pattern emerges from the summary statistics between exporters and non-exporters. For example, in South Africa, Brazil, Tanzania, and Thailand exporting firms have higher output per unit of labour, and are more capital intensive. This suggests that exporters are more productive and use more capital-intensive means of production. This was contrary to what was expected. One would expect a priori, that developing nations would have a comparative advantage in goods produced with labour intensive means of production due to the relatively cheap access to labour. In addition, many developing nations are lagging behind in the production of goods that involve complex means of production with the use of technology and capital. Developing nations also do not have the skilled labour to compete in the international arena in these technologically based products. In the case of these nations, it would be interesting to see what products were being exported. For example, South African clothing firms predominantly focus on the local market, and are relatively labour intensive, while car manufacturing constitutes a large portion of the export bundle, thus skewing exporters to be more capital intensive. In the case of the motor industry, these are large multinational firms, which link into the technology diffusion argument above.

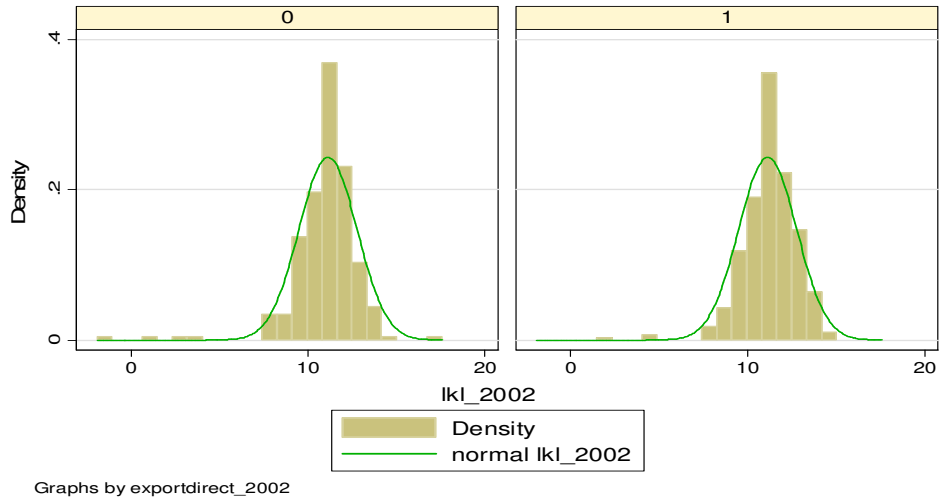
As such, it may be the linkages to international markets that bring in more advanced means of production to these exporters. Therefore, the exporters would be more capital intensive and productive by using these more advanced means of production. This would attest to the learning by exporting example found in the literature above. As such, while a specific sector continues to be a strong export earner for a given country, it is the more advanced firms in this sector that are exporting, giving them a higher productivity and capital-intensive means of production. In this case, access to a larger international market would also allow firms to invest in more capital-intensive means of production by using scale economies. Investing in larger plant and equipment (which would give rise to more capital-intensive means of production) may only be possible if the larger, international demand is tapped. Local demand may only be sufficient for the smaller-scale, more labour, less capital-intensive means of production.

Interestingly, exporters in South Africa, Brazil, Tanzania, and Thailand also record higher miscellaneous costs[9] and raw materials costs for each unit of labour used in production. The theory of the firm suggests that miscellaneous costs will increase with the size of the firm due to the extra costs of coordination and supervision as the firm grows in size. Therefore, the correlation between firm size and exporting could be clouding the correlation between miscellaneous costs and exporters. However, higher miscellaneous costs could also be due to the costs associated with exporting. As it is more of a logistical challenge to sell good in international markets, rather than locally, this will have a positive impact on miscellaneous costs. This is certainly linked to the fact that the definition of miscellaneous costs has selling, administration costs embedded within it. Increased raw materials costs show that exporting firms in these nations could be in the primary sector. One problem is distinguishing the direction of causality between these variables and exporting. For example, exporting can also cause an increase in miscellaneous costs. However, increased raw material costs per unit of labour are also linked to the fact that exporters are more capital intensive and productive. A greater use of technology in production (and thus a higher capital-labour ratio) means that workers in each exporting firm will therefore have a much larger level of output, giving rise to the reason why there are higher raw materials costs per unit of labour in exporting firms.

However, the graph of the capital labour ratio for exporters and non-exporters shows that outliers could be causing these differences. South Africa has been used as an example in figure 9 below. This is especially the case with a number of variables in the extreme left tail of the distribution of the non-exporters in the sample. There are a number of firms in the sample that do not export and have an extraordinarily low capital-intensive means of production. This may also re-iterate the fact that exporters use more advanced technology in production, and are therefore more capital intensive (either learning-by-exporting or sel-selection). A deeper look into the effects of these variables is done in the probit regressions in the next section.

[9] Miscellaneous costs represent the sum of "other costs" such as overhead, security, and selling and other administrative costs, and "energy costs"

Figure 9: The South African log of labour per unit of capital for exporters and non-exporters



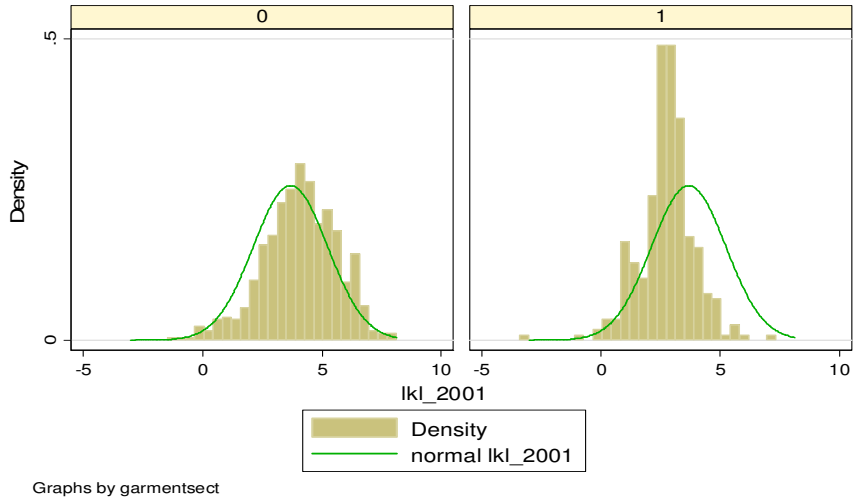
In terms of other countries in the sample, Cambodian exporters have a lower output per unit of labour ratio than non-exporters, yet the exporters also have lower miscellaneous and raw materials costs per unit of labour. Exporters also have a significantly lower capital per unit labour ratio. However, there are only 66 direct exporters in the sample of 503 firms, with 42 of these firms having 200 or more workers. The largest firms are exporters, yet these firms have the lowest capital and output per unit of labour ratios.

These results suggest that labour is exceedingly cheap in Cambodia. Therefore, one would expect to find these firms having a larger percentage of unskilled labour in their workforce. This, however, does not occur. When taking a closer look into the sectoral composition of the exporting firms, the garments sector in particular really stands out. Seventy per cent of the firms interviewed in this sector are exporters, giving 47 of the 66 exporting firms in the sample. This can explain the bias found in the data because this sector will consist of firms with a large number of employees producing low value goods with limited capital equipment. In addition, 49 of the 61 firms in this sector are foreign owned, showing that most of these firms are probably part of multinational corporations taking advantage of cheap labour within Cambodia. These companies will also typically set up very large foreign manufacturing plants, specifically designed for the production of export goods. The problem about this data is that the garment sector is seen to have a high level of skilled labour, yet their labour costs are relatively low, indicating that there could be some degree of measurement error in the sample.

Interestingly, Bangladesh firms have the same statistics as those in Cambodia. In the Bangladesh data, 306 of the 1001 firms are in the garments industry. Of these 306 firms, 242 export and 256 of the 306 firms in this sector have more then 200 employees, giving the same skewness of the data as seen in the Cambodia. The leather and textile sectors also have a high propensity to export, with both of these sectors also having a high percentage of large firms (134 of 252 with more then 200 employees for textile and 23 of 99 firms with more then 200 employees for the leather sector). However, there are very few firms with foreign ownership in this dataset, indicating very little presence of multinationals locating in Bangladesh.

Figure 10 below clearly demonstrates that firms in the garments sector (the graph on the right) are more labour intensive than average. In this case, because the production of garments is labour intensive, Bangladesh may have a comparative advantage in garment production, through access to a large supply of relatively cheap labour. The interesting disparity here is that these firms show the same fundamentals as those in Cambodia, yet the firms in Bangladesh are locally owned.

Figure 10: The Bangladesh log of capital per unit of capital for Garments firms and Other firms



The last country in the set is Madagascar, which has a mix of the results above. First, output and miscellaneous costs per unit of labour are larger for non-exporters. The results indicate extreme firm level heterogeneity across countries. Exporting from these different regions is

shown to have definite region specific phenomena, altering the distribution of the results accordingly.

The comforting feature of these results is that there is definitely a significant firm size-exporting relationship occurring that is similar across all the countries in the sample. Indeed, this is the only correlation with very little fluctuation across regions, even though there are clearly a number of industry-specific and country-specific factors that play a role in this sample.

4.2. Qualitative Response Regressions

The data in the previous section gives a clear indication that exporting firms are larger than those that do not export. However, these are only summary statistics, which can be influenced by outliers, etc. The summary statistics do not control for correlations between the different variables, such as larger firms being located within certain sectors. This correlation must be controlled for to test the preliminary results of the summary statistics. This next section turns to using a qualitative response regression model in which the probit regression is used to determine whether exporters are in fact larger, and how firm size actually affects the probability of being an exporter.

4.2.1. Measuring firm size

First**,** in order to determine the firm size-exporting relationship, a comparable unit of measurement of firm size must be established. In the literature, there are a variety of methods that can be used to determine an accurate measure of firm size that is comparable across industries. In the case of this paper, the measure of firm size has to be robust across countries (different datasets).

The technological theories discussed above form their basis on the neoclassical production function and focus on productive inputs such as the size of human and productive capital within the firm. However, this measure of the determinants of firm size does not focus on the differences in firm structure and control. These determinants affect the development of the firm and its productivity, therefore having an impact on its growth path (Kumar, Rajan, and Zingales, 1999). This theory lacks the organisational backing for the development of determinants of firm size theory.

Therefore, organisational theories focus on the impact of this hierarchical control on the development of the firm, in which the firm's actual production function is now of secondary importance. These theories focus on a definition of the firm that is based on the legal view, that is, the firm size is based on the quantity of commonly owned assets of the firm (Kumar, Rajan, and Zingales, 1999).

The recent developments in economic theory link the market transactions of the firm, and go one step further to note that ownership of assets is not necessarily sufficient for the measurement of the size of the firm (Kumar, Rajan, and Zingales, 1999). This idea is based on

the extent of the links of the supplier chain for a given firm. If the firm has a number of distinct suppliers that are in existence solely for this firm, then these suppliers can effectively be bundled as the same legal entity as the larger firm. However, if the firm keeps the links with its suppliers at arms length, in which the suppliers themselves have to continue to compete on a tender basis for the contracts, these firms are then separate legal entities to this main firm. Despite this, subsidiaries of international firms are considered separate firms in their own right (Kumar, Rajan, and Zingales, 1999). Where does one draw the line between these firms being considered a separate entity, and when are these firms included in the size of the multinational firm? The lines between these two distinctions of the development of the supply chain are indeed complex and very difficult to capture.

The theories above describe the optimum theoretical size of the firm, but this is rarely reflected in reality. There are a number of firms that are entering and exiting the market, exogenous shocks to the firms such as a change in the trade regime, etc. These factors will skew the distribution of firms within a given industry and indeed alter their respective sizes. For example, younger firms are often on much higher growth paths than more established firms in the same industry (Bernard and Jensen, 2001). The extent of the development of the firm and even the industry in a particular country thus has an effect on the size of the individual firm, which extends to the average firm size distribution within a particular industry. In the case of this paper, these questions must be borne in mind when perusing though the results of the data, as these developing nations do not have these stable markets structures for an accurate development and representation of firm size in each separate market.

As such, what are the different theoretical determinants of firm size that are available in this dataset? The first measure of firm size is the number of employees in the firm. This is based on the measure described above, taking into account both temporary and permanent employees. The second measure of firm size in the World Bank ICA dataset is that of output in a given year. This measure in itself is not comparable across sectors or countries due to the differences in exchange rates and the value and complexity in producing any given good.

Value added is preferred to output in Kumar, Rajan, and Zingales (1999) because the complexity of a given firm is correlated with the value of its contribution to the price of the product more then the price of the good (or output) sold by the firm. Value added in itself was

not directly recorded in the World Bank data, but has been constructed with the use of cost data and output variables. Therefore, the data on value added is secondary in nature, is prone to measurement error, and therefore must be used with caution.

