# Essays in Entry, Exit and International Trade

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Thesis submitted to the University of Nottingham

for the Degree of Doctor of Philosophy

September 2010

# Abstract

Firm entry and exit has been shown to strongly influence productivity growth. Productivity has been identified as the key driver of long-run economic growth. This thesis strives to understand the causes of entry and exit and the role played by globalisation in this process of creative destruction.

# Acknowledgements

I am especially grateful to my supervisors Dr. Richard Kneller and Professor David Greenaway whose excellent advice guided me so well. Without them I would never have been able to complete this work. I also thank Professor Chris Milner for his helpful advice which greatly improved Chapter Four. I thank all my colleagues and friends from B51, the surrounding offices and elsewhere who made this such a memorable and enjoyable experience. Many thanks to Christoph Görtz and Paul Atherton for all the banter.

I thank the Economic, Social Research Council for funding my studies and my parents and family for their support and for encouraging me to always pursue what interests me.

# Contents

# Chapter One

# Introduction

In the wake of the technological discoveries that prompted the industrial revolution, the largely agrarian economies of Western Europe were gradually transformed as mechanisation led to agriculture being replaced by manufacturing as the bedrock of these countries' economies. The textile, mining and iron founding industries that these innovations gave birth to have themselves over time been supplanted by service sectors. This is perhaps best exemplified in England by the death of Lancastrian linen mills and the shifting of the country's economic heartland towards the financial institutions located in the City of London. In part due to environmental considerations, but also because of concerns about current industries' competitiveness, policy makers have begun to call for the development of the industries of the future. During the 2008 U.S. Presidential Election Barrak Obama pledged to assist in the creation of green industries which would employ some 5 million people and enable the United States to remain at the fore front of international technological developments. The European Union has adopted a similar approach with the Lisbon Treaty containing a clause demanding that her members strive to create an integrated, knowledge-based economy.

Central to these transitions has been the entry and exit of firms. Innovation's relentless march has stimulated the development of new machinery and industries. These advancements have led to the creation of new products and services which often use the same inputs. For example, the iron oxide rocks which were once the crayon of choice used by our prehistoric ancestors in cave paintings have since been utilised to produce audio cassettes, video tapes and floppy disks. Through time these products have in turn been made obsolete as innovation and entrepreneurs have contrived to produce superior products which dramatically improve upon their predecessors. Often new products and ideas are embodied within new firms. They create competition within the market place which forces the exit of less efficient firms and products. This Darwinian process has been shown to impact upon productivity growth which has been identified as the key driver of economic growth (Hulten, 2000). Given the close relationship between productivity and entry and exit, the process of firm creation and death is also allied with long-run economic growth.

Empirical research has shown that the entry of new firms, and death among incumbents, has important implications for aggregate and industry productivity (see Bartelsman and Doms, 2000). Bernard and Jensen (2004) highlight that in the United States this accounts for 35% of aggregate productivity gains over a five year period. Similar conclusions have been reached for other countries. For example, Baldwin and Gu (2002) show that plant turnover contributes between 15-25 per cent of labour productivity improvements over the periods 1973-79, 1979-88 and 1988-97. In their study a very large fraction of this contribution is due to foreign-owned and multi-plant firms. For the United Kingdom multi-plant firms are also found to play a pivotal role: Disney, Haskell and Heden (2003a) show that 'external restructuring' accounts for 50% of labour productivity growth and 90% of TFP growth over the years 1980-1992.[1] This source of competition is also found by Disney et al. (2003a) to affect 'internal restructuring'.[2] In their study of Taiwan Aw, Chen and Roberts (1997) reach similar conclusions while Hahn (2000) finds that between 45 and 65 per cent of productivity growth in Korean manufacturing industries is due to entry and exit. Finally, net entry is found to play a supporting role to reallocations of output in causing productivity growth by Haltiwanger (1997) though it still accounts for 18% of changes in industry productivity.

In parallel with the studies mentioned several others have found firm or plant turnover to have a more limited effect on productivity growth for manufacturing industries in the United States (Baily, Hulten and Campbell, 1992), Israel (Griliches and Regev, 1995), Chile, Columbia and Morocco (Liu, 1993; Tybout, 2000; Liu and Tybout, 1996; Roberts and Tybout, 1997). In part these findings reflect the fact that on average entering plants have lower productivity than incumbents and that it is only through time that they begin to make a contribution. However,

[1] 'External restructuring' refers to the process by which less efficient plants exit and more efficient plants enter and increase their market share.
[2] 'Internal restructuring' refers to technology upgrading, innovation and organisational change.

unsuccessful firms play a crucial role. Their presence stimulates competition for market share and forces incumbents to improve (Bartelsman and Dhrymes, 1994; Griliches and Regev, 1995; Foster, Haltiwanger and Krizan, 1998, 2002; Eslava, Haltiwanger, Kugler and Kugler, 2004).

While entering and exiting firms play a key role in determining productivity and economic growth, their contribution to employment is substantial. Leonard (1987) reports that between 1978 and 1979 job gains through plant deaths corresponded to 11% of total job gains while plant death was responsible for 11% of total job losses. Where entrants are successful they expand rapidly (Bartelsman, Haltiwanger and Scarpetta, 2005). However, there is also evidence that even where the firm survives, the jobs it creates may not. Dunne, Roberts and Samuelson (1989b) for example find that five years after entering the average plant had a workforce between 84.3% and 87.7% of its entering size.

Much of the theoretical literature on entry and exit concentrates on the Schumpeterian idea of 'creative destruction' (Schumpeter, 1943), by which many new firms enter the market introducing new (improved) products and new technologies and processes that replace old ones, resulting in firm closures. Churn has therefore largely been positively viewed for its role as the driving force behind improvements in productivity.[3] However, the effect of churn is also linked to the impact of

[3] Churn is defined as the rate of entry plus exit.

competition on corporate performance, that is, the pressure churn creates acts as a form of market discipline, ensuring that the market operates efficiently.

One may view technology as defining the boundary of what may be created, while globalisation dictates the markets in which ideas may be sold. Ultimately, however, it is entrepreneurs that fill this space. In tandem with research on entry and exit a literature studying entrepreneurship has evolved seeking to understand why some are successful and others less so. At heart the work in this area has sought to encourage the formation of localised economies as well as encourage governments to assist small and medium sized enterprises by providing research on policy measures. The importance of this area can be seen by the litany of, often country-specific, reports published by the OECD Centre for Entrepreneurship, SMEs and Local Development which include some 8 manuals on the subject.

However, this literature on entrepreneurship is far from complete. This is in part due to the spotlight having been mainly directed at small and medium sized enterprises but is also attributable to difficulties in quantifying entrepreneurship. Nonetheless Bloom and van Reenan (2010) have shown that the managerial practices adopted in different countries partly explain firm productivity. Extrapolating this to each individual entrepreneur would be difficult and prohibitively costly. However, entry and exit represent one of the few avenues through which we can base judgement.

From entry rates we can infer whether one country is more entrepreneurial than another. For example, people in the United States appear more willing to set-up businesses than elsewhere. Japan represents an interesting case where entry and exit rates are among the lowest of developed countries. Typically the rate of churn is less than 5% in Japan. This holds across industries and organisation structure as shown in Table 1.1.

Table 1.1: Entry and Exit Rates in Japanese Manufacturing

| Sample | Economy Average | | MNE | | Multi (ex. MNE) | | Single Plant | |
|---|---|---|---|---|---|---|---|---|
| Variable | Entry | Exit | Entry | Exit | Entry | Exit | Entry | Exit |
| Rate | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |

In part this reflects differences in attitudes towards risk and the stigma attached to failure. However, cross-country differences in entry and exit allow us to study the reasons for these differences and whether this is due to specific institutions which distort entry incentives. On the other hand survival rates of new firms allow us to gauge the success of entrepreneurs. It may be that a lack of competition insulates entrants while growing markets have also been found to be more hospitable environments for entrants (Mata, Portugal and Guimaraes, 1995). Analysing exit provides a window into entrepreneurs' capabilities. However, high exit rates do not necessarily imply that entrepreneurs are low quality since entry begets exit but it remains possible to judge whether exit rates are due to industry declines (Olley and Pakes, 1996) or other reasons such as increased competition from abroad (Bernard, Jensen and Schott, 2006).

The Darwinian selection of firms makes it difficult for entrants to succeed but the probability of success is neither uniform across entrants nor industries. The sunk costs of entry play a large part in that they shape the productivity distribution of the industry and, by extension, the competition within it (Asplund and Nocke, 2000; Aw, Chung and Roberts, 2002). Firms entering growing industries are also less likely to fail but the type of entrant also matters.

Much of the theoretical literature starts with the underlying presumption that entry is through start-up but the *way* in which entry takes place is largely determined by market conditions and is not limited solely to start-ups. Dunne, Roberts and Samuelson (1988), in their study for US manufacturing, identify three modes of entry:

a) The creation of a new plant

b) A change in product mix produced by an existing plant

c) Buying a plant from an existing producer in the same industry.

An additional distinction not made by Dunne et al. (1988) is entry and exit by a firm from another industry (diversification). In his consideration of the definitional issues, Mueller (1991) distinguishes plant openings from firm openings and splits this former category into two:

a) Entry by a newly created firm

b) Entry by an existing firm that builds a new plant in the industry.

In addition to the domestic aspect, entry and exit by foreign firms also matters both in terms of exporting and location. Often this process is not without its detractors. As outlined by Scheve and Slaughter (2004, 2007) and Rodrik (1991) increased globalisation is not always welcomed. For the United Kingdom Scheve and Slaughter (2004) find that owing to multinationals' more elastic labour demand schedules employees become more uncertain about their future employment prospects and less favourable towards globalisation.[4] Market integration has also been blamed for the rise of greater inequality (Scheve and Slaughter, 2007). Recently Blinder (2007) has argued that the offshoring of tasks by firms may have profound implications upon employment of even the most skilled workers as firms look to reduce their production costs.

However, entry by foreign firms introduces new products and ideas. This is perhaps best exemplified by the productivity improvements that have been found to occur through technological spillovers from multinationals to domestic firms. Blomstrom and Kokko (1998) identify movements of highly skilled staff from multinationals to domestic firms, arm's-length relationships through which domestic firms learn about superior production technologies and processes and competition from multinationals as the fundamental channels through which spillovers

[4] Robrik (1991) shows this theoretically.

occur. Although empirical evidence on spillover effects is mixed (Görg and Strobl, 2001) some studies do find positive effects both through multinational presence and imports (Javorcik, 2004; Keller and Yeaple, 2003). Often imports and the goods sold by foreign firms increase the variety of goods available to consumers and capture market share at the expense of those produced domestically (Melitz, 2003, Bernard et al., 2003, Bernard et al., 2007). This further source of competition also serves to discipline domestic firms and force them to raise their productivity or face decline and death.[5]

In the same way as entry does not simply entail start-up there are several means of exit other than closure. In their study of Swedish manufacturing firms Greenaway, Gullstrand and Kneller (2008) find that death is the least common mode of exit. Substantially more firms are found to switch industries in part due to import competition. This has also been found for the United States by Bernard, Jensen and Schott (2006) who find that when confronted by low-wage imports firms switch into more capital intensive industries. In Sweden mergers and acquisitions are the most common form of exit accounting for approximately 56% of exits. There are reasons to believe that exit is not limited to these forms. At the same time as globalisation has stimulated the integration of world markets, production has become increasingly fragmented. This has led firms to

[5] The lack of competition in economies that lay behind the Iron Curtain is one reason why companies located there struggled to compete with entrants after the fall of the Berlin Wall. Their products were shunned by the West with only double-decker trains, Rotkäppchen Champagne and Caro Landkaffee among the few that gained market share post-1990. The success of the latter is peculiar given the uniform derision it receives throughout Germany.

outsource non-core activities (Feenstra and Hanson, 1996), or those that can be performed more cost effectively outside the firm, both domestically and abroad. The sustained fall in trade costs has also led to the rise of offshore production as firms look for further cost synergies. For example labour intensive tasks can be performed more cheaply in countries with large labour endowments which has resulted in UK manufacturers moving production of those goods abroad (Simpson, 2009). In both instances the decision of the firms to either outsource or offshore production has repercussions for plants in the domestic economy. There may be downsizing as activities that were previously performed inhouse are sub-contracted to an outside firm or outright death.

In most countries entrants play a large role in shaping the business environment. For example, between 15 and 20 per cent of all Canadian firms are 'small' (Baldwin, Beckstead and Girard, 2002). However, as demonstrated by changes in employment due to failure, entrants often face bleak survival prospects. Mata, Portugal and Guimaraes (1995) show that more than 20 per cent of Portuguese plants die during their first year and more than 50 per cent do not survive for 4 years. Only 30 per cent of the entering cohort survived for seven years. Dunne, Roberts and Samuelson (1989) report that 39.7% of new firms in the United States die before reaching their sixth birthday. In another Anglo-Saxon economy, the United Kingdom, Disney, Haskel and Heden (2003b) report that 65 per cent of entrants have exited after 5 years. The survival prospects of Canadian entrants are particularly low with between 5 and 6 per cent surviving for 5 years. In their survey of 25 countries Bartelsman, Haltiwanger and Scarpetta (2005) find that between 20 and 40 percent of entering firms fail within 2 years of life. Similar results have been found for other industrial economies which show that the hazard rate faced by this type of firm is higher than for older incumbents (Caves, 1998). Even when new plants have similar productivity compared with incumbents they face greater uncertainty in their evolution (Bartelsman and Dhrymes, 1994).

The role of dynamic adjustment in reallocating resources through the entry and exit of firms is a crucial element of the capitalist system. This turbulent process is thought to impact on industry productivity through increased competition leading to greater cost efficiency. It can also facilitate creative destruction whereby more innovative firms enter the market, replacing incumbent firms using current technologies. Through the churn process, firms and markets are thought to grow, resulting in increased employment, productivity and welfare. Understanding what drives entry and exit is therefore important since the underlying factors contribute indirectly to societal outcomes.

**Aims of the Thesis**

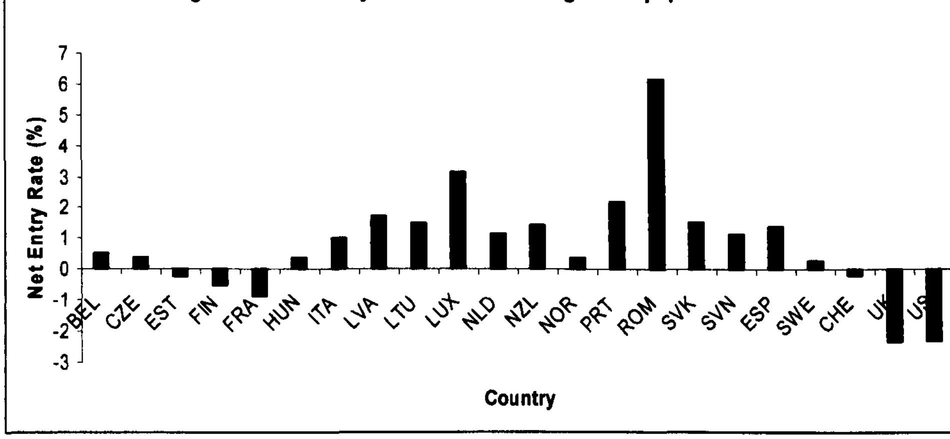
In this thesis we investigate the causes of entry and exit. In particular, we build on a recent strand of literature that deals with how globalisation affects entry and exit. For example, import competition from low-wage countries (Bernard, Jensen and Schott, 2006), trade liberalisation (Pavcnik, 2002), foreign direct investment (Yeaple, 2003) and intra-industry trade (Greenaway, Gullstrand and Kneller, 2008) have been found to raise the probability that a plant will exit. Quantitative evidence on the role of these factors in determining entry is more limited but exporting opportunities (Melitz, 2003) and profits accruing from foreign direct investment (Helpman, Melitz and Yeaple, 2004) are central to stimulating entry in recent theoretical models. However, it is not necessarily apparent that the same factors that cause plants to die will simultaneously foster entry. We build on this literature by considering how globalisation affects entry and exit. We consider three aspects of this broader question: the role of globalisation in causing exit in a cross-country setting, the death of large multinational plants and the role of trade costs in shaping export decisions.

The literature on globalisation and firm performance has generated a raft of stylised facts that have been shown to be robust in myriad countries (for a review see Greenaway and Kneller, 2007), but their reliance upon country-specific microdatasets is not without limitations.[6] The World Bank's Doing Business (2010) report shows clear differences between countries in terms of starting and closing a business. The evidence in Figure 1.1 confirms that policy environments are important and that they shape firm creation and survival: even in the same sector (machinery and

[6] Bartelsman, Haltiwanger and Scarpetta (2005) is an exception to this in that they use data on entry and exit rates from 2-digit sectors across 24 countries. However, their focus is primarily on the productivity effects of creative destruction and they do not use formal econometric techniques to explain the differences in entry and exit across countries and industries.

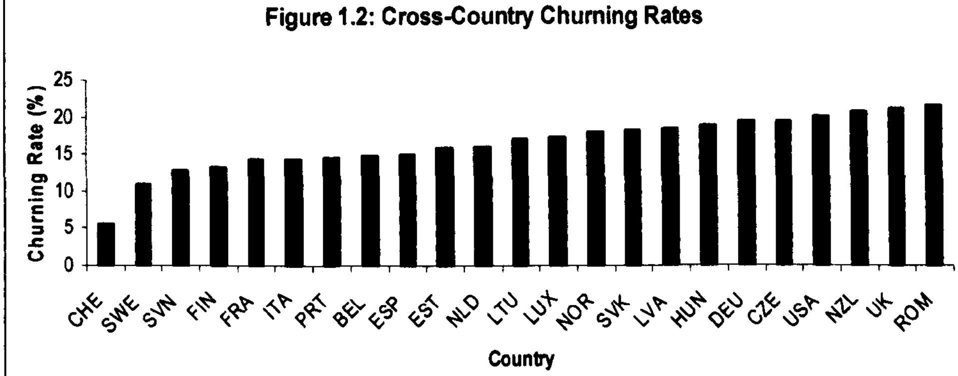
equipment) there are markedly different net entry rates across countries. In some countries the policy environment fosters more entry than exit. For others the opposite is true.

**Figure 1.1: Net Entry in the Manufacturing and Equipment Sector**




*Source*: OECD SBDS and Eurostat FEED Datasets.

**Figure 1.2: Cross-Country Churning Rates**

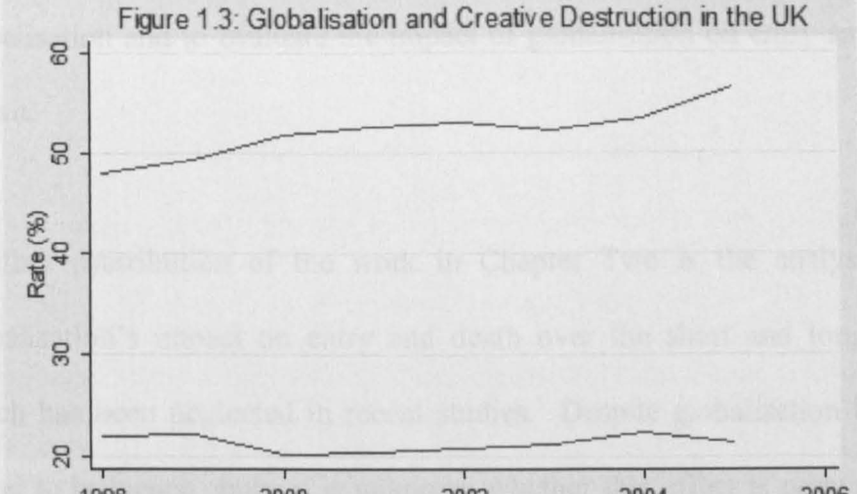



*Source*: OECD SBDS and Eurostat FEED Datasets.

Figure 1.2 shows that there is more churn in the Anglo-Saxon economies relative to Switzerland, Sweden and other continental countries from 'old' Europe. Understanding why this is the case is important. If creative destruction is so crucial in causing productivity improvements, how can the Swiss economy grow at similar rates as other Western countries despite having considerably lower entry and exit rates?[7]

Chapter Two considers the role of globalisation in causing entry and exit across countries and industries between the years 1995-2005. Specific measures of globalisation have been found to cause exit and are a fundamental source of entry in theoretical models such as Melitz (2003), Helpman et al. (2004) and Bernard et al. (2007). In light of this globalisation may be seen to speed up the process of creative destruction, cause reallocations of output and affect aggregate productivity by eliminating the weakest firms through increased competition while affording the best with commercial opportunities beyond the country's borders.

Figure 1.3: Globalisation and Creative Destruction in the UK



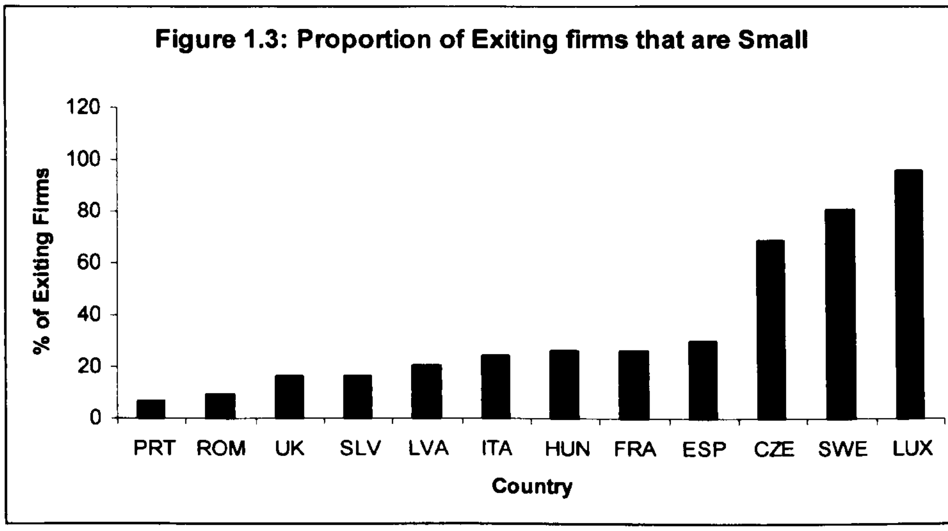

[7] The Swiss and Swedish economies tend to be open and consequently have a high share of exporters (80% of firms in Sweden according to Greenaway, Gullstrand and Kneller, 2008). Since these firms are consistently found to be less likely to exit the countries have a left truncation of their productivity distributions and lower rates of churn.

*Source*: Data on churning rates comes from the OECD SBDS and Eurostat FEED datasets. Openness is defined as the ratio of the sum of exports and imports relative to GDP. This data is taken from the Penn World Tables version 6.3.

Studies on firms and international trade have uncovered a profusion of stylised facts about how survival is related to exit. Characteristics of the plant, the firm it belongs to as well as the industry it operates in have been shown to be important determinants of survival. A key advantage of the dataset employed in Chapter Two is that the cross-country dimension allows us to investigate how the aforementioned country-specific factors influence entry and exit. Consequently factors such as the size of government as well as institutional factors are considered. It is also possible to measure the role of globalisation in each process and to test its importance relative to country characteristics. We are able to discern the effect of globalisation as a whole using the Harris (1954) measure of globalisation and to evaluate the impact of globalisation on entry as well as exit.

Another contribution of the work in Chapter Two is the analysis of globalisation's impact on entry and death over the short and long run which has been neglected in recent studies. Despite globalisation being found to influence churn it is unknown whether this effect is permanent. As shown in Figure 1.3 globalisation has increased through time but the rate of churn in the United Kingdom has remained within a narrow range. Most other measures show increased interdependencies and market integration between countries through time but entry and exit rates have remained fairly constant across countries. The chapter therefore sheds light on whether increases in competition as a result of more globalisation are temporary or sustained.

Typically the business landscape in most developed countries tends to be populated by small firms. Within the European Union Eurostat (2001) estimates that 93% of the 19,370,000 non-primary enterprises listed were classified as being 'small' (that is, they employ less than 50 workers). Only 38,000 were deemed to be 'large' (more than 250 employees) and a further 160,000 were recorded as employing between 50 and 249 persons. Similar figures are reported for the United States (Scarpetta, Hemmings, Tressel and Woo, 2002). Another striking fact is the pre-eminence of single-plant firms. In the United Kingdom approximately 95% of manufacturing firms are single-plant operations (Kneller, Riegler and Upward, forthcoming). The comparable figures for the tradable and non-tradable parts of the service sectors are 98.4% and 96%. However, the contribution single-plant firms make to aggregate output tends not to reflect their presence in the economy as a whole; for the UK the figure is reported to be 38%. For the United States Dunne et al. (1988) report figures that are more skewed towards multi-plant firms with these accounting for 85% of manufacturing output in 1982 despite comprising 7.3% of the business population.