It is for this reason that the focus in terms of firm size is on output and employment. In addition, both of these measures are also shown in logs, as the distribution of the data (as shown in the figures below) is skew before being logged. These values are taken for the individual firm. So, if a subsidiary is interviewed, the output of that subsidiary is requested. The subsidiary counts as a separate unit if it has separate accounting information or its own set of accounts. Therefore, in this dataset, any firm interviewed that forms a part of a multinational corporation has given data on its own specific operations and not those of the conglomerate in its entirety.

4.2.2. Basic probit regressions

The following section develops basic firm size-export regressions using output and employment as measures of firm size. There are four separate probit regressions on these measures of firm size. The regressions are based on maximum-likelihood method of estimation. Furthermore, the probit estimates by themselves cannot be interpreted directly, and additional marginal effects estimators are included (dF/dx). These are the change in the probability of exporting with an infinitesimal change in the independent variable (which in this case is the proxy of firm size). The mean of the independent variable has also been included here with the predicted probability of a firm in a specific country at the mean is also included in the results. A number of different specifications of the probit have been estimated. The basic premise of the probit is as follows:

1. $X_i = \beta_1 + \beta_2 Y_i$

Where

X_i = the probability that the firm is an exporter

β_1 = constant

Y_i = output

The Subscript $_i$ on each variable indicates firm specific effects. In this case, the probit regression measures the increase in the individual firm's probability that it is an exporter with a unit increase in output. This is not directly comparable across countries due to currency

effects, for example, the output of South African firms is measured in thousands of Rands. However, the emphasis here is on the sign of this relationship, rather than the magnitude. Where possible, output is measured as the total market value of production for the year. This question is not asked in all the surveys and when this occurs, the firms' sales for the year are used. Therefore, this is not the most reliable measure of firm size. The results for this set of regressions are shown in table 3 below.

The log of output is used in the second specification, demonstrated in equation 2, where the log is used to correct for outliers in the data affecting results from the first equation above.

2. $X_i = \beta_1 + \beta_2 \ln Y_i$

In the last two basic probit equations, employment is used as a measure of firm size and as in equations one and two, total employment and then the log of total employment are used:

3. $X_i = \beta_1 + \beta_2 Emp_i$

4. $X_i = \beta_1 + \beta_2 \ln Emp_i$

Where

Emp_i = the total number of employees in the firm at the time of the survey.

As defined before, employment includes both temporary and permanent workers in each firm, with the results of equations 3 and 4 displayed in tables 5 and 6 respectively. It is immediately apparent that the output and employment variables are significant in every regression at the 1 per cent level of significance, and all have the expected sign (positive). Each of these regressions are tested for significance using the chi^2 test for significance, and as can be seen, with the exception of Bangladesh with output as the independent variable, are all significant to the 1 per cent level of significance. X-bar represents the mean for the independent variable for a specific country. For example, in the employment regression, the mean number of employees for the firms in the South African sample is 343.86 employees. At this point, the observed probability of exporting is 58.26 percent, with the predicted probability at 58.51 percent.

The results presented for all four measures of firm size conform to the a-priori expectations and theoretical predictions about firm size and exporting. There is a significant, positive relationship between these variables in every country in the study. Therefore, there are no

apparent region-specific dynamics for the firm size and exporting relationship. Furthermore, the constant term in the regressions (β_1) is usually negative.

As such, there may also be some minimum threshold of both employees and output to be reached before firms are likely to begin exporting. This result follows a-priori expectations in both export and firm size theory. The results confirm that there may be significant barriers to entry into exporting, and that these may be too large for small firms to overcome. The results give an indication that issues such as entry costs and economies of scale in production play a role in the firm size and exporting relationship.

However, in the South African regressions, the constant is found to be positive for both the output and employment equations. This is not the case with the logged independent variables, strengthening the theoretical reasons for choosing the logged variables in later regressions.

Table 3: Probit results of the export-output regression

	Export	Coefficient	Std. Error	Z-value	P-value	No of obs	LR chi2	Prob > chi2	dF/dx	obs. P	Pred. P (at x-bar)	x-bar
South Africa	**Output (2002)**	2.120E-10	9.000E-11	2.350	0.019	557	7.33	0.0068	8.230E-11	0.585	0.589	2.300E+08
	Constant	1.761E-01	5.581E-02	3.160	0.002							
Cambodia	**Output (2002)**	2.350E-07	5.320E-08	4.410	0.000	316	20.92	0	3.190E-08	0.082	0.071	3.650E+05
	Constant	-1.552E+00	1.142E-01	-13.600	0.000							
Brazil	**Output (2002)**	8.290E-09	8.110E-10	10.210	0.000	1576	155.26	0	2.830E-09	0.270	0.289	2.600E+07
	Constant	-7.690E-01	3.719E-02	-20.680	0.000							
Bangladesh	**Output (2001)**	2.040E-07	1.180E-07	1.730	0.084	982	4.96	0.0259	7.750E-08	0.380	0.381	1.856E+05
	Constant	-3.414E-01	4.520E-02	-7.550	0.000							
Tanzania	**Output (2002)**	8.370E-11	2.280E-11	3.670	0.000	155	17.04	0	2.620E-11	0.252	0.243	2.200E+09
	Constant	-8.758E-01	1.247E-01	-7.030	0.000							
Thailand	**Output (2002)**	3.990E-10	5.020E-11	7.960	0.000	1383	99.54	0	1.560E-10	0.547	0.580	5.800E+08
	Constant	-3.267E-02	3.760E-02	-0.870	0.385							
Madagascar	**Output (2004)**	2.620E-11	6.500E-12	4.030	0.000	233	20.95	0	9.180E-12	0.296	0.305	8.100E+09

Table 4: Probit results of the export-log of output regression

	Export	Coefficient	Std. Error	Z-value	P-value	No of obs	LR chi2	Prob > chi2	dF/dx	obs. P	Pred. P (at x-bar)	x-bar
South Africa	**Log Output (2002)**	0.314	0.036	8.65	0.00	544	85.72	0	0.121	0.588	0.602	17.417
	Constant	-5.211	0.628	-8.30	0.00							
Cambodia	**Log Output (2002)**	0.323	0.056	5.81	0.00	316	40.53	0	0.031	0.082	0.046	10.368
	Constant	-5.027	0.665	-7.56	0.00							
Brazil	**Log Output (2002)**	0.463	0.023	20.09	0.00	1576	531.99	0	0.133	0.270	0.208	14.643
	Constant	-7.584	0.354	-21.42	0.00							
Bangladesh	**Log Output (2001)**	0.216	0.028	7.64	0.00	982	62.37	0	0.082	0.380	0.371	10.883
	Constant	-2.679	0.315	-8.49	0.00							
Tanzania	**Log Output (2002)**	0.297	0.055	5.42	0.00	155	36.06	0	0.083	0.252	0.199	19.018
	Constant	-6.502	1.100	-5.91	0.00							
Thailand	**Log Output (2002)**	0.320	0.021	15.58	0.00	1383	281.97	0	0.127	0.547	0.557	18.230
	Constant	-5.699	0.374	-15.24	0.00							
Madagascar	**Log Output (2004)**	0.324	0.053	6.13	0.00	233	42.36	0	0.107	0.296	0.268	21.015
	Constant	-7.436	1.136	-6.55	0.00							

Table 5: Probit results of the export-total employment regression

	Export	Coefficient	Std. Error	Z-value	P-value	No of obs	LR chi^2	Prob > chi^2	dF/dx	obs. P	Pred. P (at x-bar)
South Africa	**Employment (2002)**	0.000	0.0001	2.69	0.01	575	8.39	0.0038	0.000070	0.583	0.585
	Constant	0.153	0.0564	2.72	0.01						
Cambodia	**Employment (2002)**	0.003	0.0004	8.34	0.00	486	149.61	0	0.000763	0.134	0.141
	Constant	-1.650	0.1011	-16.32	0.00						
Brazil	**Employment (2002)**	0.003	0.0002	13.28	0.00	1629	232.49	0	0.000925	0.271	0.271
	Constant	-0.946	0.0419	-22.57	0.00						
Bangladesh	**Employment (2002)**	0.001	0.0001	6.99	0.00	983	54.5	0	0.000311	0.380	0.380
	Constant	-0.556	0.0546	-10.20	0.00						
Tanzania	**Employment (2002)**	0.003	0.0007	5.08	0.00	257	37.81	0	0.001052	0.233	0.229
	Constant	-1.072	0.1102	-9.73	0.00						
Thailand	**Employment (2002)**	0.001	0.0001	9.41	0.00	1383	124	0	0.000321	0.547	0.569
	Constant	-0.119	0.0409	-2.92	0.00						
Madagascar	**Employment (2004)**	0.004	0.0005	6.67	0.00	286	92.24	0	0.001300	0.294	0.338
	Constant	-1.082	0.1069	-10.13	0.00						

Table 6: Probit results of the export-log of total employment regression

	Export	Coefficient	Std. Error	Z-value	P-value	No of obs	LR chi^2	Prob > chi^2	dF/dx	obs. P	Pred. P (at x-bar)	x
South Africa	**Log_Emp (2002)**	0.354	0.044	8.04	0.00	575	71.03	0	0.137	0.583	0.593	
	Constant	-1.422	0.208	-6.83	0.00							
Cambodia	**Log_Emp (2002)**	0.528	0.050	10.54	0.00	486	153.32	0	0.070	0.134	0.068	
	Constant	-2.978	0.212	-14.08	0.00							
Brazil	**Log_Emp (2002)**	0.662	0.036	18.21	0.00	1629	403.02	0	0.201	0.271	0.231	
	Constant	-3.387	0.159	-21.25	0.00							
Bangladesh	**Log_Emp (2001)**	0.415	0.038	11.03	0.00	983	139.98	0	0.155	0.380	0.359	
	Constant	-2.444	0.202	-12.09	0.00							
Tanzania	**Log_Emp (2002)**	0.573	0.081	7.06	0.00	257	62.93	0	0.150	0.233	0.180	
	Constant	-2.924	0.339	-8.64	0.00							
Thailand	**Log_Emp (2002)**	0.446	0.030	15.01	0.00	1383	257.88	0	0.176	0.547	0.557	
	Constant	-2.039	0.147	-13.88	0.00							
Madagascar	**Log_Emp (2004)**	0.651	0.072	9.09	0.00	286	110.63	0	0.206	0.294	0.247	
	Constant	-3.245	0.314	-10.35	0.00							

The results of the probit regression using the log of employment as the explanatory variable are mapped out in figure 11 below. In line with the results of Kumar, Rajan, and Zingales (1999), it was decided that the log of employment is the best measure to test for the relationship between firm size and exporting. The figure illustrates the relationship between firm size and exporting from the predicted variables of the regression for each country. The probability the firm will export is on the y-axis, and the log of employment on the x-axis. The predicted probability of exporting extrapolates a firms probability of exporting based on its size, in this case the log of employment. Figure 11 is an accurate representation of the actual probability of exporting, as the predicted and observed probabilities[10] are very similar.

The shape of the predicted probability curves are strongly positively correlated between employment and the probability of becoming an exporter. Both South Africa and Thailand have slightly different shape to the probability curve, with a larger number of small firms exporting than other nations in the sample. In Madagascar, Cambodia, and Bangladesh, a very small number of smaller firms export, showing very low probabilities in each of these countries at low levels of the log of employment. This could indicate the existence of size thresholds before exporting occurs. Once the threshold has been passed, the probability a firm starts to look to the international market to sell its goods increases quite dramatically. This is shown really well in the Brazil dataset, where the probability that a firm will be an exporter increases slowly at first, but then increases quite substantially thereafter.

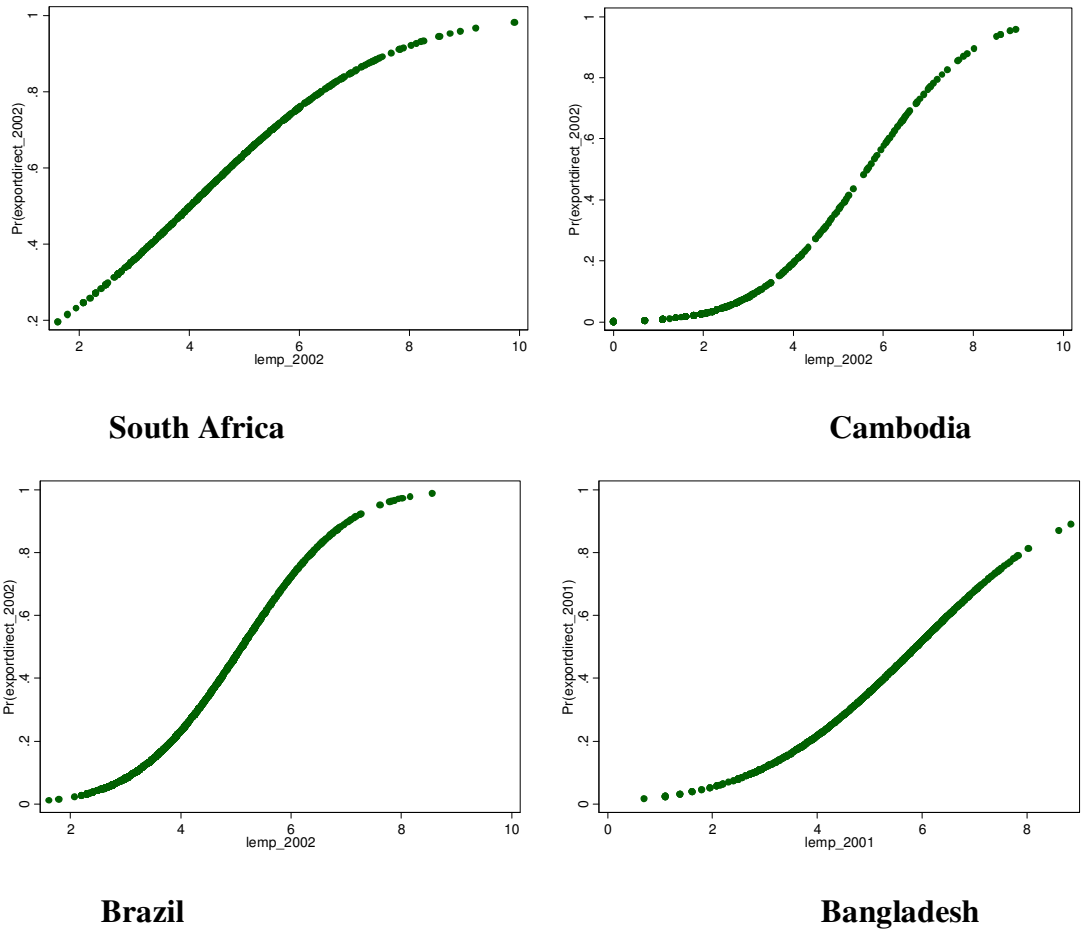
Overall, the change in the probability increases with the increase in firm size up to approximately 80 per cent for the large firms, and tapers off at this point due to the fact that not every large firm sells its products internationally. Interestingly, a lower number of large firms tend to export in Bangladesh. This result is particularly interesting because the export propensity for small firms also rises very slowly for Bangladesh, but there is still a strong, and significant relation between firm size and exporting here. However, a closer look at the composition of the firms in the Bangladesh dataset indicates that the majority of exporters are in a few key sectors, which may be skewing the results somewhat. Further research into what barriers to exporting exist in Bangladesh would be useful, as in this case, there may be

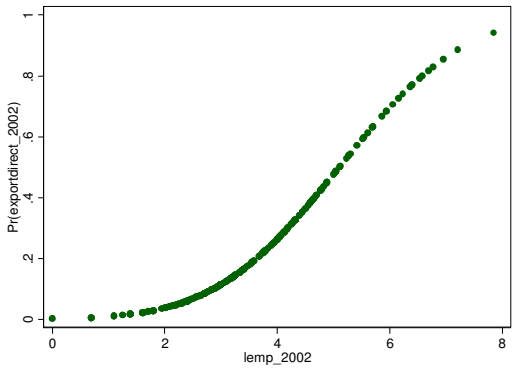
[10] As can be seen in tables 2-5 above

evidence that there are significant barriers to exporting in Bangladesh. However, the fact that a comparatively smaller percentage of larger firms export in Bangladesh remains a topic that must be explored further.

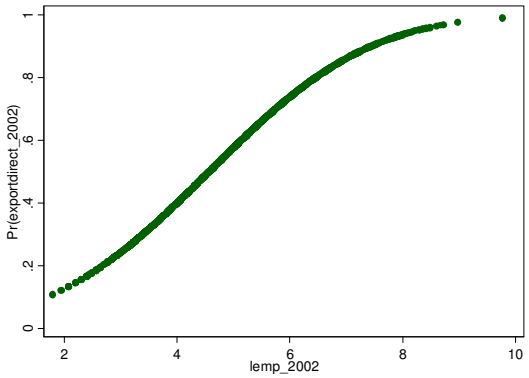
Interestingly, countries that were considered outliers in the descriptive statistics have similar changes in probabilities with increasing firm size to other nations in the sample. These preliminary regressions strengthen the results of the descriptive statistics from above and further indicate the presence of a strong relationship between firm size and exporting across every region.

Figure 11: Predicted Probability of Exporting with respect to Firm Size

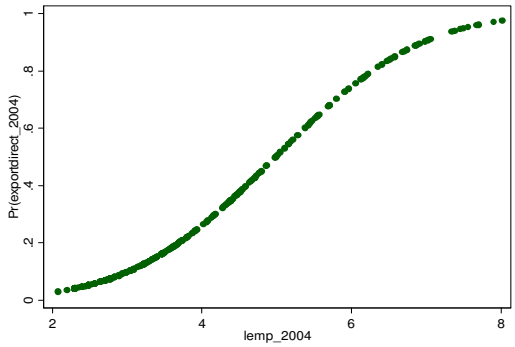




Tanzania



Thailand



Madagascar

This section has added further weight to the conclusions found in the summary statistics. Figure 11 clearly shows that even with country-specific influences, a relatively uniform increase in probability associated with exporting across every country in the sample from the basic probit regressions above. These regressions have been used to test which measure of firm size is the most accurate using the dataset from the World Bank surveys. While the results of the regressions do not conclusively indicate that the log of total employment is the most accurate and comparable measure of the size of the firm, because the regressions on the log of output also show strong, significant results, it will be used in the following sections. The log of employment is the preferred variable as employment itself is a more consistent measure of size than output. The output variable is more subject to differences in measurement than employment. For example, a large firm can produce a small number of items, which themselves are very big, where as a significantly smaller firm can have a higher

output because it is producing a smaller good. Therefore, following Kumar, Rajan, and Zingales (1999), the log of employment will be used on further cross-sectional testing of the relationship between firm size and the probability of exporting.

4.3. Main probit regression

To test the relationship between exporting and firm size further, other variables are added to the basic probit regression to control for missing effects and to show that the observed relationship is not merely due to other correlated variables. These tests have been carried out with each different country in the sample.

Firstly, is there any discernable difference in the characteristics of the firms in different nations as far as explaining firm exports are concerned? The probit regressions have been set up in a manner to maximize the comparativeness of each so that conclusions about country specific effects can be drawn up. Equation 5 is the final probit regression that is used to test the observed firm size-exporting relationship in the descriptive statistics and basic probit regressions in the sections above.[11] A linear regression model focuses on calculating the mean of the difference between exporters and non-exporters. In this case, a probit model is preferred because the object is calculating the probability that a firm will be an exporter, dependant primarily on its size. In this case, the model is looking at the effect of a change in the size of the firm on the probability that a firm is an exporter, all other factors held constant.

5. $$X_i = \beta_1 \ln Emp_i + \beta_2 \ln m + \beta_3 \ln o + \beta_4 \ln k + \beta_5 \ln y + \beta_6 age + \beta_7 foreign + \beta_8 reg + \beta_9 \sec + \beta_{10} imp$$

[12]Where

X = the probability that the firm will export

Emp = the natural log of total employment

m = the natural log of raw materials costs per unit of labour

[11] All results of the probit regressions from each country can be found in appendix 2. Included in the appendix is the country-specific predicted probability of exporting graph, based on each individual firm in the data set (using the log of employment on the x-axis).

[12] By using the natural log of the variable, and then dividing this through by labour, the correlation between firm size and output has been removed. In this case, the productivity of the firm is looked at, rather than just the output.

o = the natural log of miscellaneous costs per unit of labour

k = the natural log of capital per unit of labour in the firm

y = the natural log of output per unit of labour

age = the age of the firm

foreign = a dummy representing foreign ownership

reg = represents the regional dummies[13]

sec = represents the sector dummies

imp = represents whether the firm imports or not

Here, there is no constant in the regression, as a marginal effects probit is used (Gujarati, 2003). The focus here is on an infinitesimal change in the mean value of each variable and its effects on the probability of exporting, and the effects of the addition of these variables on the proxy for firm size (Gujarati, 2003).

The age of the firm has been included in the regression to test whether age is a significant determinant of export participation. A priori, one can expect the probability of being an exporter to be positively related to the age of the firm. Older firms tend to be more established in their production processes, and tend to be more efficient in production.

First, and above all, the firm size and exporting relationship continues to hold, even after controlling for other firm specific effects. The measure of firm size, the log of total employment, continues to be positive and significant across the sample. Table 7 demonstrates that in all countries except for Bangladesh and Cambodia, the measure of firm size is significant to the 1 per cent level of significance. None of the other variables can systematically explain the observed size differentials between exporters and non-exporters in the sample, and confirms the preliminary results from the descriptive statistics and basic probit regressions from above: there is a significant, positive relationship between exporting and the size of the firm.

[13] The sector and regional dummies are specific to each country. A regional dummy usually represents a province within a particular nation.

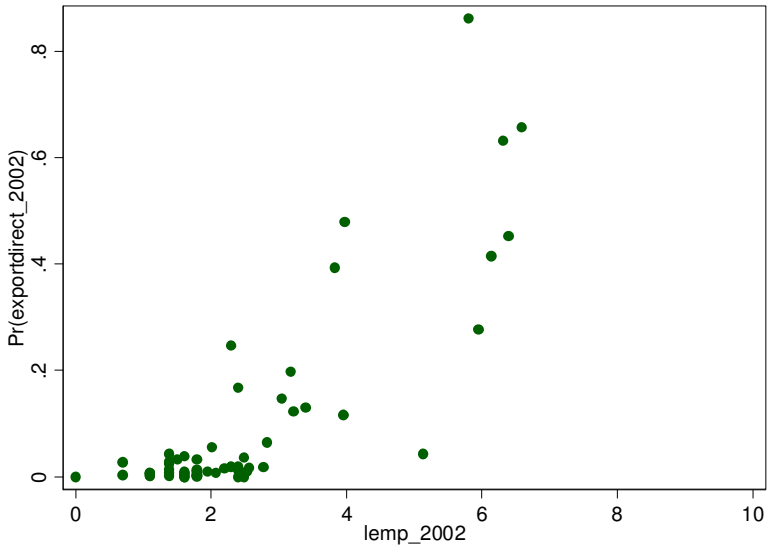
Table 7: Significance of the size variable in the export equation

Export	Bangladesh	Brazil	Cambodia	Madagascar	South Africa	Tanzania	Thailand
l_emp[14]							
dF/dx[15]	0.0556053	0.148176	0.014437	0.158985	0.145841	0.041035	0.116571
z	2.74	11.21	1.12	4.62	5.8	3.95	7.87
P>z	0.006	0	0.263	0	0	0	0

The one caveat in the sample is Cambodia, in which the employment variable is no longer significant (but remains positive). However, once the import variable has been removed from the equation within the Cambodian sample, firm size once again becomes significant at the 10 per cent level of significance. The significance of the measure of firm size in this regression can be explained by other issues in this dataset. Firstly, the Cambodian dataset is incomplete, and therefore a number of observations were dropped from the sample with the addition of the firm specific effects (such as the age of the firm, any foreign ownership, etc). The regression is only left with 62 observations, making it difficult to draw any strong conclusions from this data. Secondly, a large number of the existing 62 observations in the dataset are small firms that do not export, which is demonstrated in figure 12. This figure represents the probability of becoming an exporter, based on the size of the firm. A large number of firms are located in the bottom, left side of the figure, which represent small firms with a low probability of exporting. This may be clouding the results of the regression. Therefore, based on the observed results of the other nations, a more comprehensive dataset from Cambodia may show the same positive association between firm size and exporting. It is due to these measurement errors that Cambodia will not be included in the detailed firm level, cross-country description of the various regressions.

[14] Log of employment
[15] The change in the probability of exporting associated with a unit increase the log of employment.

Figure 12: Scatterplot of the firms in the Cambodian dataset[16]



Based on the firm size and trade literature, exporting firms should be more efficient, productive, and more capital intensive (Bernard and Jensen, 2001). These factors allow the firm to increase in size in the local market, and therefore one would expect these to have a positive relationship to the probability of exporting. While these variables are positive in most countries, they are not always significant in this study, downplaying the role of efficiency and technical methods of production on exporting. This result is perhaps a bit unexpected, as a stronger correlation with the probability of exporting was expected. Indeed Baldwin and Gu (2003), for example, found that productivity differentials between exporters and non-exporters actually increased over time.