*Source*: Eurostat FEED Database for 2005

Figure 1.4 reveals that a significant population of exiting firms are 'small' (defined as having less than 5 employees). In some countries such as the Czech Republic, Sweden and Luxembourg this pattern is more apparent than in others such as the United Kingdom and France. However, most visible and possibly damaging in terms output, employment and productivity is the death of large plants. Chapter Three addresses what causes the death of large plants using Japanese microdata. This approach is necessary since we focus upon the reasons why organisational design affects plant exit within multi-plant firms.

We first investigate what causes the death of plants belonging to multi-plant firms that only have operations within Japan and multinationals. Exit in the Japanese context contrasts markedly with other countries in that most exiting plants are large. Japan represents a unique setting in that 49% of plants belong to a multi-plant firm. Their impact upon the economy is substantially greater than in other countries since they contribute 77% of total output and a similarly disproportionate share of employment. The size of plants is dramatically different compared with other countries. The average continuing plant employs 227 workers while the average entering and exiting plants have 150 and 132 workers respectively. The country is therefore heavily dependent on large plants and those belonging to multi-plant firms, 78% of which belong to multinationals. Multiplant ownership has frequently been found to raise the probability a plant will die (Bernard and Jensen, 2007; Bandick, 2007; Kimura and Kiyota, 2006) but although widely recognised the reasons for this effect are far from understood. Lieberman (1990), for example, shows that larger multiplant firms are more likely to close plants in declining industries. Alternatively large diversified firms may encounter fewer agency problems when deciding upon plant closure, making their plants less likely to survive relative to standalone plants (Harrigan, 1980; Baden-Fuller, 1989). Related to this is the idea that strategic interactions within multi-plant firms may be the source of the higher failure rates. Where a multi-plant firm expands output or cuts price to improve the profit of one of its plants, it generates a negative externality for the other plants within the group (Sutton, 1997).

In addition to this effect multinationals have been shown to be 'footloose' which raises the hazard rate further. They have often been perceived as having shallow roots in the host economy (Hood and Young, 1997); exemplified by their higher elasticity of demand for labour (Rodrik, 1997). The regularity of these findings has been impressive with results for

Sweden (Bandick, 2007), Japan (Kimura and Kiyota, 2006), Chile (Alvarez and Görg, 2005) and the United States (Bernard and Jensen, 2007) contributing to the idea of multinationals being 'footloose'. The loss of a large manufacturing plant has often been cited anecdotally as having an acute, localised impact associated with both deleterious economic and social consequences due to unemployment.

Creative destruction is often ascribed a positive role since it causes productivity growth. This plays a key role in recent theoretical models of international trade such as Melitz (2003) where increased globalisation leads to more competition and forces the exit of the least productive firms. Aggregate productivity increases as the output these firms produced is reallocated towards more productive firms. However, where plants exit within multi-plant firms creative destruction may not be welfare enhancing. For example, a firm may decide to shutdown a plant because it is relatively unproductive relative to other plants within the group but if it is productive relative to the industry aggregate productivity will fall. In light of the consequences on both productivity and employment in the wake of multinational plant closure we study why multinationals are 'footloose'. This contributes to the wider literature on globalisation which seeks to understand the role of multinationals in fostering productivity improvements and development.

The recent empirical literature has heavily emphasised the role of firm productivity in determining internalisation status. The arguments in favour of self-selection are most powerfully put by Bernard and Jensen (1999, 2004) whereby high productivity firms enter the export market because they are best equipped to cover the high fixed costs of entry. However, as shown by Mayer and Ottaviano (2007) there is a high degree of overlap between the productivity distributions of firms irrespective of their internationalisation status. A potential explanation for this discrepancy is that trade costs affect goods differently: some goods are more affected by trade costs than others.

In Chapter Four we investigate the role played by trade costs in shaping entry into foreign markets. Foreign firms are important since they introduce new ideas and products. The insights generated are fundamental to the broader question of creative destruction since export market opportunities have implications for entry and exit alike. Where bilateral trade costs are low firms can more easily enter export markets where they earn greater profits relative to selling in the domestic market (Melitz, 2003; Bernard et al., 2003; Helpman et al., 2004). This stirs up competition in the foreign market as incumbents there must now compete for market share with domestic rivals and foreign firms. However, the opportunity to export also has repercussions for churn in the domestic market. Exporting raises the expected profits of entry which attracts new firms into the industry which in turn generates exit (Meltiz, 2003).

Existing studies by Romalis (2004), Levchenko (2007) and Nunn (2007) have shown that countries with large 'traditional' endowments tend to specialise in producing goods that use them intensively. In Chapter Four we investigate whether trade costs can be viewed as an endowment in similar fashion. The analysis is conducted at the industry level owing to the predictions of theoretical models. The variation in trade costs across countries and trade cost intensity across industries is necessary since this provides variation in a way that would not be possible in a dataset confined to the domestic market. The work demonstrates that firm's entry into export markets may be affected by the both the trade cost endowment of the country as well as the trade cost intensity of the good it sells.

As noted previously, the creation and destruction of firms has productivity implications accounting for as much as 35% of aggregate productivity growth in the United States over a five year period (Bernard and Jensen, 2004). Chapter Five represents a departure from the previous chapters in that it looks at the consequences when the Schumpeterian process grinds to a halt. Japan's 'Lost Decade' constitutes a unique case study where this has taken place. The chapter attempts to answer several questions. In particular, the spotlight falls upon aggregate productivity growth; both in terms of the extent to which the low rates of entry and exit have contributed to this as well as whether productivity has been harmed by multinationals offshoring their best plants to low cost sites elsewhere. Given that we are able to utilise the large panel dataset covering the manufacturing sector, Japan's economic bedrock, described above in relation to Chapter Three, it is also possible to make inferences regarding the role of plant exit in causing and perpetuating other elements of the long recession such as employment falls. Multinationals have been cited by the media as being culpable for the economic malaise despite their importance in generating economic growth during the post-WW2 epoch. Hence, we pay attention to the role they have played with regards to plant death and employment during the crisis.

Generally, we find that globalisation causes entry and exit. However, upon further inspection the results are more nuanced. For example, market integration raises entry and survival prospects as well but only during the short run. Plants belonging to multinationals face higher hazard rates but when we analyse the process of closure within multi-plant multinational firms there is a residual effect of multinational ownership that insulates plants from death. Trade costs are found to affect entry into foreign markets but the effect is not uniform across firms: it depends upon the type of good the firm produces. We also find that the Schumpeterian process is influenced by institutional factors. For example, country-specific factors such as the size of government and macroeconomic stability are found to have a much greater effect on churn relative to globalisation. In other cases institutions serve to mitigate the effect of globalisation: keiretsu networks are part of the reason why import penetration does not affect plant closure in Japan as in other countries.

Finally, we conclude this thesis in Chapter Six which draws together the main results and insights. We also offer possible improvements to the methodologies and data as well as directions for future research.

### 1.1 Literature Review

#### 1.1.1 Theoretical Literature on Entry and Exit

Before we can fully explore the causes of churn we need to consider the determinants of entry. Standard neoclassical economic theory states that firms will enter a competitive industry in which positive profits act a signal for entry. The threat of competition drives firms in the industry to produce at the lowest point on their average cost curve, which then constrains long run profits to zero (Nicholson, 1989). This theory is based on the following assumptions:

a) Rational preferences by individuals and firms

b) Individuals choose to maximise utility and firms maximise profits

c) People act independently of one another and have all relevant information.

In the real world, these assumptions are not always realistic. For example, markets may be incomplete with missing or inaccurate information and/or there may be incentive problems. In addition, there may be increasing returns to scale, or natural monopoly conditions which favour one single firm to supply the market. In these circumstances, the assumption of a competitive equilibrium solution does not hold and perfect competition is unlikely to be reflective of the market structure. Given this, we have to consider theories that move beyond the simple perfectly competitive framework and consider firm behaviour under imperfect conditions.

Taking a macroeconomic perspective, Aghion and Howitt (1992) and Romer (1990) develop models of creative destruction that consider technological progress directly affecting economic growth. Aghion and Howitt (1992) show that monopoly profits motivate businesses to innovate (and make improvements in product quality) but this causes obsolescence of existing goods. Churn in the sense of creative destruction is then related to the amount of research and development (R&D) that is undertaken. 'Too much' R&D can be a deterrent to new firm entry because monopoly profits are lost too quickly. This balance may be affected by government policy towards protecting intellectual property rights through patents, as these give firms a chance to earn profits from their innovations before the patent expires.

Progress in research and development may be associated with higher demand for skilled labour and higher wages demanded by workers. This will reduce the profits derived from innovation and reduce the likelihood of businesses carrying out innovation. Where research projects are a choice between current costs and future benefits, the level of innovation will be sensitive to the interest rate (Romer 1990). Therefore, the macroeconomic environment directly affects the propensity for businesses to innovate, and will also affect the level of churn observed.

Consideration also needs to be given to business churn at the industry level. Churn is substantially determined by product life cycle factors. Mature, traditional manufacturing industries have seen substantial contraction and downsizing in recent years, at the same time as major growth in the service sector. Thus we can see the importance of taking an industry perspective in the analysis of churn and its impact.

A model of the relationship between (monopolistic) competition and product diversity developed by Dixit and Stiglitz (1977) identifies the difference between market competitive solutions and socially optimum solutions. Innovation takes the form of diversifying products; firms create new ideas within an industry that reduce the profits of existing firms with old ideas (following Schumpeter, 1943). The model recognises that there is a trade-off between quantity and diversity, combining the benefits of scale economies (larger quantities of fewer goods) with the demand for variety of products which increases consumers' welfare. The competitive solution will be based on the profit criterion while achieving the socially optimal requires maximizing consumer welfare.

Asplund and Nocke (2002) suggest that industry-specific characteristics (such as sunk costs and market size) offer causal explanations as to why some industries have higher firm turnover than others.[8] Firm profits are dependent on market size, cost and their relative position in the industry distribution of costs. Entry decreases with the existence of sunk costs so

[8] This has shown to be the case empirically for Taiwan and Korea by Aw, Chung and Roberts (2002).

that once a firm has entered a market it will choose to remain if the value of investing for another period is greater than zero. Sunk costs are costs that are irrecoverable after entry such as specialised assets that have no alternative economic use. An increase in market size results in higher sales and profits for firms, but when associated with a wide distribution of firms, the least efficient firms (or those with highest costs) will have lower price cost margins and will exit.

The level of concentration in an industry is also thought to have significant bearing on entry and exit decisions. Amel and Liang (1992) suggest that market structure and concentration have an ambiguous effect on firm's decision to enter. This is because concentration will have a positive effect on new entry if high market concentration results in high observable profits, making the market look relatively attractive. On the other hand, a negative effect may be seen so that market concentration is accompanied by collusive behaviour of the incumbents which restricts new entry. If firm entry is declining with market concentration, this may indicate the existence of implicit barriers to entry and anti-competitive behaviour by the incumbent firms.

When considering entry and exit at the industry level, the behaviour of existing firms in the market is crucial to the impact churn has on aggregate indicators such as employment and productivity growth. Incumbents are affected by new entry through an immediate effect on profits and also by long run adjustments in firm behaviour and strategy in response to the increased competition (Hines 1957).

Turning to firm level models of entry and exit, Jovanovic (1982) made an early contribution to the literature on firm entry and learning processes through his *passive* or *learning by doing* model. Jovanovic puts forward a model of 'noisy selection' where firms enter with incomplete information about their efficiency and learn about their potential profitability from realised profits. Uncertainty is recognised as occurring at the individual level but not at the aggregate level. That is, all firms know output prices and the equilibrium product price but not their own productivity capabilities and cost functions. In this model, firms fail when they are not efficient enough to maintain positive profits. Within an industry, firms differ in size because some are more efficient than others. The Jovanovic model predicts that firm size and concentration are positively related to rates of return and that the correlation over time of rates of return is higher for larger firms and in concentrated industries.

Developing from the Jovanovic model, Ericsson and Pakes (1995) put forward the *active learning model*, whereby the firm explores actively the economic environment and makes investment decisions to increase its capability to earn profits under competitive pressure from both within and outside an industry. A firm's potential and actual profitability changes over time in response to unpredictable outcomes generated by the firm's own investment and those of other firms in the market. Firms will grow if they are successful but will shrink and/or exit if unsuccessful.

In these firm-level models of learning (Jovanovic 1982; Ericsson and Pakes 1995), exit rates are related to the age of the firm. Young firms are less familiar with their attributes and capabilities, and so it is more likely that learning about the cost structure will induce exit. Hazard rates, which calculate the probability of exit, will be lower for older and larger firms (Hopenhayn 1992). These selection models predict that the size and the age of a plant will determine the failure and growth rate distribution. In these models, firms are assumed to be single plant establishments and the relationship between survival and size or age may be different for already established firms seeking to diversify. Firms can however benefit from experiences in other establishments or other lines of products, and do not have to rely completely on learning from the market (Disney, Haskel and Heden 2003b).

Following the empirical insights of Bernard and Jensen (1995) there has been a proliferation of theoretical models that have built upon the existing literature on firm entry and exit. However, the departure between these models and those outlined above is that they incorporate measures of globalisation. The framework in Melitz (2003) and Bernard et al. (2003) rely heavily upon the monopolistic trade model of Krugman (1979) but incorporate the idea of firm heterogeneity which has been prevalent in industrial organisation circles (see for example Hopenhayn, 1992). The insights produced by these models have aligned many of the stylised facts generated by recent empirical investigations. Exporting raises the expected profits of entry but also intensifies competition within the industry and makes survival more difficult. Extensions of the models have shown similar effects for other forms of globalisation such as foreign direct investment (Helpman, Melitz and Yeaple, 2004).

### 1.1.2 Empirical Literature on Entry and Exit

Extensive empirical research on entry and exit has blossomed since the late 1980s. This is chiefly due to the emergence of large microdatasets and advancements in computing technology. In this short time span however the literature has grown and produced many stylised facts which have been shown to hold regardless of the country context.

The plants and firms found to be most vulnerable to exit tend to be small (Dunne, Roberts and Samuelson, 1989a; Schwalbach, 1991; Disney, Haskel and Heden, 2003b; Bartelsman, Haltiwanger and Scarpetta, 2005; Mata, Portugal and Guimaraes, 1995), old (Dunne, Roberts and Samuelson, 1989a) and have low productivity (Foster, Haltiwanger and Krizan, 2002). As predicted by theoretical models sunk costs are also found to exert a key influence. Kessides (1991) shows that sunk costs stifle competition as entrants are less able to challenge incumbents. In a more rigorous study Aw, Chung and Roberts (2002) examine how sunk costs influence the productivity distribution of an industry. They find that

Korean manufacturing sectors typically have higher entry barriers relative to Taiwan. Consequently incumbents are subjected to less intense competition and there is greater variance in Korean productivity than in Taiwan.

It has also been recognised that in addition to plant characteristics, the ownership structure of the firm that plant belongs to affects plant survival. Multiplant ownership has been found to affect the probability of plant death (Bernard and Jensen, 2007; Bernard and Wagner, 2001). The reasons behind the ownership effect are far from understood. Lieberman (1990), for example, shows that larger multiplant firms are more likely to close plants in declining industries. Alternatively large diversified firms may encounter fewer agency problems when deciding upon plant closure, making their plants less likely to survive relative to standalone plants (Harrigan, 1980; Baden-Fuller, 1989). Related to this is the idea that strategic interactions within multi-plant firms may be the source of the higher failure rates. Where multi-plant firms expand output or cuts price to improve the profit of one of its plants, it generates a negative externality for the other plants within the group (Sutton, 1997).

Recently there has been an explosion of research on entry and exit related to international trade. As with the previous revolution in international trade this was prompted by empirical insights. Bernard and Jensen (1995) drew attention to the fact that contrary to existing models of international trade there were clear differences between exporters and non-exporting firms. A wave of studies have attempted to discern whether internationalisation status affects firm and plant survival as well as what determines entry and exit into export markets.

Exporting has been found to lower the probability that a firm will die (for a review see Greenaway and Kneller, 2007). This is attributed to exporting firms being, on average, more productive relative to non-exporters. Similar evidence has accrued which shows firms that undertake foreign direct investment are also less vulnerable to death. However, while there is a clear ordering of productivity according to internationalisation status there is a high degree of overlap of the productivity distributions of domestic-only firms, exporters and those engaging in foreign direct investment (Mayer and Ottaviano, 2007). This indicates that internationalisation status may be capturing unobservable factors such as managerial quality or that there are firm-specific exporting sunk costs.

Enquiries have also been made into how other measures of globalisation affect firm survival. The firm's import status for example has been found to act in a similar manner to exporting status (Castellani, Serti and Tomasi, 2008; Muuls and Pisu, 2009). However, more attention has been focussed on various aspects of globalisation. Generally integration has been shown to raise the probability of failure since it generates more competition with trade liberalisation (Pavcnik, 2002), low-wage imports (Bernard, Jensen and Schott, 2006) and intra-industry trade (Greenaway, Gullstrand and Kneller, 2008) found to raise hazard rates. Multinational ownership has also been shown to affect plant death. Numerous reasons for this effect have been proposed but most centre upon the idea that multinational firms have shallow roots in the host economy and are willing to relocate production elsewhere should the costs of production be lower (Hood and Young, 1997). Taxation has been proposed by Devereux and Griffith (1998) as a possible explanation of multinationals' location decisions.

Overall the literature has established many stylised facts. Exiting plants tend to be small and generally have low productivity relative to incumbent firms. Ownership has also been shown to affect survival though there is a lack of consensus on the direction of the effect with respect to multiplant ownership. On the other hand firms that are engaged in foreign markets tend to have a lower likelihood of exit which in part reflects their productivity advantages that enable them to enter these markets. Finally globalisation has been identified as raising the hazard rate a plant or firm faces through increasing competition for market share

# Chapter Two

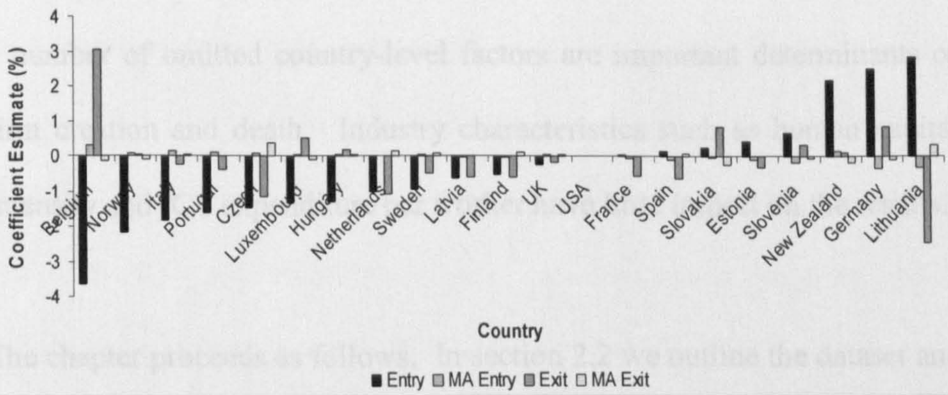
# Entrepreneurship Dynamics, Market Size and Country-Specific Factors

## 2.1 Introduction

Recent theoretical models of heterogenous firms and international trade such as Melitz (2003) and Bernard, Redding and Schott (2007) make predictions about how trade liberalisation affects firm entry and survival. Empirical evidence has frequently shown myriad measures of globalisation to reduce the probability that a firm will survive. For example, Bernard, Jensen and Schott (2006) find that imports from low-wage countries raise the probability that a U.S. manufacturing plant will die. Similar results are found for Sweden by Greenaway, Gullstrand and Kneller (2008) using aggregate imports. Other forms of globalisation such as trade liberalisation (Pavcnik, 2002), foreign direct investment (Yeaple, 2003) and intra-industry trade (Greenaway, Kneller and Gullstrand, 2008) have also been shown to impact upon survival.

A feature of existing studies has been the use of country-specific datasets. However, the World Bank's doing business report shows clear differences in the ease of opening and closing a business according to where it is located. The evidence in Figure 2.1 illustrates the profound impact that policy environments may have on entry and exit rates. For example, the policy environments in New Zealand, Germany and Lithuania foster approximately 3% more entry relative to the U.S. while firms located in Belgium are 3% more vulnerable to death. The figure also shows that globalisation (measured as market access) appears to play a muted role relative to country-specific factors.

**Figure 2.1: The Role of Policy and Market Access in Entry and Exit Rates**




*Notes*: Entry and exit are calculated as the coefficient on the country dummy in Table 2.4. MA entry and MA exit refer to the coefficient estimate on the interaction between market access and the country dummies in Table 2.4. All coefficient estimates are measured relative to the United States.

Using a unique dataset that draws observations from 29 industries across 21 OECD countries this chapter addresses the extent to which globalisation influences the process of creative destruction. In contrast to previous studies we construct a measure that captures both the opportunities and threats of globalisation. We find that globalisation has a positive effect on net entry rates but only in the short run. Moreover, the effect is small and confined to service sectors. However, industries with a comparative advantage in exporting and the production of value added goods have significantly higher net entry rates.

When country-specific variables are included in the model we find that government intervention reduces the incentive to enter and makes it more difficult for incumbents to survive. Sound monetary policy is found to cause net entry by providing entrepreneurs with stable economic environments to form profit expectations. Despite the inclusion of such broad measures, the country fixed effects remain large which suggests that a number of omitted country-level factors are important determinants of firm creation and death. Industry characteristics such as human capital intensity and ICT expenditure per worker have little impact on the results.

The chapter proceeds as follows. In section 2.2 we outline the dataset and present descriptive statistics on the rate of churn across countries and industries. Section 2.3 provides formal econometric analysis on the role of globalisation in affecting entry and exit rates, the source through which this is mitigated and the extent to which globalisation influences different sectors and countries. Section 2.4 considers how country factors affect entry and exit rates and Section 2.5 addresses industry characteristics. Conclusions are drawn in Section 2.6.

## 2.2 Data Description

Two separate cross-country, cross-industry and cross-time datasets have been used to construct measures of churning[9]: the OECD Structural and Demographic Business Statistics Database (SDBS) and the Eurostat Firm Entry and Exit Data Dimensions dataset (FEED). We have information on entry and exit rates for 21 countries across both manufacturing and service sectors. Studies of firm entry and exit customarily focus on a single country. Colantone and Sleuwaegen (2008) represents a departure from this in that they address entry and exit in nine European Union countries. In contrast to that study we include both manufacturing and service sectors for a wider range of countries, use a measure of globalisation that incorporates outward and inward components and use an econometric framework that includes both short- and long-run components.

A list of the countries and years during which they are present in each of the datasets is provided in Table 2.1. Observations are also separated according to whether entry and exit data is available for both manufacturing and services. Across the datasets all countries are listed as having data for the manufacturing sector and 17 for services. In the manufacturing sector 12 have information in each of the main datasets while for service industries, 17 countries have data available for the SBDS.

[9] Churning is defined as the sum of the entry and exit rates.

The time spans during which churning data is available differs substantially by country. For example, there are only two years of Belgian data are available in SDBS (1998 & 1999) and New Zealand only appears for 2002 in both datasets. In contrast Spain, Sweden and the United Kingdom are present between 1998 and 2005 in both datasets and the United States features from 1995 until 2004. We pool the data across the datasets to provide the longest possible time series and to maximise the country and sectoral coverage. This appears possible for the SDBS and Eurostat FEED datasets since the correlation between entry and exit in the two is 99.92 percent. Combining the data means we can extend the coverage to 21 countries and include the service sector.