However, in Brazil and Tanzania, the log of output per unit of labour is positive and significant, indicating that in these nations exporting firms are more productive. It must also be noted that the log of output per unit of employment variable is positive in every country, but not always significant, hinting at the productivity differentials noted in Baldwin and Gu (2003). There may be a degree of endogeneity in this correlation, as larger firms also tend to

[16] The x-axis shows the proxy of the size of the firm in 2002, measured by the log of employment, with the y-axis representing probability of being an exporter based on the results of the full probit regressions. Each point represents a firm in the dataset.

be more technologically intensive and hire higher skilled workers, increasing productivity (Bernard and Jensen, 2001).

In terms of South Africa, two opposing forces may be in play. At the time of the survey, the South African currency was undergoing a major depreciation, to levels below its equilibrium position. This weak level of the exchange rate would artificially increase South African competitiveness, allowing more inefficient firms to start to export. The relative weakness of the exchange rate at the time of the survey may have skewed the results, partially explaining the insignificant productivity differential between exporting firms, and those firms that did not. On the other hand, South Africa is located far away from large markets, increasing transport costs to these countries. Therefore, based on increased costs associated with exporting, a priori, one would expect exporting firms to be more efficient and productive to cover for these increased transport costs. Therefore, at the time of the data collection, two additional, and external opposing forces could be said to be weighing on the probability of exporting in South Africa.

As the distance to major first world markets may be a deterrent for South African firms, a large percentage of exporting that does occur could be regional. This idea is based on the vent for surplus argument, whereby firms export surplus production to other countries in the SADC region. As these nations share similar tastes and similar, if not less competitive markets, selling regionally will not raise productivity of these firms. Further research may correlate the size of the firm with the distance to markets in terms of exporting. One may find that in the South African case, smaller firms are more likely to enter the regional market, as there would be lower costs involved in exporting regionally, as opposed to entering international markets further abroad.

Miscellaneous costs[17] per worker are higher for exporting firms. This can be based on two factors: firstly, larger firms face higher miscellaneous costs to running the business (based on increased costs to supervision in the workplace), and exporters could also incur increased

[17]As defined earlier, miscellaneous costs represent the sum of "other costs" such as overhead, security, and selling and other administrative costs, and "energy costs"

costs to ship the product to international markets (Bernard et al. 2000). In this way, they would be more dependent on infrastructure and network services. This would strengthen the case of significant entry barriers to exporting, due to the inhibitive nature of the extra costs involved in effectively selling in other nations. However, data limitations do not allow for a further breakdown of these miscellaneous costs. Certainly, further research into what constitutes the increase in miscellaneous costs would allow a deeper understanding to the importance of the different costs related to exporting, and of course a better understanding of the barriers to exporting that firms face. This is particularly relevant in developing nations where inadequate infrastructure provision and poor network industries can significantly increase costs and problems associated with exporting.

In Bangladesh and Thailand, the existence of specific export sectors could affect the productivity variable considerably. In both these nations, the garments and textiles sectors account for a large portion of the exporters in the sample (Thailand to a lesser extent). Production in these industries tends to be based on a large number of semi-skilled labourers, thereby decreasing the output per unit of labour variable, down playing its importance in the regression. Therefore, in the cases where exporters are seemingly not significantly more efficient than local firms, a priori assumptions can explain much of the fluctuation in the results of this dataset. The important finding still remains, in that even though there is evidence of industry specific effects on exporting in different nations, the positive and significant firm size and exporting relationship still stands.

In stark contrast to the a priori expectations, foreign ownership and firm age are found to be insignificant in increasing the probability of export participation in every country. Cabral and Mata (2003) find that as the firm ages, finance becomes less of a constraint on the firm, thereby making the costs of establishing an export link less of a concern. Baldwin and Gu (2003) find that firms with some foreign ownership also tend to export more. The results of the regressions in this report do not seem to support the works of Cabral and Mata (2003) and Baldwin and Gu (2003). However, the lack of significance of these variables in these regressions could be due to correlation with other variables. When a probit of firm ownership

and firm age is run with these variables as the only explanatory variables, they are positive and significant determinants of exporting, thereby supporting the work of the authors above.

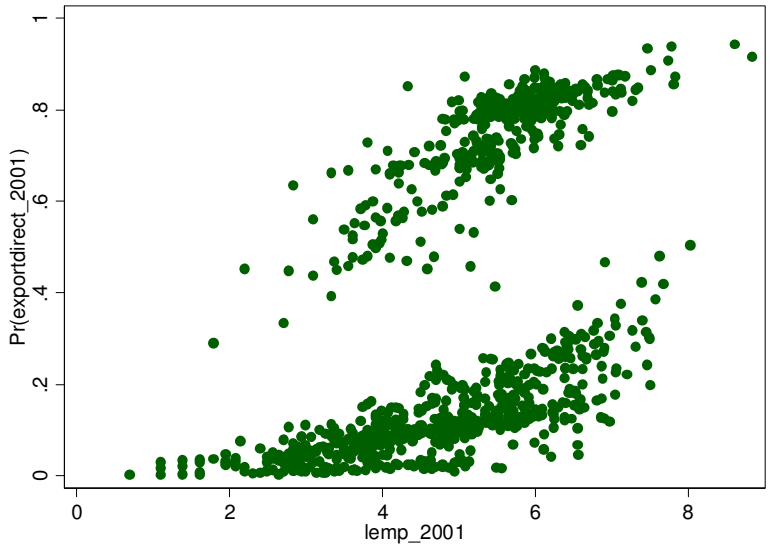
There is one noticeable exception with regard to foreign ownership. It has a significant, positive influence on the probability of the firm exporting in the full probit regression. In the Thailand sample, the link between exporting and foreign ownership is expected to be strong due to the large number of multinational firms operating out of is country, taking advantage of the availability of relatively cheap labour. However, this break with a priori expectations in the other countries is surprising in nations such as Bangladesh, where multinational companies are also expected to have an effect on the overall population of local firms. Exporting literature has often demonstrated that foreign ownership is a major determinant on the probability of exporting by the firm because the foreign ownership acts as an effective link to access the international market (Baldwin and Gu, 2003). It aids in establishing linkages to markets to sell the product. However, in this data, the relationship is not as strong as expected.

Sector and regional dummies were included in the analysis. In a number of nations, the sector and regional dummies all showed to be insignificant in playing a role in export participation. However, there is evidence that there were some regional and sectoral differences in export determination, as expected. The underlying effects of sectoral and regional differences seem to be sector and country specific, where a variety of local demand and supply conditions actually affect aggregate export and import needs.

Interestingly, in Bangladesh, the garments and textiles sectors are highly significant. Firms in these sectors have a much larger propensity to export. These results confirm the results in the summary statistics noted earlier in the text. Furthermore, the scatterplot of the firms in the Bangladesh dataset (see figure 13 below) shows a clear duality across the set. The figure demonstrates the probability a given firm is an exporter, based on the results of the regression based on equation 5 above.

It is clear in this case that there are a group of firms, that even when size is taken into account, that have a larger propensity to export, given the characteristics of the firm added in the regressions. This indicates that there may be specific exporting sectors in Bangladesh, such as the garments and textiles sectors that are causing this distribution amongst the firms in the dataset. These significant sectors are not seen in any other nations. This seems to be a Bangladesh specific occurrence. These exporting sectors may have been the focus of previous or current export development schemes by public authorities. Significant regional dummies may also explain learning externalities which help to ease the transition from local to international markets.

Figure 13: Scatterplot of the firms in Bangladesh dataset[18]



The import variable is also of interest because it is significant and positive in every country. The problem is that the direction of causality is not known. Does export market participation allow for or cause a firm to import, or does importing give the firm access to the international market, and lower the barriers to exporting? Previous literature points to evidence on both processes occurring (Bernard and Jensen, 2001). In this case it is important to note that in every country in this dataset, importing has a significant, positive effect on the probability of

[18] The x-axis shows the proxy of the size of the firm in 2002, measured by the log of employment, with the y-axis representing probability of being an exporter based on the results of the full probit regressions. Each point represents a firm in the dataset.

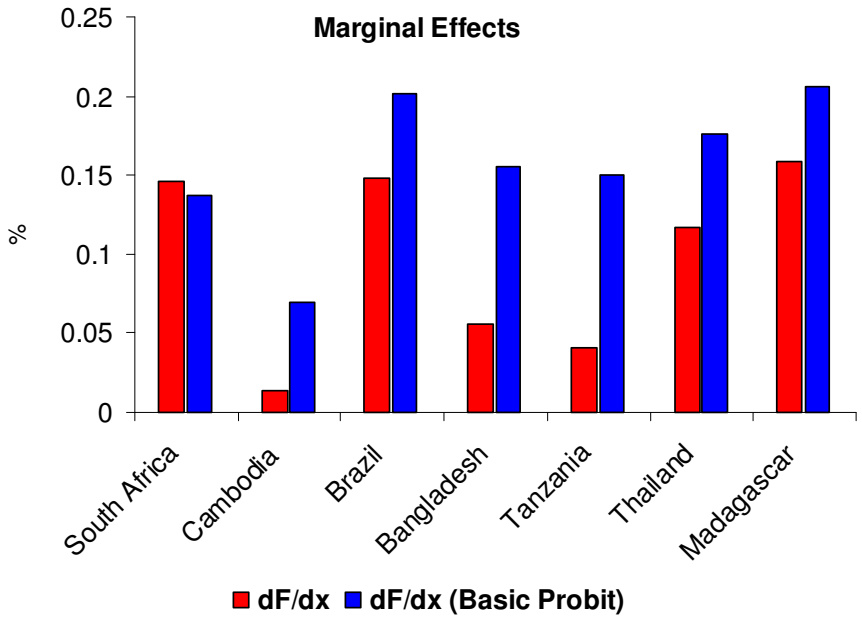
being an exporter. The theory predicts that firms that import have increased access to the international market, information on demand and supply linkages, and international technology (Baldwin and Gu, 2003). These factors have been shown to significantly increase the incumbent firms' probability of exporting successfully. In addition, firms that actually seek international products for inputs to the production process may be showing more resourcefulness in increasing competitiveness. This increased competitiveness will allow for the firm to expand in the local market and seek international markets to sell its product, hence increasing the probability of being an exporter and the size of the firm at the same time. As such, there may be the same inherent linkage between the size of the firm and the probability of importing as there has been found in firm size and exporting relationship.

How do the marginal effects estimators compare between the different countries? Figure 14 below shows the marginal effects of an increase in the log of employment at the mean on the probability of exporting in each country. This is the average, or mean firm in each country-specific dataset. It demonstrates what effect a unit increase of the log of employment, at the mean level of employment, would have on the probability of becoming an exporter in each specific dataset. Figure 14 shows the results of the comparison of the extent of the marginal effects between the probit on the log of employment, and the effects of the full probit with other explanatory variables in the estimation. Understandably, in most countries, the marginal effects of the employment variable decreases as other explanatory variables are added to the regression. The extended probit is attempting to control for any other firm-specific factors that could account for the observed firm size and exporting relationship. However, South Africa presents an outlier in this regard. The marginal effect of the proxy for firm size on the probability of exporting actually increases with the other explanatory variables added to the regression. This is indeed not expected, as one would expect that the correlation between exporting and firm size would be lessened as other significant variables are added to the analysis.

The important feature to note from figure 14 is the fact that there remains a significant, positive relationship between employment (firm size) and exporting in each country. The addition of other variables related to exporting does explain away part of the observed

strength of the relationship, but even after all these have been accounted for, the link between exporting and firm size still remains highly significant and positive. There is also a considerable variation in the extent of these marginal effects between countries. Even though there are definite country and even sector specific dynamics at play in the determination of an individual firm becoming an exporter, the basic size-exporting relationship still holds! These variations in the marginal effects indicate that each nation has to develop a policy specifically catered to its local conditions to stimulate exporting. What works in South Africa for example may not necessarily work in Bangladesh, etc.

Figure 14: The estimated Marginal increase in the probability of exporting with a unit increase in firm size (this is a one unit increase in the log of employment).[19]



4.4. A comparable probability function

The focus now turns to producing a comparable probability function across the different nations in this analysis, based on firm size. Included in this comparison would be the observed effects of the other variables in the full probit regressions above. In this way, a comparison can be made, based on the firms in each of the data sets, on how many

[19] Where dF/dx represents a change in the probability of exporting divided by a unit increase in the log of employment

employees a company in each country is required, on average, in order to reach 50 per cent probability of becoming an exporter, based on the observations in the dataset. This process bases the mean of each of the variables used in the separate country regressions to develop a predicted export probability for a firm in each country based on the number of employees in the firm. This is necessary because the fitted values from the direct probit regression are not directly comparable due to the large variation in observations across the datasets. These probabilities of exporting have been developed from the results of the full probit regressions, and are therefore the "fitted values" of the probability of exporting, based on the observed characteristics of the firm.