Table 2.1: Countries in the Data Sets

| Country/Data set | Manufacturing OECD SDBS | Manufacturing E.Stat FEED | Services OECD SDBS | Services E.Stat FEED |
|---|---|---|---|---|
| Belgium | 98-99 | | 98-99 | |
| Czech Republic | 01- | 01- | 01- | |
| Estonia | | 00-05 | | |
| Finland | 98-04 | 98-04 | 98-04 | |
| France | 03- | 03- | 03- | |
| Germany | 00-02 | | | |
| Hungary | 00-04 | 00-05 | 00-04 | |
| Italy | 98-04 | 98-05 | 98-04 | |
| Latvia | | 00-05 | | |
| Lithuania | | 00-02 | | |
| Luxembourg | 98-04 | 98-04 | 98-04 | |
| Netherlands | 00-04 | 99-04 | 00-04 | |
| New Zealand | 02- | | 02- | |
| Norway | 99-01 | | 99-01 | |
| Portugal | 98-04 | 98-05 | 98-04 | |
| Slovakia | 00-04 | 00-04 | 00-04 | |
| Slovenia | 00-04 | 00-05 | 00-04 | |
| Spain | 98-05 | 98-05 | 98-05 | |
| Sweden | 98-05 | 98-05 | 98-05 | |
| United Kingdom | 98-05 | 98-05 | 98-05 | |
| United States | 95-04 | | 95-04 | |

### 2.2.1 Summary Statistics – Churning Rates

Figure 2.2: Average Churning Rates Across Countries

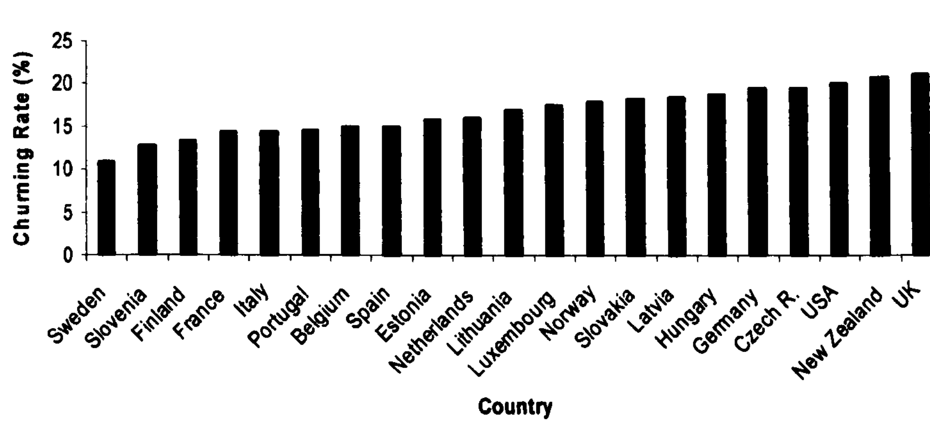



Figure 2.2 displays information on the average rate of churn for countries in the merged dataset. Although there are differences in churning across

industries and years there is a clear country dimension. The churning rates lie in the range 11.02% (Sweden) to 21.23% (United Kingdom). To provide some perspective on these figures, assuming equal balance between entry and exit, at a rate of churn of 11 per cent per annum it would take 6.3 years before half of an initial stock of firms would have exited the market (the remainder of the industry being made up of new firms that replaced them). At a rate of churn of 21.23 per cent the half-life of the initial cohort of firms is just over 3 years. The opportunities and threats of entrepreneurship differ markedly across countries with some offering better survival prospects than others.

A pattern in the country churning rates is that the transition economies from Central and Easter Europe tend to have higher rates of churn than established OECD members. In Figure 2.2 the Czech Republic, Hungary and Latvia feature among the group of countries with the highest churning rates though they are notably lower than the Anglo-Saxon economies. A possible explanation for this is that countries which have been engaged in world markets for longer have already undergone a period of. Those with the lowest include Sweden and Slovenia. A potential explanation for why small, open integrated economies such as these have lower churning rates is that their productivity distributions are left truncated.[10] Under these circumstances a high percentage of firms export. The survival rate of exporting firms has been shown to be higher than for non-exporters

[10] According to the Penn World Tables version 6.3 for 2005 openness in theses countries (defined as the sum of exports and imports divided by GDP) 126.63 (Slovenia) and 89.73 (Sweden).

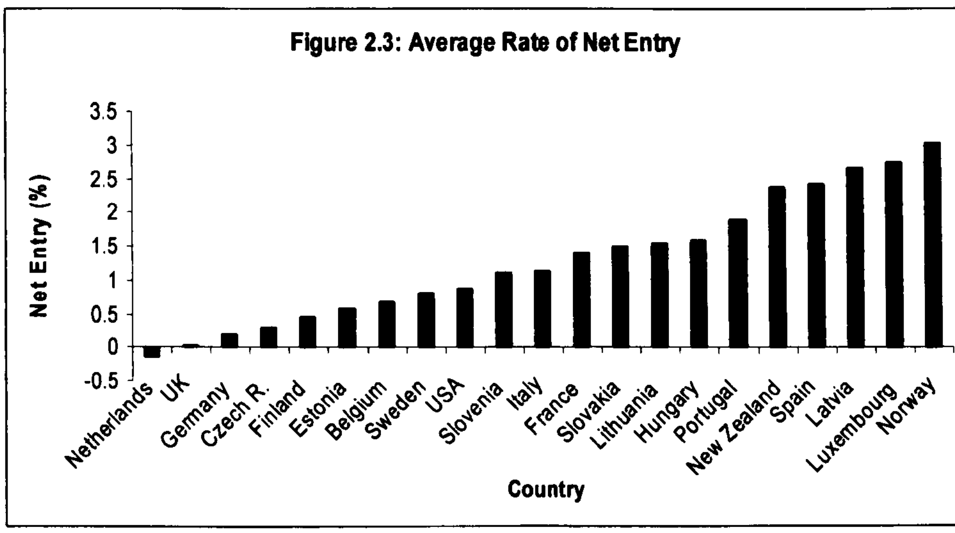
meaning that churning rates will be lower in such countries (Bernard and Jensen, 1997; Wagner, 2005). Given the size advantage of exporters this may lead to a lower industry-level churn rate because they gain a first mover advantage in response to market opportunities similar to what Appelbaoum and Katz (1996) describe in oligopolistic sectors. This is considerably different to what Melitz (2003) would predict. In that model industry-level rates of churning would not change following an increase in market size (through access to foreign markets) because the probability of exiting is exogenous. However, as the empirical literature has demonstrated the probability of exit is shaped to a large degree by firm characteristics (Dunn et al., 1988). Recent evidence shows that exporters are significantly less susceptible to exit meaning that where self-selection into export markets occurs the reduction in trade costs in Melitz (2003) could lead to a lower rate of churn due to a greater share of exporting firms within the industry.

The country churning rates mask substantial variation across industries within the country. For example, an Italian industry has a churning rate of 1.28 percent while the highest, at 57 percent, comes from Latvia. These are equivalent to half-lives of 108 and 2.4 years for the initial stock of firms. In Table 2.2 we present data on the average rate of churn according to country and broad 2-digit sector definitions. A general observation would be that for all countries for which manufacturing and service sector data is available, churning rates are higher for services. A t-test of the mean manufacturing and service sector rates of churn confirms this with services having significantly higher values.

Table 2.2: Average Rate of Churn by Country - Manufacturing and Service Sectors

| Country/Sector | Manufacturing | Services |
|---|---|---|
| Belgium | 10.57 | 17.63 |
| Czech Republic | 16.82 | 21.49 |
| Estonia | 15.95 | |
| Finland | 10.69 | 15.12 |
| France | 11.08 | 17.18 |
| Germany | 14.77 | 24.22 |
| Hungary | 14.51 | 22.99 |
| Italy | 11.15 | 17.25 |
| Latvia | 18.48 | |
| Lithuania | 17.06 | |
| Luxembourg | 10.58 | 21.92 |
| Netherlands | 11.75 | 19.74 |
| New Zealand | 14.52 | 25.09 |
| Norway | 12.09 | 21.92 |
| Portugal | 13.2 | 15.91 |
| Slovakia | 15.94 | 19.87 |
| Slovenia | 9.65 | 15.52 |
| Spain | 12.55 | 16.9 |
| Sweden | 9.29 | 12.22 |
| UK | 18.19 | 23.37 |
| US | 17.82 | 22.16 |

In some countries the gap in churning rates between manufacturing and services is pronounced. The largest is for New Zealand where the gap is 10.57 percent per annum. This implies a half-life of 4.77 years for manufacturing firms compared with 2.76 years in services within New Zealand. Portugal records the smallest difference with an annual gap of 2.71 percent. The manufacturing sector is often perceived to be more exposed to global competition with imports often being found to decrease the probability of survival (see Bernard, Jensen and Schott, 2006; Greenaway, Gullstrand and Kneller, 2008) while exporting opportunities provide entry incentives. However, the differences in churning rates reflect differences in the sunk costs of entry. Despite lacking formal evidence these are generally believed to be lower in services than for manufacturing industries making it easier for prospective entrants to participate in the market. Consequently there is a higher degree of competition as a greater number of firms compete for market share. As each firm's share of the market falls survival becomes more difficult and exit rates increase.




A second fact that emerges is that most countries have consistently higher levels of net entry (defined as gross entry minus gross exit). Melitz (2003) predicts that entry and exit should offset one another in the steady state. However, with the exception of the Netherlands, all countries in the dataset record varying degrees of net entry. In some instances such as the UK and Germany this is marginal but twelve countries have net entry rates exceeding 1 percent per annum. The highest rate of net entry is 3.05 percent per annum for Norway. A potential explanation of the persistently positive net entry rates is that these countries have witnessed increasing market size, either domestically or abroad, or that they have been subject to similar business cycle conditions.

Contrary to the predictions of models such as Melitz and Ottaviano (2008) market size (measured using GDP) appears to have little influence on churning rates. That paper predicts that larger markets attract more entry and subsequently have higher exit rates. However, despite being of roughly similar size the United Kingdom and France have substantially different churning rates. The United Kingdom also has a similar rate of churn despite being smaller and less wealthy than the United States. Similar discrepancies are borne out in Table 2.3 with New Zealand recording an almost identical rate of churn with the United States in spite of its market size being several orders of magnitude smaller. In later sections we investigate the role of country-specific factors in shaping churning rates.

Table 2.3: Market Size and the Average Rate of Churn

| | Churning | GDP |
|---|---|---|
| Estonia | 15.95 | 21.06 |
| Latvia | 18.48 | 27.75 |
| Luxembourg | 17.46 | 33.37 |
| Lithuania | 17.06 | 44.87 |
| Slovenia | 12.83 | 45.96 |
| Slovakia | 18.25 | 80.03 |
| New Zealand | 20.72 | 99.39 |
| Hungary | 13.29 | 155.46 |
| Finland | 18.8 | 162.28 |
| Norway | 19.56 | 198.89 |
| Czech Republic | 14.68 | 206.69 |
| Portugal | 17.91 | 209.88 |
| Sweden | 11.02 | 275.97 |
| Belgium | 14.93 | 329.07 |
| Netherlands | 16.08 | 535.51 |
| Spain | 15.04 | 1175.97 |
| Italy | 14.5 | 1614.97 |
| UK | 14.36 | 1810.55 |
| France | 21.23 | 1829.91 |
| Germany | 19.49 | 2435.66 |
| US | 20.14 | 12376.2 |

*Note*: GDP data comes from Penn World Tables 6.3 and is defined as billions of U.S. dollars in 2005 prices.