The full probit regressions are used, with the fitted value of each regression collapsed at the mean. This was then used to extrapolate a predicted probability for each country's firms based on a sample size between one and one thousand workers, and the characteristics of the firms in each country dataset. The results of this extrapolation give a fully comparable measure of the firm size and exporting relationship across different datasets, as there is now the same number of observations in each country. There are 1000 representative firms, each with a different number of employees, ranging from 1 to 1000 employees. Employment in the firms in each dataset has now been controlled for, as each extrapolated dataset now has this range of firm sizes. Figures 15 and 16 show the results of these predicted probabilities. Each dataset still demonstrates the positive firm size-exporting relationship varies in each country. As was seen in the marginal effects estimation above (figure 14), the change in probability of exporting with an increase in firm size varies significantly within each country. Importantly, the positive trend still exists.

What are the size thresholds in which each country reaches a 50 per cent probability of exporting? Interestingly, South Africa is the first to break this threshold, with firms of 52 or more workers having a 50 per cent probability of exporting. The second nation is Thailand, with a firm of 76 workers to export half of the time. Interestingly, Thailand and South Africa are the nations with the second and third highest GDP per capita scores. Furthermore, Thailand rates highly on the openness stakes with a very high ratio of international trade to GDP. GDP per capita, can be said to be a rough proxy for the extent of the development of

the markets in these nations, and therefore, the extent of competition in many sectors. Certainly, the two nations with comparatively large GDP per capita indicators (Thailand and South Africa) tend to have smaller companies beginning to enter into the export market. This may also be related to the extent of infrastructure development, and other forces that may be seen in nations with higher per capita GDP levels that allows for a decline in the costs of exporting, reducing barriers to entry into other nation's markets.

South Africa and Thailand are followed by Tanzania and Madagascar with 185 and 209 workers respectively. Thereafter, firms in Brazil usually have to employ 276 workers to export 50 per cent of the time. Brazil is an interesting case, as it is the nation with the highest per capita GDP level, but has the lowest level on international trade as a percentage of GDP. Cambodia and Bangladesh do not reach the 50 per cent point throughout the firm size distribution. The Cambodia result may be due to the poor data collected in this sample, as it is quite an outward oriented nation, with a very high international trade number as a percentage of its GDP. Bangladesh on the other hand has a very low GDP per capita, and trade is a small part of its GDP.

Figure 15: Predicted probabilities of the firm size-exporting relationship

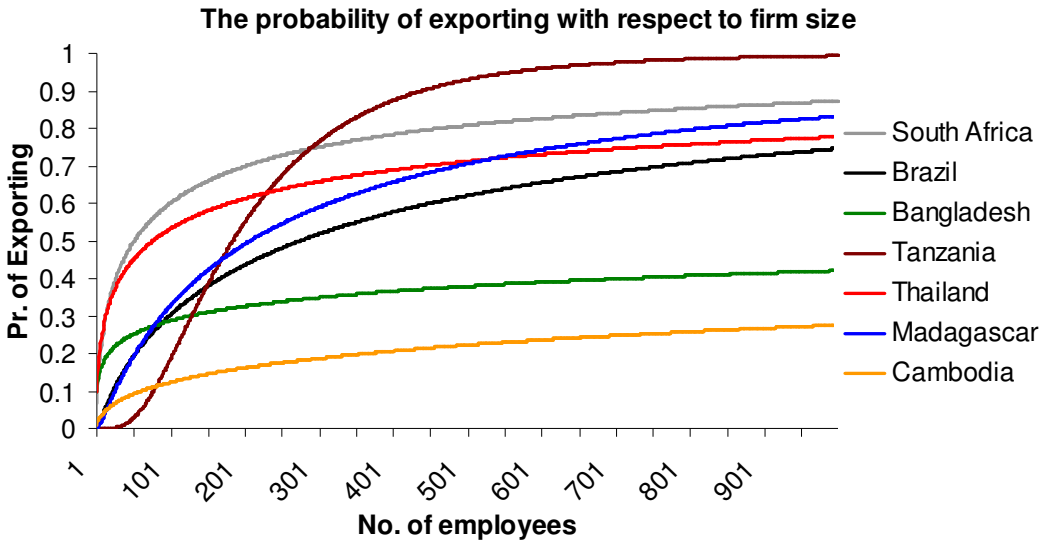
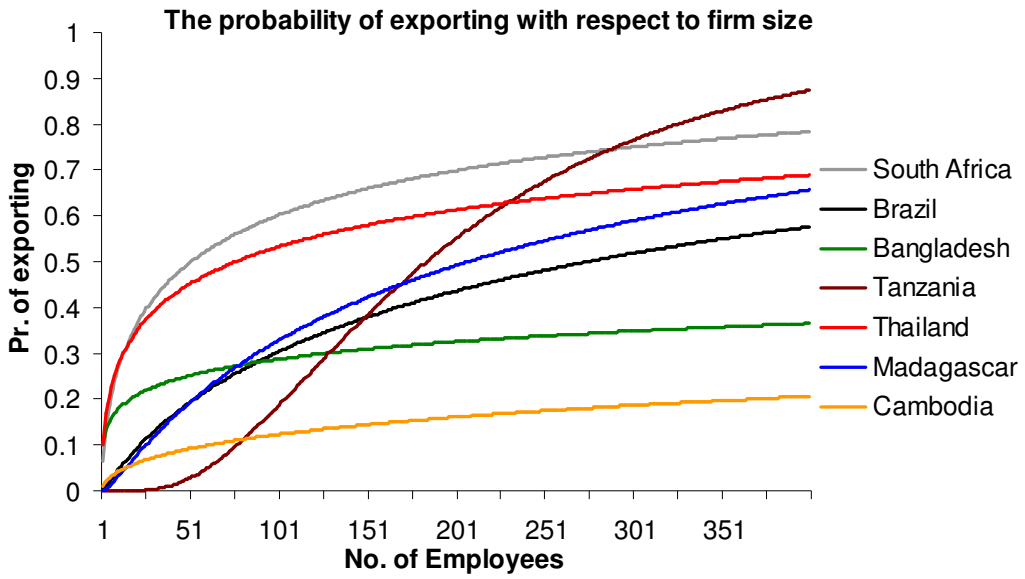
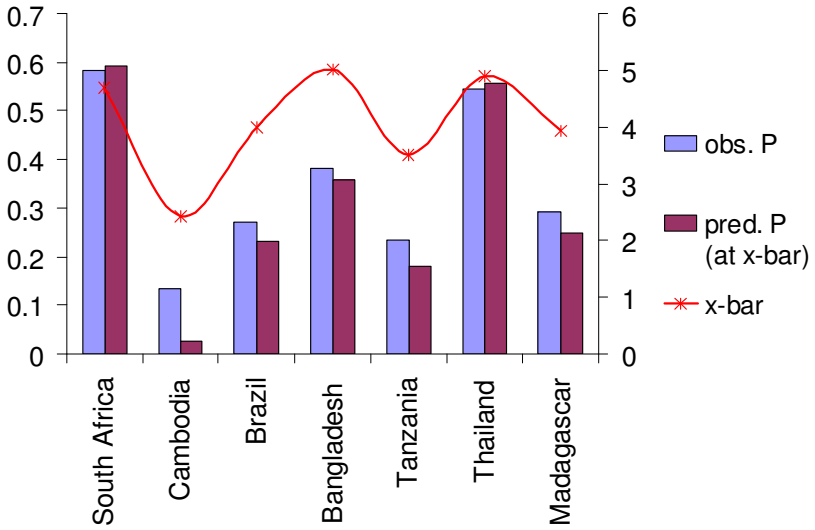


Figure 16: Predicted probabilities of the firm size-exporting relationship (first 400 firms)



A comparison between the predicted probability of exporting for the firms in the country samples, and the observed number of exporters in each sample is also shown in figure 17 below. Overlaid on the graph is the mean of firm size (measured in the log of employment) in each country. The graph shows that the results obtained using this technique of collapsing the results at the mean and extrapolating the relationship between the number of employees and exporting is fairly robust. The predicted number of exporters in each sample is similar to the observed exporters. This graph also demonstrates a rough correlation between exporting and the size of the firm. The average probability of exporters in the sample of firms' increases and decreases across nations as the mean of the firm size increases or decreases respectively.

Figure 17: The predicted and observed exporters in each country, with x-bar a mean of firm size in each country sample[20].



In combining the results seen in figures 15 to 17, it can be seen that while the incidence of exporting varies across each dataset, the results remain robust. Cambodia in particular has done poorly, with a predicted probability only reaching 27 per cent with 1000 employees in the firm. This demonstrates that only one in four large firms in Cambodia export. However, this poor result could be from the poor dataset in the Cambodian sample. This is further supported by the low marginal change in the probability of exporting with an increase in the size of the firm. Yet one can clearly see that the average size of the firms in the Cambodian sample is significantly smaller than in any other country. The low number of exporters in this sample may represent a sample bias. The size distribution of the firms in the Cambodian set is skewed to the left, with a few large, exporting firms also evident. It is difficult to take direct conclusions out of this result from the Cambodian dataset.

[20] x-bar represents the mean firm size of each dataset, measured by the log of employment (on the right axis).

Figure 15 shows that there are some minimum size thresholds before firms in these countries begin to export (as did figure 11). In particular, the probability of a small firm becoming an exporter is very low in each sample, with each line showing a positive slope with an increase in firm size. Both South Africa and Thailand also show similar export probability curves, each increasing substantially early in the sample[21]. This sharp increase in the probability of exporting with a small increase in firm size is of particular interest. Further investigation as to the causes behind this dynamic is required, as it may hold some important information as to the causes behind the dynamics of firm size and exporting. This seems to represent a threshold firm size before exporting occurs, which may stem from financial constraints, the ability to establish international linkages, productivity improvements, or a variety of other causes theorised in the relation between firm size and exporting.

The data indicates that smaller firms in Tanzania face larger barriers to exporting than the other countries in this sample, as the exporting probability increases slowly with a change in the size of the firm with smaller firms. Thereafter, a sharp increase in probability of becoming an exporter is seen, showing that many larger firms in Tanzania are exporters. Indeed, the mean size of the firm in Tanzania from this sample is relatively small, indicating that there are significant hurdles to overcome in firm size growth. The firm size scatterplot (seen in Appendix 2) of Tanzania demonstrates a set of relatively large firms that have a very high probability of exporting along a large number of firms that show little probability of being an exporter.

This probability function has demonstrated that there are differences between nations in export propensities. Even though each dataset has borne out different probability functions, the trend has confirmed the positive association between exporting and firm size. In fact, in every measure of firm size, and method of demonstrating the relation between firm size and the probability of exporting, there exists a clear, positive relation between the two variables.

[21] In this case, early in the sample correlates with firms that have few employees (small firms). As the sample is sorted in terms of the size of the firm, further in the sample indicates a larger firm.

5. Conclusion

This paper seeks to lay out the foundation of the research into the relation between firm size and exporting, and to find some preliminary core themes that run across these theories to understand the processes behind firm formation and development. A World Bank[22] cross-country dataset is used to test the similarities in the firm size and exporting relationship between firms across the globe. As this is not a panel dataset, the mechanisms behind the formation of the exporting process and the development of the size of the firm cannot be looked at and tested. However, a positive and significant relationship between firm size and exporting was found in all of the developing countries from different regions across the globe.

As such, the results in this paper have shown a definite link between firm size and exporting. This relationship has stood up to all changes in model specification and the inclusion of a number of different variables that, a priori, would affect the probability that a firm would export. The survey of the literature on firm size and on exporting has opened up a number of key questions. These questions have hinted at the mechanisms behind the true nature of this relationship between firm size and exporting have opened up a number of further research opportunities. The answers to these questions will aid in understanding the intricacies involved in firm export decisions. Whatever the processes behind firm size and exporting, a strong positive correlation has been found between the size of the firm and the probability that it will export.