**Figure 2.4: Churning Rates across Industries**

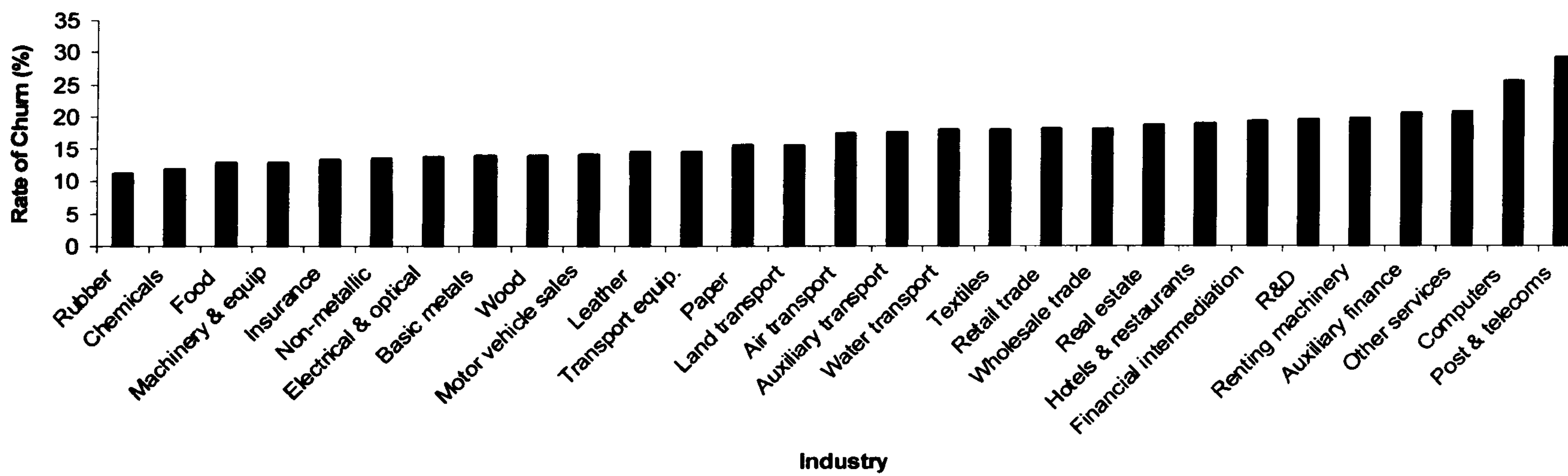
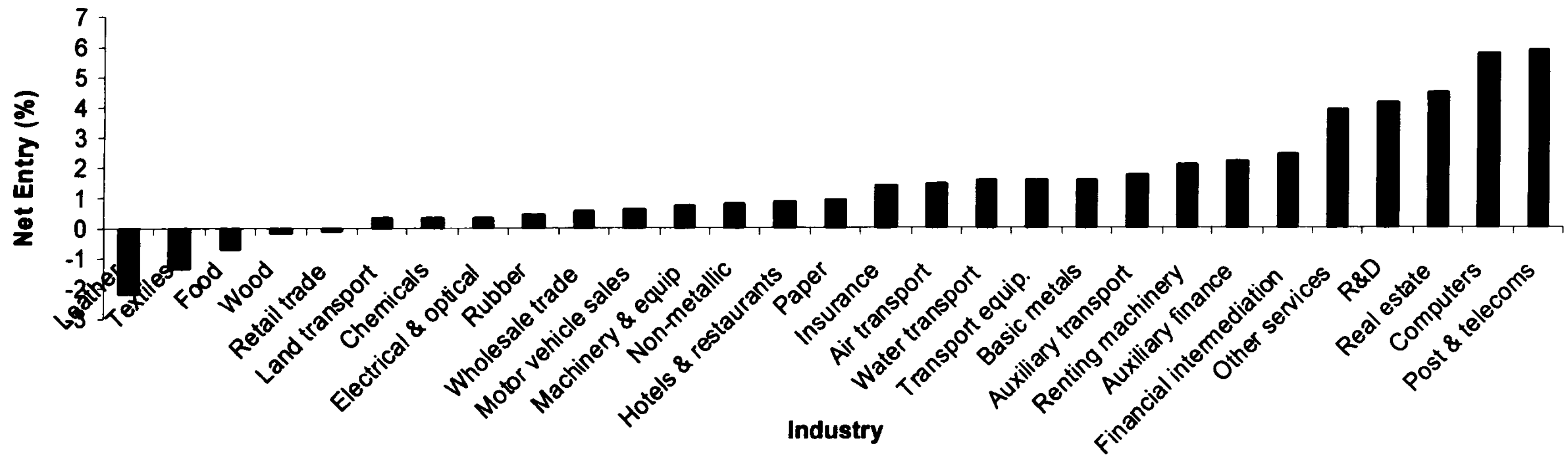


**Figure 2.5: Average Rate of Net Entry across Industries**



Earlier we highlighted differences between churning rates in broadly defined manufacturing and service sectors. In Figures 2.4 and 2.5 we present evidence on the rate of churn and net entry in each 2-digit industry in the dataset. There are clear differences between entry and exit in each sector with churning ranging between 11.3 percent per annum in the paper industry to 29.4 percent for post and telecommunications. Another observation would be that service sectors dominate the upper end of the distribution. From Figure 2.5 we can see that this is due to net entry. Manufacturing sectors record significantly lower rates of churn with leather, textiles, wood and the food industry experiencing net exit. Anecdotal evidence suggests that competition from low-wage countries has played a large role in causing these declines, particularly for leather and textile sectors. The only service sector that records net exit is retail though the annual rate of net exit is low at 0.11 percent.

### 2.3 Regression Results

In this section we develop the analysis to control for a range of entrepreneurial determinants. To reflect the possibility that these determinants may have different effects in the short and long run we specify the regression equation to allow for this. Specifically we estimate an error correction model of the following form

$$\Delta y_{ijt} = \alpha + \beta_1 y_{ijt-1} + \beta_2 x_{ijt-1} + \beta_3 \Delta x_{ijt} + \varphi_i + \varphi_j + \varphi_t + u_{ijt}, \qquad (2.1)$$

where $y_{ijt}$ is the rate of entry (exit) in industry $i$ of country $j$ at time $t$, $x_{ijt}$ represents a vector of explanatory variables and $u_{ijt}$ is a random error term. The long run effects are given by the parameter vector $\beta_2$ while $\beta_3$ captures short run effects. To control for time invariant country and industry factors we include country and industry fixed effects denoted by $\varphi_i$ and $\varphi_j$. We control for business cycle effects that are common to all industries through time fixed effects denoted $\varphi_t$. The use of an error correction model is also valid given that Melitz and Ottaviano (2008) argue for different effects in the short and long run.

One of the central assumptions underlying theoretical models such as Melitz (2003), and Bernard, Redding and Schott (2007) is that in the steady-state entry and exit rates move together. To test for this we estimate equation (2.1) for entry controlling for lagged exit. To test the hypothesis we then test whether the long run parameter on exit $(\beta_2/1-\beta_1)$ is equal to 1. The coefficient estimates in regression 1 of Table 2.4 (below) show the long run parameter to be 0.12. An F-test decisively rejects the hypothesis that this is equal to 1 [F(1, 2272) = 555.84, p-value=0.00].[11] The main implication of this result is that entry and exit rates are not equal over the long run. Rather, as the descriptive statistics show, there is net entry which may arise through increases in market size. Consequently, regressions using churning rates, as suggested by

[11] We reach a similar conclusion when exit is used as the dependent variable. In that case the test statistic is 1018.06 (p-value = 0.00).

theoretical models, would be inappropriate and we report regressions of entry and exit alongside those of net entry to ascertain long-run effects.

### 2.3.1 Market Access, Entry and Exit

The key variable of interest in our regressions is market access. This is measured following Harris (1954). This yields a measure of market size which weights the sum of domestic and foreign market size where the distance between the countries provides the weights. Large countries, or those situated in close proximity to large markets, have a greater number of consumers to sell their goods too. However, they also offer better survival prospects to foreign competitor firms. Market access therefore captures both the opportunities and threats globalisation offers. According to this measure Belgium and the Netherlands rank as the countries with access to the largest markets due to their proximity with considerably larger economies while New Zealand is the least.

Results for the baseline regressions of entry, exit and net entry are reported in Table 2.4. Market access is found to only affect these over the short run. A one standard deviation increase in market access is found to cause a 0.64 percentage point increase in entry and a 0.16 percentage point decline in the exit rate. These results resemble those found elsewhere in the theoretical literature: improved access to foreign markets raise expected profits and cause entry (Melitz, 2003; Bernard et al., 2003; Melitz and Ottaviano, 2008). Globalisation is also found to ameliorate the likelihood of death, at least in the short-run. The empirical literature has frequently found that measures of globalisation such as import penetration (Bernard, Jensen and Schott, 2006), intra-industry trade (Greenaway, Gullstrand and Kneller, 2008) and trade liberalisation (Pavcnik, 2002) raise the probability that a plant or firm will die. A possible explanation for the differences between those and our findings is that traditional globalisation measures predominantly capture the threats of foreign competition while our market access measure also incorporates exporting opportunities. In regression 3 we constrain the model to investigate net entry. This allows us to study the long-run predictions of theoretical models of heterogenous firms in international trade.

Although a positive and significant correlation is found between market access and net entry over short-run horizons there is no effect in the long run. This confirms what theory predicts: in the steady state entry and exit are equal. Indeed this result is not entirely surprising. Anecdotal evidence, and most measures of globalisation, suggests that market integration has been increasing through time while entry and exit rates however have remained fairly constant. In regressions 4 to 6 of Table 2.4 we consider how import penetration and intra-industry trade, traditional measures of globalisation, perform relative to our market access variable. Owing to data limitations we are forced to use a considerably smaller dataset but in no instance do we find a significant correlation between these and the dependent variables.

Table 2.4: Base Regressions for Entrepreneurship and Globalisation

| Indicator | 1<br>Entry | 2<br>Exit | 3<br>Net Entry | 4<br>Entry | 5<br>Exit | 6<br>Net Entry |
|---|---|---|---|---|---|---|
| Long run effect of Market Access | .26<br>(1.40) | .12<br>(.88) | .11<br>(1.08) | | | |
| Short run effect of Market Access | 3.84**<br>(2.45) | -2.75**<br>(-2.08) | .07***<br>(2.85) | | | |
| Long run effect of Import Penetration | | | | .00<br>(.01) | .00<br>(.24) | -.00<br>(-.17) |
| Short run effect of Import Penetration | | | | .00<br>(.42) | -.01<br>(-1.22) | .01<br>(1.09) |
| Long run effect of Intra-Industry Trade | | | | .00<br>(.32) | .00<br>(.32) | .00<br>(.02) |
| Short run effect of Intra-Industry Trade | | | | -.01<br>(-.60) | -.02<br>(-1.16) | .01<br>(.39) |
| Lagged entry | -.50***<br>(-8.91) | .31***<br>(8.94) | | -.26***<br>(-3.79) | .04<br>(.86) | |
| Lagged exit | .47***<br>(4.82) | -.44***<br>(-9.81) | | -.01<br>(-.14) | -.31***<br>(-6.20) | |
| Change in exit | .29***<br>(3.75) | | | .02<br>(.23) | | |
| Change in entry | | .14***<br>(5.16) | | | .02<br>(.22) | |
| Lagged net entry | | | -.68***<br>(-13.14) | | | -.29***<br>(-4.12) |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of Observations | 2382 | 2382 | 2334 | 523 | 523 | 523 |
| $R^2$ | .32 | .27 | .39 | .42 | .33 | 0.31 |

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively. Robust t-statistics reported in parentheses. All equations are estimated using OLS.

However, these effects are small, especially when one considers that the average entry and exit rates over the sample are 9.31% and 8.02% respectively. The standardised coefficient of 0.06 implies that raising market access by one standard deviation (equivalent to increasing it from the U.S. level (4.2) to the level in the Netherlands (6.0)) would have essentially no effect on the rate of entry. Indeed such large changes in market access are rare in the data. In fact the average increase in market access across the sample is approximately 8%. There are some notable instances such as Slovenia, Hungary, Portugal and Italy where market access does increase by a value close to one standard deviation.[12] In Table 2.5 we compute the implied change in entry and exit using the results in columns 1 and 2 of Table 2.4 and the observed change in each country's market access. The effects tend to be small with an average increase in the entry rate of 0.216 percentage points and a decrease of 0.194 percentage points for exit. Even for the most extreme case, Italy, the effect is small at 1.262 percentage points for entry and -1.13 for exit.

[12] The reason for the perceived decline in market access in the Netherlands is due to service sectors entering the sample in 2000. For the Netherlands these sectors are less globalised than Dutch manufacturing industries. When we look at the period 2000-04 market access increases by 0.024 percent of a standard deviation in the Netherlands implying a minute increase in entry and exit.