[22] World Bank Private Enterprise Survey, Productivity and the Investment Climate

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Appendix 1: Descriptive Statistics

1. South Africa

exportdirect_2002	Emp	Emp-1[23]	Emp-2	log output/ labour	Log R[24] costs/ labour	Log M[25] costs/ labour
0[26]	220.38	209.95	198.76	12.47	11.68	10.51
1	462.03	448.33	447.39	12.87	12.16	10.84
Total	363.19	350.99	342.57	12.71	11.96	10.70
exportdirect_2002	**Value added**	**Log capital /labour**	**Expats employed**	**Age**	**Foreign ownership**	**capital stock**
0	2.58E+07	10.99	0.13	20.75	0.11	2.11E+07
1	1.36E+08	11.23	0.15	29.05	0.26	5.41E+07
Total	8.95E+07	11.13	0.14	25.51	0.20	4.01E+07
exportdirect_2002	**Percentage skilled workers**	**import**				
0	0.45	0.43				
1	0.45	0.73				
Total	0.45	0.60				

[23] Emp-1 and Emp-2 represent employment in the firm, one and two years before survey was done
[24] Raw materials costs
[25] Miscellaneous costs
[26] 0 in this sample represents firms that do not export, and 1 represents exporting firms

2. Cambodia

exportdirect_2002	Emp-2	Emp-1	Emp	log output/ labour	log R costs/ labour	log M costs/ labour	log labour
0	45.89	38.51	34.22	7.91	6.86	5.11	2.41
1	679.22	1026.06	1033.75	7.83	5.93	4.27	5.54
Total	281.55	167.95	167.90	7.90	6.78	5.02	2.82

exportdirect_2002	Value added	Log capital /labour	Age	Foreign ownership	capital stock	Percentage unskilled workers	Percentage skilled workers
0	90409.13	6.026853	10.58124	0.09611	45026.62	0.260854	0.739146
1	-1804714	4.237942	9.863636	0.772727	35537.55	0.192825	0.807175
Total	-56073.79	5.836544	10.48708	0.184891	43950.54	0.24866	0.75134

exportdirect_2002	Import
0	0.1647597
1	0.8030303
Total	0.2485089

3. Brazil

exportdirect_2002	Emp-2	Emp-1	Emp	log output/ labour	log R costs/ labour	log M costs/ labour	log labour
0	62.5278	63.9721	65.51009	10.31681	9.393269	7.534746	3.668986
1	278.192	282.777	282.6301	11.5458	10.62608	8.993742	4.8995
Total	121.559	123.4597	124.3495	10.64979	9.740149	7.930123	4.002455

exportdirect_2002	Age	Foreign ownership	Capital Stock	Percentage unskilled labour	Percentage skilled labour	Import
0	16.19447	0.01463537	3484015	0.585507	0.414493	0.06622
1	27.14898	0.1273609	2.37E+07	0.620152	0.379848	0.401806
Total	19.16076	0.04515947	9098372	0.594855	0.405145	0.157091

4. Bangladesh

exportdirect_2001	Emp-2	Emp-1	Emp	log output/ labour	log R costs/ labour	log M costs/ labour	log labour
0	207.2649	220.2791	229.9967	5.92386	5.250179	3.344422	4.655036
1	388.7672	409.0067	428.742	5.77015	5.172258	2.855326	5.611315
Total	274.4508	291.9649	305.6129	5.865513	5.220601	3.158765	5.01887

exportdirect_2001	Log capital /labour	Value added	Age	Expats employed	Foreign ownership	Capital stock	Percentage unskilled workers
0	3.831462	35861.05	19.09672	0.252459	0.044262	38244.1	0.323578
1	3.428837	97419.67	16.76676	0.362667	0.048	36853.54	0.302732
Total	3.678415	59243.3	18.21261	0.294416	0.045685	37715.17	0.315058

exportdirect_2001	Percentage skilled workers	Import					
0	0.676422	0.413793					
1	0.6972683	0.733333					
Total	0.6849416	0.535569					

5. Tanzania

exportdirect_2002	Emp-2	Emp-1	Emp	log output/ labour	log R costs/ labour	log M costs/ labour	log labour
0	57.49063	53.23037	51.04061	15.29025	14.70741	13.10028	3.144311
1	247.1771	237.7845	240.8667	16.30002	15.3549	14.16765	4.684135
Total	101.2644	96.21888	95.35798	15.54933	14.85529	13.35666	3.503803
exportdirect_2002	**Value added**	**Log capital /labour**	**Age**	**Foreign ownership**	**Capital stock**	**Percentage unskilled workers**	**Percentage skilled workers**
0	-6.34E+08	14.15066	22.44279	0.170732	9.50E+08	0.461465	0.538535
1	2.29E+09	15.08532	21.70968	0.419355	3.16E+09	0.52806	0.47194
Total	6.02E+07	14.36756	22.26996	0.228464	1.45E+09	0.482744	0.517256
exportdirect_2002	**Import**						
0	0.3247423						
1	0.6666667						
Total	0.4023904						

6. Thailand

exportdirect_2002	Emp-2	Emp-1	Emp	log output/ labour	log R costs/ labour	log M costs/ labour	log labour
0	159.4092	163.0318	155.6146	13.00051	12.45185	10.87997	4.286949
1	500.6098	523.646	492.2985	13.5919	13.06764	11.43986	5.407072
Total	345.7876	360.1329	339.6361	13.32375	12.78855	11.18599	4.899175

exportdirect_2002	Value Added	Log capital /labour	Age	Foreign ownership	Capital stock	Percentage unskilled workers	Percentage skilled workers
0	3.82E+07	11.26608	17.93471	0.10828	4.92E+07	0.780786	0.219214
1	1.88E+08	11.49093	18.87318	0.400264	1.77E+08	0.797793	0.202207
Total	1.20E+08	11.38925	18.44765	0.26787	1.19E+08	0.790095	0.209905

exportdirect_2002	Import
0	0.1687898
1	0.4940555
Total	0.3465704

7. Madagascar

exportdirect_2004	Emp-2	Emp-1	Emp	log output/ labour	log R costs/ labour	log M costs/ labour	log labour
0	50.31609	49.54872	57.56618	17.21153	16.28201	13.34387	3.385264
1	364.694	425.2125	500.8824	16.95468	15.31931	13.5383	5.313916
Total	137.7158	158.8327	187.9533	17.1358	16.01282	13.40191	3.952514

exportdirect_2004	Value added	Log capital /labour	Age	Foreign ownership	expats employed	Capital stock	Percentage unskilled workers
0	4.39E+09	16.18824	18.13725	0.263415	0.142857	4.98E+09	0.641493
1	6.35E+09	15.53942	12.68605	0.709302	0.362069	8.48E+09	0.752878
Total	4.96E+09	16.00925	16.52069	0.395189	0.224359	5.96E+09	0.67423

exportdirect_2004	Import
0	0.316832
1	0.662791
Total	0.420139

Appendix 2[27]

1. South Africa

A number of regional and sectoral dummies have been dropped from the regression. This regression also has the largest chi2 value of all combinations of regressions tested, with more regional and sectoral dummies added to the equation.

dProbit estimates		**Number of obs**	=	495
		LR chi2(26)	=	158.08
		Prob > chi2	=	0
Log likelihood =	-256.383	**Pseudo R2**	=	0.2356

Export 2002	**Coef.**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.1458408	0.0249959	5.8	0	4.67164	0.09685
Log Raw mat costs/labour 2002	0.0250213	0.0316368	0.79	0.429	11.9266	-0.036986
Log Misc costs/Labour 2002	0.0167584	0.0255382	0.66	0.512	10.6742	-0.033296
Log Capital/labour 2002	0.0027857	0.0223607	0.12	0.901	11.1912	-0.041041
Log output/Labour 2002	0.071445	0.0495666	1.44	0.15	12.726	-0.025704
Age firm	-0.0003905	0.0012536	-0.31	0.755	26.2263	-0.002847
Foreign ownership	0.0368072	0.0696421	0.52	0.601	0.185859	-0.099689
Prov ga~g	0.1583255	0.1439048	1.1	0.27	0.674747	-0.123723
Prov kzn	-0.0239661	0.1623138	-0.15	0.882	0.082828	-0.342095
Prov wc~e	0.0675246	0.1444048	0.46	0.647	0.2	-0.215504
Mining	-0.3953729	0.2622901	-1.21	0.225	0.006061	-0.909452
Food	-0.4246089	0.0842743	-4.22	0	0.10101	-0.589784
Textiles	-0.0150105	0.1519704	-0.1	0.921	0.034343	-0.312867
Garment	-0.1903861	0.1458932	-1.3	0.194	0.034343	-0.476332
Wood	-0.3440133	0.1210323	-2.53	0.011	0.040404	-0.581232
Paper	-0.0083268	0.1476657	-0.06	0.955	0.030303	-0.297746
Publishing	-0.1497454	0.1125077	-1.34	0.179	0.062626	-0.370256
Chemical	-0.1811742	0.1053616	-1.72	0.085	0.088889	-0.387679
Plastic	-0.223121	0.1097783	-2	0.045	0.066667	-0.438282
Non-metals	-0.1785571	0.1477022	-1.21	0.226	0.036364	-0.468048
Metals	-0.0018747	0.1593679	-0.01	0.991	0.030303	-0.31423
Metal-products	-0.0147869	0.1029569	-0.14	0.885	0.086869	-0.216579
Machinery	0.0427918	0.1114526	0.38	0.706	0.062626	-0.175651
Elec-machinery	0.2009649	0.0866858	1.97	0.048	0.09697	0.031064
Auto	0.0580098	0.1376156	0.41	0.682	0.044444	-0.211712
Import	0.1770717	0.0541601	3.26	0.001	0.593939	0.07092

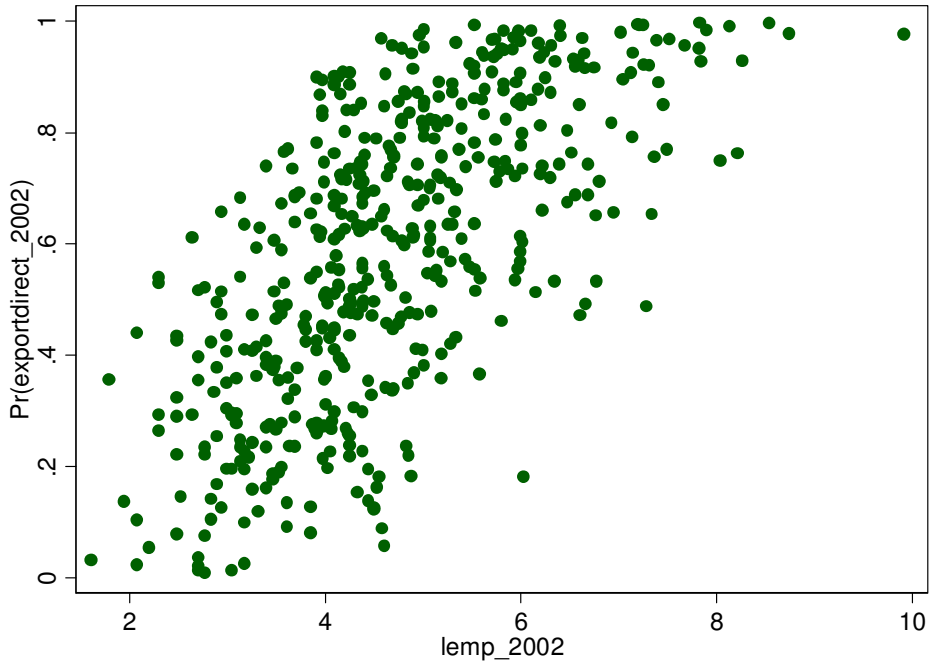
[27] The scatterplots from each country represent the predicted probability of the firm being an exporter, based on the results of the probit regression (the y-axis), along with the representative measure of the size of the firm, measured as the log of employment at the firm at the time of the survey. Each point on the scatterplot represents an observation.

obs. P	0.5878788	
pred. P	0.6165621	(at x-bar)

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

The sectors left out included the business sector, auto retail sector, tobacco, footwear, coke, office machinery, other manufacturing, and the recycle sector.

Figure A2.1: Scatterplot of the South African dataset



2. Cambodia

The probit regressions with the city and sector dummies were dropped from the regressions. Interestingly, 90 per cent of the exporters in this dataset come from one sector. However, even in this sample, the firm size variable is still significant with respect to the probability of exporting.

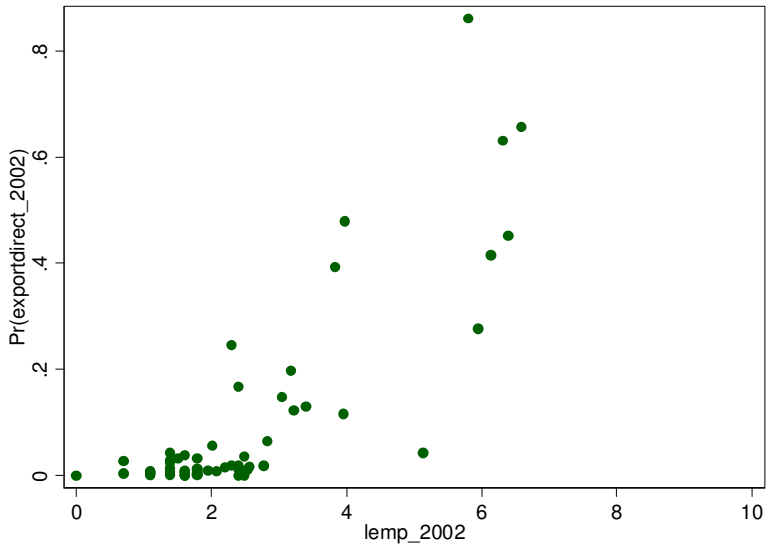
dProbit estimates		**Number of obs**	=	62	
		LR chi2(7)	=	16.03	
		Prob > chi2	=	0.0248	
Log likelihood =	-11.6969	**Pseudo R2**	=	0.4066	

Export 2002	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.0227826	0.0191434	1.89	0.059	2.41842	-0.014738
Log Raw mat costs/labour 2002	-0.020233	0.0176795	-1.3	0.194	6.95107	-0.054884
Log Misc costs/Labour 2002	0.0102794	0.0137874	0.86	0.392	5.30556	-0.016743
Log Capital/labour 2002	-0.013615	0.0127269	-1.09	0.274	5.67655	-0.038559
Log output/Labour 2002	0.0133091	0.0177365	0.66	0.511	7.76567	-0.021454
Age firm	0.0019498	0.0053908	0.35	0.725	9.43548	-0.008616
Foreign ownership	0.1528676	0.1730601	1.44	0.15	0.129032	-0.186324

obs. P	0.0967742	
pred. P	0.0251407	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

Figure A2.2: Scatterplot of the Cambodian dataset



One can clearly see from the figure above that there were not many firms that were both exporters who also completed the surveys correctly. Therefore, the results from the Cambodian sample must be treated with caution. The table below shows that the employment variable becomes insignificant with the addition of the import variable into the probit equation.

Probit estimates		**Number of obs**	=	62		
		LR chi2(8)	=	18.08		
		Prob > chi2	=	0.0207		
Log likelihood =	-10.673638	**Pseudo R2**	=	0.4585		
exportd~2002	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.0144366	0.0165496	1.12	0.263	2.41842	-0.018
Log Raw mat costs/labour 2002	-0.019913	0.0175981	-1.19	0.235	6.95107	-0.054404
Log Misc costs/Labour 2002	0.0123605	0.0153202	0.91	0.365	5.30556	-0.017666
Log Capital/labour 2002	-0.00783	0.0122	-0.67	0.5	5.67655	-0.031742
Log output/Labour 2002	0.0039031	0.0175893	0.22	0.828	7.76567	-0.030571
Age firm	0.0052009	0.0060078	0.81	0.415	9.43548	-0.006574
Foreign ownership	0.1486743	0.1680395	1.35	0.177	0.129032	-0.180677
importd	0.1494191	0.1768978	1.45	0.147	0.145161	-0.197294

obs. P	0.0967742	
pred. P	0.0252228	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

3. Brazil

There were a number of sector dummies that were dropped from the equation due to collinearity:

note: miningsect dropped due to collinearity
note: autoretailsect dropped due to collinearity
note: tobaccosect dropped due to collinearity
note: woodsect dropped due to collinearity
note: publishsect dropped due to collinearity
note: cokesect dropped due to collinearity
note: nonmetalsect dropped due to collinearity
note: officemachsect dropped due to collinearity
note: recyclesect dropped due to collinearity
note: wholeretailsect dropped due to collinearity
note: hotelsect dropped due to collinearity

In addition, the area Amazonas is not included in the regression.

dProbit estimates		**Number of obs**	=	1503	
		LR chi2(28)	=	625.95	
		Prob > chi2	=	0	
Log likelihood =	-579.325	**Pseudo R2**	=	0.3508	

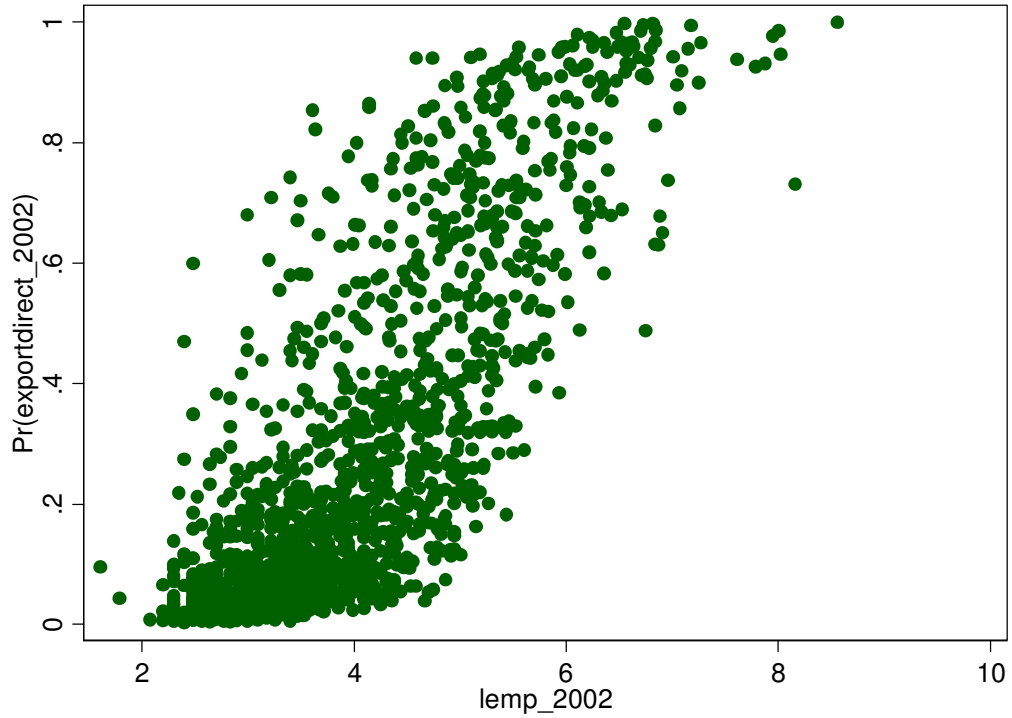
Export 2002	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.1481755	0.0132759	11.21	0	4.01131	0.122155
Log Raw mat costs/labour 2002	-0.0321845	0.0195032	-1.65	0.099	9.73304	-0.07041
Log Misc costs/Labour 2002	0.0288882	0.0124971	2.3	0.021	7.97602	0.004394
Log output/Labour 2002	0.0888107	0.0269245	3.29	0.001	10.6925	0.03604
Age firm	0.0008829	0.0007696	1.15	0.25	19.6307	-0.000625
Foreign ownership	0.000871	0.0006608	1.32	0.186	4.47045	-0.000424
Food	-0.072557	0.081317	-0.8	0.426	0.075183	-0.231935
Textiles	-0.0807201	0.0784548	-0.9	0.37	0.061211	-0.234489
Garment	-0.0769687	0.0845694	-0.85	0.393	0.254824	-0.242722
Footwear	0.0087437	0.1007404	0.09	0.93	0.101796	-0.188704
Chemicals	-0.080824	0.0805674	-0.87	0.384	0.053227	-0.238733
Machinery	0.0111631	0.0989535	0.11	0.909	0.111111	-0.182782
Elec-machinery	-0.0450956	0.09415	-0.45	0.655	0.043912	-0.229626
Auto	-0.0483669	0.0870309	-0.52	0.604	0.080506	-0.218944
Other Manu	-0.0468452	0.0873762	-0.51	0.608	0.19827	-0.218099
Prov Saopaulo	0.0604497	0.1253177	0.5	0.616	0.222222	-0.185168
Prov Rio	0.0214978	0.1292972	0.17	0.865	0.074518	-0.23192
Prov Minas	-0.0203905	0.1134792	-0.18	0.86	0.142382	-0.242806
Prov Santa	0.2730221	0.1574021	1.92	0.055	0.0998	-0.03548
Prov riograng	0.2244529	0.1529486	1.63	0.104	0.117099	-0.075321
Prov Goias	0.0510734	0.1434956	0.37	0.708	0.0499	-0.230173

Prov Parana	0.1078212	0.1399537	0.83	0.405	0.111776	-0.166483
Prov Matogrosso	0.1106003	0.1714032	0.71	0.479	0.023287	-0.225344
Prov Ceara	-0.0018336	0.1266008	-0.01	0.988	0.053892	-0.249967
Prov Paraiba	0.0231183	0.1509032	0.16	0.875	0.028609	-0.272646
Prov Maranhao	0.0349212	0.1704115	0.21	0.831	0.014637	-0.299079
Prov Bahia	-0.0124755	0.1270291	-0.1	0.923	0.04857	-0.261448
Import	0.1999656	0.0464475	4.78	0	0.157019	0.10893

obs. P	0.2807718	
pred. P	0.2120392	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

Figure A2.3: Scatterplot of the Brazilian dataset



The interesting feature about this graph is that there is a lot of spatial variation in the probability of exporting with regard to firm size. There are a large number of firms that have a very low probability of exporting, yet within the same size category, there are also a large number of firms that have a very high probability of selling their product abroad. Importantly, a clear trend can be identified, a positive sloping correlation between firm size and the probability of being an exporter.

4. Bangladesh

The area variables were dropped from the regression. Interestingly, the chi2 value was exactly the same with the city variables included as it was without these city variables. In addition, there were a number of sector dummies that were dropped from the equation. These include the food and other manufacturing sectors.

dProbit estimates		**Number of obs**	=	970	
		LR chi2(13)	=	487.38	
		Prob > chi2	=	0	
Log likelihood =	-399.7	**Pseudo R2**	=	0.3788	

Export 2001	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2001	0.0556053	0.0201498	2.74	0.006	5.01806	0.016112
Log Raw mat costs/labour 2001	-0.0111068	0.0323304	-0.34	0.731	5.21456	-0.074473
Log Misc costs/Labour 2001	0.0091653	0.0199383	0.46	0.646	3.14322	-0.029913
Log Capital/labour 2001	0.0245375	0.0155184	1.58	0.114	3.67306	-0.005878
Log output/Labour 2001	0.0016764	0.0427659	0.04	0.969	5.8555	-0.082143
Age firm	0.0012485	0.0014971	0.83	0.404	18.1031	-0.001686
Foreign ownership	0.0971521	0.0959598	1.05	0.293	0.042268	-0.090926
Import	0.1024918	0.0427044	2.38	0.017	0.534021	0.018793
Textiles	0.0361435	0.0697773	0.52	0.601	0.254639	-0.100617
Garments	0.65324	0.0552181	9.1	0	0.312371	0.545014
Leather	0.5353874	0.0573892	7.37	0	0.1	0.422907
Chemicals	-0.0619026	0.0820672	-0.72	0.471	0.080412	-0.222751
Electronics	-0.2269709	0.0708381	-2.27	0.023	0.091753	-0.365811

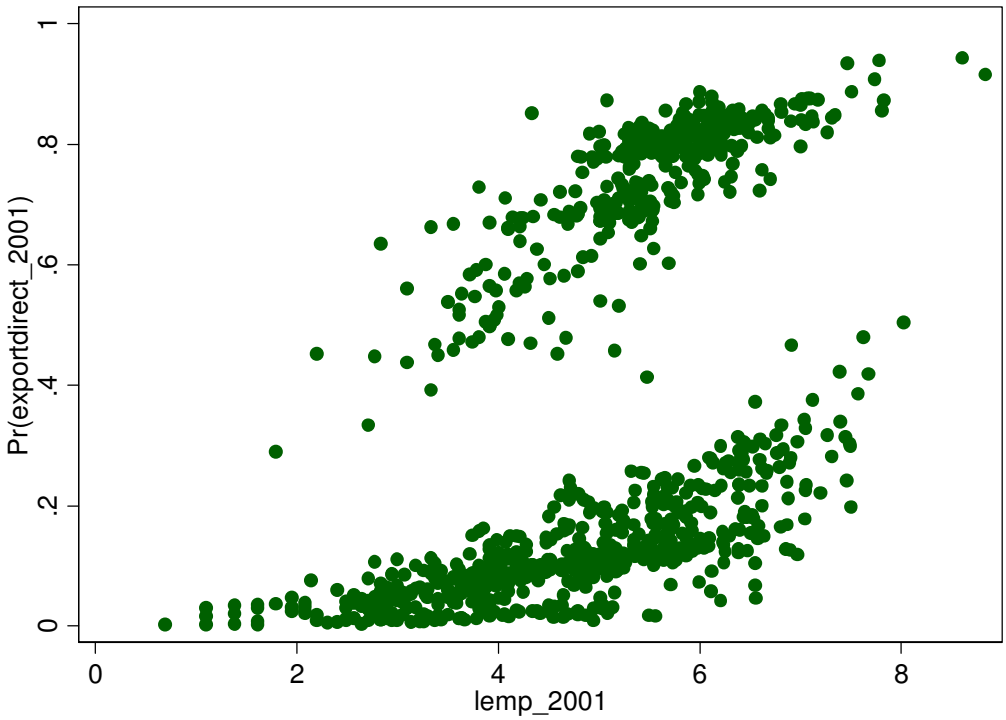
obs. P	0.3783505	
pred. P	0.3139531	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

The interesting feature about this equation is that it is clear that the garments and leather sectors are the main exporters in Bangladesh. Most other sectors hardly have any exporters, and yet the size-exporting relationship still holds. However, one caveat to this is that the garments and leather-manufacturing firms are predominantly larger then other firms in the sample, which would therefore give the observed firm size-exporting relationship.