Table 2.5: Market Access through time and Implied Change in Churning

| Country | First Year | | Last Year | | Change in | Implied Change | Implied Change |
|---|---|---|---|---|---|---|---|
| | Year | MA | Year | MA | MA | in Entry | in Exit |
| Netherlands | 1999 | 7.224 | 2004 | 5.976 | -1.248 | -0.691 | 0.619 |
| New Zealand | 2002 | 1.897 | 2003 | 1.822 | -0.075 | -0.041 | 0.037 |
| Latvia | 2000 | 6.204 | 2005 | 6.146 | -0.058 | -0.032 | 0.029 |
| Estonia | 2001 | 6.311 | 2005 | 6.254 | -0.057 | -0.032 | 0.028 |
| Lithuania | 2000 | 6.179 | 2002 | 6.144 | -0.036 | -0.020 | 0.018 |
| Germany | 2003 | 5.891 | 2005 | 5.929 | 0.038 | 0.021 | -0.019 |
| Belgium | 1998 | 5.810 | 1999 | 5.868 | 0.059 | 0.033 | -0.029 |
| Czech Rep. | 2001 | 4.928 | 2004 | 4.990 | 0.062 | 0.034 | -0.031 |
| Slovakia | 2000 | 5.035 | 2004 | 5.102 | 0.067 | 0.037 | -0.033 |
| France | 2003 | 5.524 | 2005 | 5.632 | 0.108 | 0.060 | -0.054 |
| Sweden | 1998 | 4.385 | 2005 | 4.512 | 0.127 | 0.070 | -0.063 |
| Finland | 1998 | 4.147 | 2004 | 4.335 | 0.189 | 0.105 | -0.094 |
| UK | 1998 | 5.408 | 2005 | 5.618 | 0.210 | 0.116 | -0.104 |
| Luxembourg | 1998 | 5.635 | 2004 | 5.858 | 0.223 | 0.124 | -0.111 |
| Spain | 1998 | 4.516 | 2005 | 4.769 | 0.253 | 0.140 | -0.125 |
| Norway | 1999 | 3.951 | 2001 | 4.227 | 0.276 | 0.153 | -0.137 |
| US | 1995 | 4.035 | 2004 | 4.343 | 0.308 | 0.170 | -0.152 |
| Slovenia | 2004 | 4.783 | 2005 | 6.512 | 1.730 | 0.958 | -0.857 |
| Hungary | 2000 | 4.596 | 2005 | 6.399 | 1.804 | 0.999 | -0.894 |
| Portugal | 1998 | 4.232 | 2005 | 6.174 | 1.942 | 1.075 | -0.962 |
| Italy | 1998 | 4.357 | 2005 | 6.636 | 2.279 | 1.262 | -1.130 |
| *Average* | | *5.002* | | *5.393* | 0.390 | 0.216 | -0.194 |

*Note*: The figures reported for the implied changes in entry and exit are calculated using standardised coefficients from regressions 1 and 2 in Table 2.4. They therefore constitute percentage point estimates.

The literature on firm heterogeneity has shown that a firm's reaction to globalisation may depend on its source or nature (for a review of this literature see Greenaway and Kneller, 2007). For example, imports from low-wage countries are found to have a greater impact on firm death in the United States than imports from more developed countries (Bernard, Redding and Schott, 2006). Swedish firms are found to be more likely to switch industries when they are foreign owned (Greenaway, Gullstrand and Kneller, 2008). A key question then is how the source of access to markets affects firm entry and survival. For example, if export profits are relatively larger than those earned in domestic markets an increase in foreign market access may stimulate more entry. Equivalently where foreign firms are more productive than domestic rivals then increased competition from abroad may cause more exit than an equal increase in the domestic market. A unique feature of our globalisation measure is that it can be disaggregated into domestic and foreign components to assess whether the source of market access has differential effects. The data reveal that domestic market access has grown at an average annual rate of 4.1% compared with 2.3% for foreign market access over the sample.

We can then discern whether access to the foreign or domestic market underlie the results in Table 2.4. The results in Table 2.6 suggest that while access to foreign markets has grown more slowly, trading in these markets is more lucrative than selling domestically. In columns 2 and 3 a one standard deviation increase in foreign market access raises the short-run entry rate by 0.16 and 0.23 percentage points respectively. Conditional upon domestic market access, access to foreign markets has no effect on the exit rate. In none of the regressions do we find that domestic markets affect the birth or death of firms. The results suggest that the expected value of exporting is responsible for attracting entrants. However, the small magnitude of the effect may indicate that only the 'better' (or more productive) firms are drawn in since they are most likely to succeed in overcoming the fixed costs of internationalisation.

Table 2.6: Domestic and Foreign Market Access

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Sample | All | All | All | All | All | All |
| Indicator | Entry | Entry | Entry | Exit | Exit | Exit |
| Long run effect of | .07 | | .09 | -.00 | | -.05 |
| Domestic Market Access | (.58) | | (.67) | (-.02) | | (-.35) |
| Short run effect of | 1.04 | | .91 | .50 | | .54 |
| Domestic Market Access | (.88) | | (.75) | (.55) | | (.60) |
| Long run effect of | | .02 | -.14 | | .16 | .31 |
| Foreign Market Access | | (.08) | (-.52) | | (.92) | (1.38) |
| Short run effect of | | 2.85* | 4.00** | | -3.13** | -1.49 |
| Foreign Market Access | | (1.80) | (2.56) | | (-2.17) | (-1.17) |
| Lagged entry | -.46*** | -.50*** | -.47*** | .29*** | .31*** | .29*** |
| | (-7.23) | (-8.88) | (-7.27) | (7.87) | (8.99) | (7.88) |
| Lagged exit | .43*** | .47*** | .44*** | -.42*** | -.44*** | -.42*** |
| | (4.26) | (4.81) | (4.26) | (-8.61) | (-9.82) | (-8.62) |
| Change in entry | | | | .11*** | .14*** | .11*** |
| | | | | (3.42) | (5.16) | (3.45) |
| Change in exit | .23** | .29*** | .23** | | | |
| | (2.56) | (3.75) | (2.57) | | | |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of Observations | 2115 | 2382 | 2115 | 2115 | 2382 | 2115 |
| $R^2$ | .29 | .31 | .29 | .28 | .27 | .28 |

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively. Robust t-statistics reported in parentheses. All equations are estimated using OLS.

The raw data reveals that manufacturing industries are approximately twice as 'globalised' relative to services. To investigate the extent to which the source of competition drive the results in Table 2.6 we split market access into domestic and foreign components. The results reported in Appendix Table A2.1 point towards foreign market access tending to be more important in affecting entry and exit across the sectors. For services foreign market access is estimated to raise the exit rate by 1.68% over the long-run. However, during the short run foreign market access increases entry rates by 4.4% while the value for domestic market access is approximately half this. A potential explanation for this could be that the short-run effects are capturing the entry of domestic firms attracted by foreign market opportunities as well as entry by foreign competitors. Through time sorting occurs leading only the best firms to remain. During this period they capture market share from weaker competitors leading the latter to exit. In contrast opportunities in foreign markets lead to entry in manufacturing over both horizons but in each instance the results are only weakly significant.

We next test the robustness of the results to splitting the sample into manufacturing and service sectors and re-run the entry and exit regressions. We find that there is some sensitivity of the results across the sectors. For example, market access increases exit in manufacturing industries over the long run but no effect is found for service sectors. In the short run more globalisation causes more entry but fewer exits in services.

Table 2.7: Entry and Exit in Manfuacturing and Service Sectors

| Sample<br>Indicator | 1<br>Manufacturing<br>Entry | 2<br>Manufacturing<br>Exit | 3<br>Services<br>Entry | 4<br>Services<br>Exit | 5<br>Manufacturing<br>Net Entry | 6<br>Services<br>Net Entry |
|---|---|---|---|---|---|---|
| Long run effect of Market Access | .39 | .68* | .45* | -.07 | -.20 | .48 |
| | (.91) | (1.84) | (1.71) | (-.45) | (-.35) | (1.58) |
| Short run effect of Market Access | 2.99 | -1.37 | 4.55** | -3.28* | 3.71 | 5.90*** |
| | (1.38) | (-.69) | (2.31) | (-1.85) | (1.26) | (2.66) |
| Lagged entry | -.80*** | .16*** | -.44*** | .29*** | | |
| | (-9.41) | (3.23) | (-9.03) | (6.03) | | |
| Lagged exit | .10 | -.71*** | .41*** | -.41*** | | |
| | (1.30) | (-11.57) | (4.52) | (-6.48) | | |
| Change in exit | .21* | | .18** | | | |
| | (1.70) | | (2.26) | | | |
| Change in entry | | .09** | | .10** | | |
| | | (2.58) | | (2.17) | | |
| Lagged net entry | | | | | -.81*** | -.63*** |
| | | | | | (-8.67) | (-11.97) |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of Observations | 1115 | 1115 | 1267 | 1267 | 1091 | 1243 |
| $R^2$ | .44 | .40 | .33 | .26 | .42 | .39 |

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively. Robust t-statistics reported in parentheses. All equations are estimated using OLS.

Over time the market access variable grows at different rates in both the cross-country and cross-industry dimensions. For example, the emergence of the Eastern European bloc has resulted in rapid integration with the world economy. In contrast the western European countries were already highly globalised. The effect of different rates of integration would be expected to translate into variations in churning rates. Countries which undergo rapid integration with world markets would be expected to have more sorting as firms are drawn into markets through the expectation of export profits. On the other hand, one would expect this sorting process to have occurred in highly integrated economies.

Table 2.8: Transition and non-Transition Economies

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Sample | Transition | Transition | Transition | Other | Other | Other |
| Indicator | Entry | Exit | Net Entry | Entry | Exit | Net Entry |
| Long run effect of | -2.06 | -.73 | -1.18 | .25 | .15 | .20 |
| Market Access | (-1.52) | (-.85) | (-.81) | (1.40) | (1.14) | (.97) |
| Short run effect of | 5.92 | -5.10 | 7.54 | 4.10*** | -1.08 | 4.41** |
| Market Access | (1.09) | (-.97) | (1.13) | (2.87) | (-.85) | (2.49) |
| Lagged entry | -.85*** | .25*** | | -.34*** | .28*** | |
| | (-12.35) | (6.74) | | (-7.58) | (5.72) | |
| Lagged exit | .26** | -.78*** | | .30*** | -.39*** | |
| | (2.43) | (-11.91) | | (3.59) | (-6.40) | |
| Change in exit | .40*** | | | .04 | | |
| | (3.48) | | | (.46) | | |
| Change in entry | | .15*** | | | .03 | |
| | | (6.17) | | | (.46) | |
| Lagged net entry | | | -.89*** | | | -.58*** |
| | | | (-12.57) | | | (-9.98) |
| Country dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of Observations | 596 | 596 | 596 | 1786 | 1267 | 1738 |
| $R^2$ | .51 | .44 | .51 | .30 | .26 | .35 |

Notes: *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively. Robust t-statistics reported in parentheses. All equations are estimated using OLS.

Previously we speculated that a possible reason for high churning rates among eastern European countries could be due to the pace of global integration proceeding fastest there. Where the pace of globalisation is quicker entry and exit rates would be higher due to foreign market opportunities and competition from abroad causing exit of previously sheltered firms. To examine this issue we split the sample into transition and non-transition economies.[13] In contrast to our prior, the results in Table 2.8 show that globalisation has played a larger role in the process of creative destruction in non-transition countries. Again market access only enters significantly in the short run where it raises the entry rate by 0.35 percentage points. For the non-transition countries globalisation does not affect the exit of firms during the short run but owing to the entry effect there is net entry during this horizon. A potential explanation for these findings is that our dataset has a fairly limited time series dimension. This is more acute in some instances than others, for example, New Zealand, the Czech Republic, Belgium and Norway. A consequence of this is that we rely upon variation in the between group dimension for identification.

### 2.3.2 Revealed Comparative Advantage

In Melitz (2003) trade liberalisation spurs market entry as the expected profits from exporting increase firms' profit expectations. In an extension of this model Bernard, Redding and Schott (2007) take the Melitz framework and weld it to a Heckscher-Ohlin model. The introduction of a second sector into the model produces some novel insights and yields testable empirical predictions. Among these is the response of entry and exit rates which are found to be higher in comparative advantage sectors.

[13] The transition economies are the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Slovakia, Slovenia and Romania.

**Figure 2.6: Productivity Thresholds pre- and post- Trade Liberalisation**

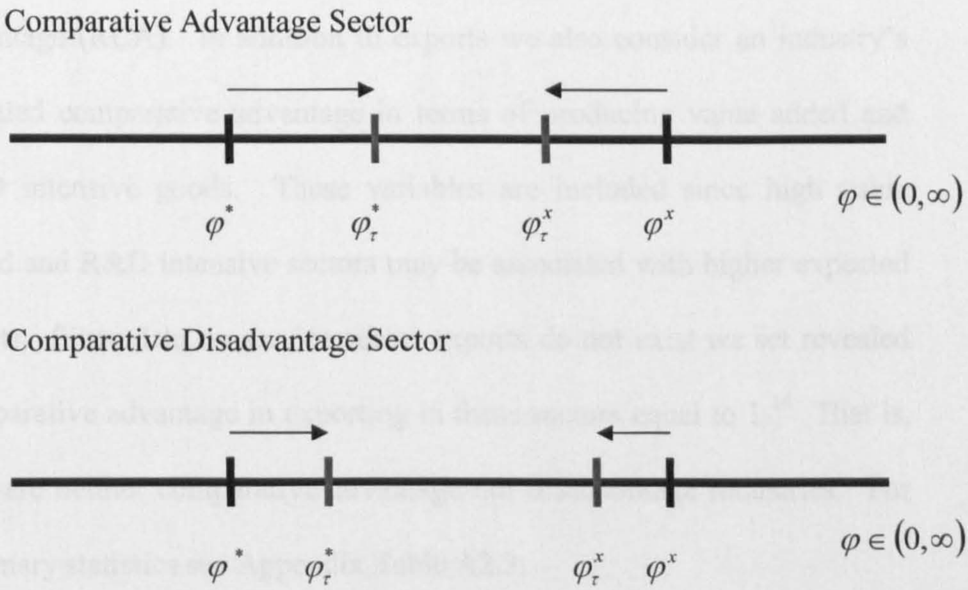



Figure 2.6 illustrates the central tenets of the model. As in the underlying Melitz framework trade liberalisation causes reallocations of output in both industries as the most productive firms take advantage of exporting opportunities. However, these opportunities are relatively greater in comparative advantage industries meaning that entry incentives are greater relative to the comparative disadvantage sector. The entry of disproportionately more firms into the comparative advantage industry results in more intense competition between incumbents and more exit. The threshold productivity required for survival increases by relatively more in comparative advantage industries.