The interesting feature about the prediction results is that they are similar to those from Cambodia.

Figure A2.4: Scatterplot of the Bangladesh dataset



5. Tanzania

The food sector is not used in the regression, along with a number of regional dummies that have been dropped from the equation due to the probit predicting failure perfectly (i.e. there are no exporters in these regions).

dProbit estimates		**Number of obs**	=	112	
		LR chi2(20)	=	76.54	
		Prob > chi2	=	0	
Log likelihood =	-23.59	**Pseudo R2**	=	0.6187	

Export 2002	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.0410346	0.0535779	3.95	0	3.3889	-0.063976
Log Raw mat costs/labour 2002	-0.0285674	0.0358527	-2.95	0.003	14.9367	-0.098837
Log Misc costs/Labour 2002	0.0004329	0.0064395	0.07	0.947	13.3343	-0.012188
Log Capital/labour 2002	-0.0007499	0.004065	-0.19	0.849	14.7046	-0.008717
Log output/Labour 2002	0.0356183	0.0453815	3.12	0.002	15.651	-0.053328
Age firm	-0.0006158	0.0010267	-1.06	0.287	22.2411	-0.002628
Foreign ownership	0.0026332	0.0178263	0.16	0.873	0.196429	-0.032306
Import	-0.0125648	0.0222015	-0.81	0.42	0.401786	-0.056079
Textiles	0.2233398	0.310813	1.75	0.08	0.125	-0.385843
Garments	-0.005902	0.017408	-0.29	0.77	0.125	-0.040021
Leather	0.0247392	0.0611947	0.7	0.486	0.142857	-0.0952
Chemicals	-0.0062108	0.0172968	-0.3	0.763	0.151786	-0.040112
Electronics	-0.0070621	0.0178926	-0.34	0.734	0.116071	-0.042131
Other-Manu	0.0256371	0.0546924	0.76	0.447	0.169643	-0.081558
Prov Regdar	0.2433413	0.295284	1.23	0.22	0.339286	-0.335405
Prov Regmwanza	0.8656571	0.2759984	1.97	0.049	0.160714	0.32471
Prov Regkilma	0.3837638	0.6308094	1.03	0.303	0.071429	-0.8526
Prov Regtanga	0.8874328	0.268342	1.91	0.056	0.125	0.361492
Prov Regkagera	0.9399436	0.1984157	1.83	0.068	0.071429	0.551056
Prov Regmbeya*	0.0319914	0.1861856	0.26	0.794	0.026786	-0.332926

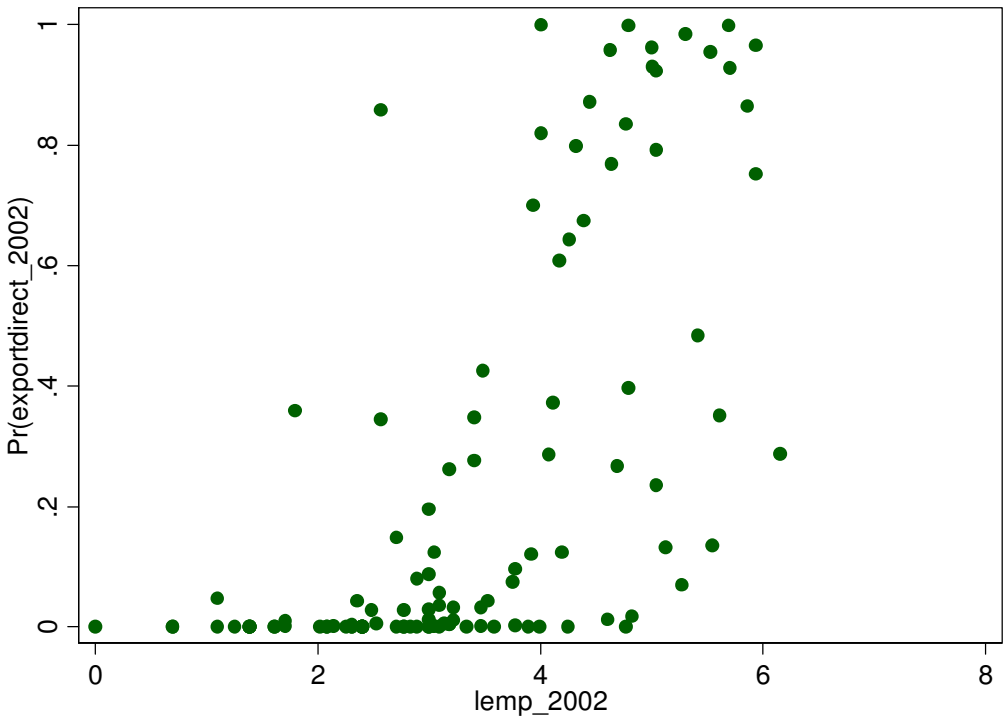
obs. P	0.2410714	
pred. P	0.0105085	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

note: 13 failures and 0 successes completely determined.

A large number of variables were dropped with the addition of the logged output per labour, indicating a large number of incomplete data points.

Figure A2.5: Scatterplot of the Tanzanian dataset



6. Thailand

The central region was not included in the regression. A number of sector dummies were also dropped from the equation, but this was mostly because there were no recorded firms in these sectors. The only sector to be dropped from the equation was the wood sector due to collinearity. The following sectors were dropped due to no observations in them:

Mining, Auto retail, tobacco, footwear, paper, publishing, coke, chemicals, non-metals, metals, recycling, whole retail, hotels, and the business sector

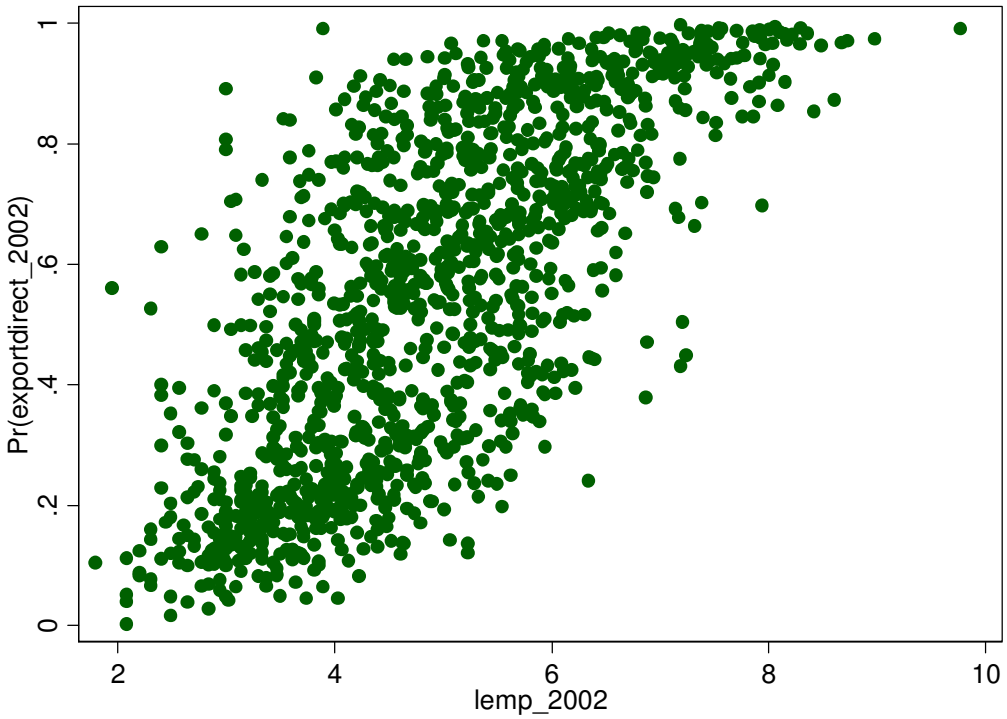
dProbit estimates		**Number of obs**	=	1352	
		LR chi2(23)	=	475.6	
		Prob > chi2	=	0	
Log likelihood =	-693.077	**Pseudo R2**	=	0.2555	

Export 2002	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.1165711	0.0148071	7.87	0	4.90687	0.08755
Log Raw mat costs/labour 2002	-0.019827	0.0214403	-0.92	0.355	12.7944	-0.061849
Log Misc costs/Labour 2002	0.0654033	0.0228308	2.87	0.004	11.1888	0.020656
Log Capital/labour 2002	-0.0074433	0.0106743	-0.7	0.486	11.39	-0.028364
Log output/Labour 2002	0.0345887	0.0294033	1.18	0.239	13.336	-0.023041
Age firm	-0.0003808	0.0018007	-0.21	0.833	18.5059	-0.00391
Foreign ownership	0.2110171	0.0377686	5.22	0	0.27145	0.136992
Import	0.2777969	0.0348452	7.39	0	0.346893	0.209502
Food	-0.0020841	0.1442765	-0.01	0.988	0.128698	-0.284861
Textiles	-0.2448927	0.136612	-1.71	0.087	0.135355	-0.512647
Garments	0.0694467	0.136616	0.5	0.618	0.123521	-0.198316
Plastics	-0.2056174	0.1389528	-1.45	0.148	0.172337	-0.47796
Metal-products	-0.2492604	0.1713098	-1.35	0.178	0.014793	-0.585021
Machinery	-0.1187996	0.1447578	-0.82	0.412	0.111686	-0.40252
Office equipment	-0.2887014	0.1549395	-1.66	0.097	0.01997	-0.592377
Elec-machinery	-0.2490339	0.1399545	-1.68	0.092	0.098373	-0.52334
Auto	-0.2547937	0.1357655	-1.77	0.076	0.10503	-0.520889
Other Manu	-0.1196036	0.1455436	-0.82	0.412	0.079882	-0.404864
South	0.2247869	0.0644296	3	0.003	0.076183	0.098507
North East	-0.1628691	0.0855981	-1.87	0.061	0.051036	-0.330638
East	0.0398748	0.0638713	0.62	0.536	0.139793	-0.085311
Bangkok	-0.0369627	0.0552411	-0.67	0.504	0.573964	-0.145233
North	-0.2166667	0.0794856	-2.61	0.009	0.053254	-0.372456

obs. P	0.5480769	
pred. P	0.5693051	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

Figure A2.6: Scatterplot of the Thai dataset



In this large sample, the positive association between exporting and firm size and clearly be seen once more.

7. Madagascar

A number of variables were dropped due to the existence of too few variables with the necessary data. The other region was left out. The tobacco, mining and construction sectors were not included in the regression.

dProbit estimates		**Number of obs**	=	228	
		LR chi2(19)	=	134.64	
		Prob > chi2	=	0	
Log likelihood =	-68.0264	**Pseudo R2**	=	0.4974	

Export 2004	**dF/dx**	**Std. Err.**	**z**	**P>z**	**[95 % Conf.**	**Interval]**
Log emp 2002	0.1589851	0.0356958	4.62	0	3.84303	0.089023
Log Capital/labour 2002	-0.0128174	0.0206954	-0.62	0.535	15.9603	-0.05338
Firm age	-0.0028092	0.0023988	-1.17	0.24	15.6009	-0.007511
Foreign ownership	0.1074135	0.0833803	1.34	0.179	0.390351	-0.056009
Import	0.2232795	0.0911397	2.55	0.011	0.385965	0.044649
regtam~e*	0.3751877	0.2987589	1.4	0.161	0.026316	-0.210369
regans~e*	-0.0813547	0.166376	-0.4	0.692	0.04386	-0.407446
regant~o*	0.0361573	0.1089883	0.32	0.752	0.846491	-0.177456
Food	-0.1538559	0.1159219	-0.92	0.356	0.149123	-0.381059
Textiles	0.2326463	0.2993735	0.89	0.371	0.109649	-0.354115
Apparel	-0.0017972	0.2154383	-0.01	0.993	0.184211	-0.424049
Leather	0.1632307	0.4451559	0.42	0.672	0.017544	-0.709259
Wood	0.0809146	0.2539442	0.35	0.73	0.131579	-0.416807
Paper	0.1212044	0.270957	0.5	0.616	0.061404	-0.409862
Publishing	-0.1936221	0.1011046	-1.14	0.253	0.153509	-0.391783
Chemicals	-0.1093956	0.1384987	-0.59	0.555	0.070175	-0.380848
Metals	-0.1775448	0.0573729	-1.26	0.207	0.048246	-0.289994
Machinery	-0.0136585	0.2775355	-0.05	0.962	0.02193	-0.557618
Furniture	0.0357115	0.2441116	0.15	0.878	0.087719	-0.442738

obs. P	0.2807018	
pred. P	0.176619	**(at x-bar)**

(*) dF/dx is for discrete change of dummy variable from 0 to 1
z and P>z are the test of the underlying coefficient being 0

Figure A2.7: Scatterplot of the Madagascan dataset