We take the prediction regarding how comparative advantage affects entry and exit rates to the data. Comparative advantage is measured using the technique of Balassa (1965) which computes 'revealed' comparative advantage (RCA). In addition to exports we also consider an industry's revealed comparative advantage in terms of producing value added and R&D intensive goods. These variables are included since high value added and R&D intensive sectors may be associated with higher expected profits. Since data on service sector exports do not exist we set revealed comparative advantage in exporting in these sectors equal to 1.[14] That is, they are neither comparative advantage nor disadvantage industries. For summary statistics see Appendix Table A2.3.

Table 2.9: Revealed Comparative Advantage

| Regression<br>Indicator | 1<br>Entry | 2<br>Exit | 3<br>Churn | 4<br>Net Entry |
|---|---|---|---|---|
| Exporting | .18*** | -.02 | .19* | .15** |
| | (2.91) | (-.26) | (1.92) | (2.08) |
| *Number of Observations* | *2324* | *2324* | *2324* | *2276* |
| $R^2$ | *.31* | *.27* | *.17* | *.37* |
| Value Added | .95*** | -.31 | .74* | 1.15*** |
| | (2.76) | (-1.56) | (1.65) | (3.16) |
| *Number of Observations* | *2266* | *2266* | *2266* | *1357* |
| $R^2$ | *.35* | *.34* | *.29* | *.39* |
| R&D | .02 | .00 | .02 | .01 |
| | (1.01) | (.15) | (1.29) | (.70) |
| *Number of Observations* | *1476* | *1476* | *1476* | *1432* |
| $R^2$ | *.35* | *.30* | *.24* | *.38* |

*Note*: Unreported regressors are identical to those in Table 2.4.

[14] A series of robustness tests were conducted where distance played a significantly greater role among service sectors. For example, when the distance coefficient is set to -2 for the hotels and restaurants and retail and wholesale trade sectors the results remain robust. Equally, when the service sector is excluded from the analysis the results remain robust.

The results of the regressions are reported in Table 2.9. We find that comparative advantage in exporting and the production of high value added goods results in more entry. The magnitudes of the effects are substantially different, however, with a one standard deviation increase in exporting RCA causing a 0.13 percentage points increase in the entry rate compared with a 3.61 percentage point increase for value added RCA. The same variables are also found to be positively and significantly correlated with net entry. This suggests that sectors with a comparative advantage in exporting or value added goods production have higher expected profits. Comparative advantage in R&D is not found to affect any of the left hand side variables. This may be due to only a limited number of firms undertaking R&D investments. For example, Haskel (2007) reports that over 80 per cent is conducted by just a dozen large companies while Harris and Li (2009) find that 13 per cent of UK firms are engaged (18 per cent in manufacturing and 10 in non-manufacturing).

However, perhaps the cleanest test of the Bernard, Redding and Schott (2007) hypothesis is to use the churning rate as the dependent variable. Since the model's predictions relate to the response of firm entry and exit over the long run churning is the most appropriate measure. In column 3 of the table we find some tacit support for the hypothesis when exporting and value added RCA are used. The point estimates of 0.19 and 0.74 imply that increasing a sector's comparative advantage in exporting and value added production causes an increase in the churning rate albeit at the 10% level of significance. From this we conclude that comparative advantage is also an important industry determinant of entry and exit rates in a cross-country context.

## 2.4 Robustness Tests – Country Factors

The analysis suggests that globalisation has had a positive effect on net entry though primarily during the short run. Typically the effects are found to be small. Figure 2.1 illustrated that the magnitude of the importance of time invariant country-specific factors and market access in affecting churning rates across the sample. Most striking is the prominence of country factors in shaping the rate of churn. For example, the policy environments in New Zealand and Germany result in churning being 2.3% and 2.8% higher relative to the United States. In contrast, for the Czech Republic and Norway the policy regime serves to reduce entry and exit rates by 2.6% and 2.1% respectively.

To examine how policy environments affect our entrepreneurship indicators we include broad measures of the policy environment within countries in the regressions reported in Table 2.10.[15] Our policy variables are from the economic freedom (EFI) data assembled by the Canadian Fraser Institute and published annually in Gwartney and Lawson (2005). Summary statistics of the following measures are provided in Appendix Table A2.2:

[15] For regression results with each policy variable included individually see Appendix Table A2.4.

1. *Size of Government*: EFI index with values between 0-10 capturing the size of general government consumption in total consumption, transfers and subsidies as a percentage of GDP, government enterprises and investment as a percentage of GDP and the top marginal income tax rate.

2. *Legal and Property Rights*: EFI index with values between 0-10 capturing judicial independence, impartiality of courts, protection of intellectual property, military interference in the rule of low and political progress and the integrity of the legal system.

3. *Monetary Policy*: EFI index with values between 0-10 capturing excess growth in the money supply above GDP growth, the standard deviation of inflation variability (last 5 years), the recent inflation rate and the freedom to own foreign currency bank accounts domestically and abroad.

4. *Regulatory Burden*: EFI index with values between 0-10 capturing the administrative burden on new business.

5. *Competition in Domestic Banking*: EFI index with values between 0-10 capturing the extent of competition from foreign banks.

These variables were chosen based on evidence from existing literature. For example, Cullen and Gordon (2007), Ba Rin et al. (2011) and Gentry and Hubbard (2000) find that taxation influences entry rates although they only consider either entry by incorporation or self-employment. This literature has also considered the impact of regulatory burdens upon entrepreneurship decisions while legal quality is found by Nunn (2007) to affect entry although that paper only deals with entry into export markets.

Introducing the policy variables into the regression reduces globalisation's role in affecting entry and death. Market access now only significantly affects entry and net entry over the short run though in the former the effect now only holds at the 10% level. The results suggest that in countries with large governments, high regulatory burdens and good protection of legal and property rights there is net exit while sound monetary policy causes net entry.

Table 2.10: Policy Variables

| Sample<br>Indicator | 1<br>Entry | 2<br>Exit | 3<br>Net Entry |
|---|---|---|---|
| Long run effect of Market Access | -.20<br>(-.85) | .18<br>(1.06) | -.16<br>(-.59) |
| Short run effect of Market Access | 3.54*<br>(1.84) | -2.09<br>(-1.42) | 4.83**<br>(2.25) |
| Size of Government | -.92**<br>(-2.21) | .67**<br>(2.17) | -1.11**<br>(-2.32) |
| Legal and Property Rights | -.07<br>(-.28) | .84***<br>(4.12) | -.68**<br>(-2.22) |
| Monetary Policy | 2.18***<br>(4.02) | -.31<br>(-.76) | 1.86***<br>(3.09) |
| Regulatory Burden | -.33<br>(-1.36) | .37***<br>(2.61) | -.53**<br>(-2.14) |
| Competition in Domestic Banking | .07<br>(.31) | .40***<br>(2.88) | -.20<br>(-.79) |
| Lagged entry | -.53***<br>(-6.71) | .32***<br>(7.90) | |
| Lagged exit | .62***<br>(6.15) | -.49***<br>(-9.27) | |
| Change in entry | | .19***<br>(6.27) | |
| Change in exit | .43***<br>(4.31) | | |
| Lagged net entry | | | -.73***<br>(-12.02) |
| Country dummies | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes |
| Number of Observations | 1702 | 1702 | 1678 |
| $R^2$ | .32 | .33 | .42 |

*Notes*: *, ** and *** denote significance at the 10%, 5% and 1% level. Robust t-statistics are reported in parentheses.

Higher values of the first measure, the size of government, indicate a greater presence of the government in economic activity. This variable is significantly correlated with both the rate of entry and exit, moving them in opposite directions. Increases in the size of government appear to blunt entrepreneurial incentives with s one standard deviation increase in the size of government (roughly equivalent from moving from the United States (2.9) to the United Kingdom (4.2)) reducing entry by 1.18 percentage points and causing the exit rate to increase by 1.29 percentage points. It is worth noting that these regressions include country fixed effects and consequently these changes in government size abstract from changes that occur within the data across time. In the constrained regression of net entry we find that larger governments are associated with persistent declines in net entry either through crowding out of investment or taxation effects. We investigate this in further detail in Table 2.11.

Somewhat surprisingly we find that better legal and property right protection results in higher exit rates and persistent declines in net entry. One would expect that superior contract enforcement and transparency would foster more entry. A possible explanation for the result is that the variable is correlated with the other policy measures in the regression. Indeed the correlation with monetary policy and competition in domestic banking is 56% and 55% respectively. We investigate the effect of legal and property rights variable by excluding the other policy factors. The results reported in Appendix Table A2.4 no longer exhibit a significant effect on net entry while the entry variable is now positively signed though it remains insignificant at conventional levels. However, the points estimate in the exit regression of 0.39 remains.

Financial factors might also influence firm birth and survival. Access to credit has been shown to reduce the barriers to export market entry (Greenaway, Guariglia and Kneller, 2007). To capture similar effects on domestic market entry we include an index of the degree of competition in domestic banking. We anticipate that greater competition among banks leads to firms being able to secure cheaper finance. However, our results suggest the contrary. In regression 2 we find that greater competition in the domestic banking sector is significantly associated with higher exit rates. Again we investigate whether this result is caused by collinearity with the other variables by excluding the other policy factors in the results in Appendix Table A2.4, the result persists.

As with size of government, the monetary policy index is also significantly correlated with entry. The positive coefficient on entry and churn suggest that stable monetary environments ameliorate to a certain degree some of the uncertainties surrounding investment and allow entrepreneurs to form more accurate forecasts of future profits. A one standard deviation increase in regulatory burdens raises the exit rate by 0.58 percentage points as the higher compliance costs firms must bear reduce their profitability.

Table 2.11: Size of Government

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Sample | All | All | All | All |
| Indicator | Entry | Exit | Churn | Net Entry |
| Long run effect of Market Access | -.41 | .12 | -.31 | -.35 |
| | (-1.06) | (.46) | (-.61) | (-.80) |
| Short run effect of Market Access | 3.78 | -3.17 | -.99 | 5.70* |
| | (1.32) | (-1.24) | (-.22) | (1.75) |
| Government consumption | -1.50* | .57 | -1.09 | -1.56* |
| | (-1.72) | (1.33) | (-.99) | (-1.78) |
| Share of government enterprises and investment in GDP | -.25 | -.03 | -.40 | -.13 |
| | (-1.29) | (-.18) | (-1.48) | (-.58) |
| Top income tax rate | .08 | .32*** | .60*** | -.12* |
| | (1.25) | (7.37) | (6.62) | (-1.70) |
| Legal and Property Rights | -.30 | .68 | .74 | -.82 |
| | (-.54) | (1.48) | (.95) | (-1.24) |
| Monetary Policy | 2.93*** | 1.39*** | 6.17*** | 1.38* |
| | (4.33) | (3.37) | (6.11) | (1.93) |
| Regulatory Burden | -.98 | -.09 | -1.52 | -.76 |
| | (-1.45) | (-.29) | (-1.61) | (-1.14) |
| Competition in Domestic Banking | -.07 | .55*** | .79* | -.39 |
| | (-.18) | (2.79) | (1.87) | (-1.02) |
| Lagged entry | -.58*** | .33*** | | |
| | (-6.74) | (7.20) | | |
| Lagged exit | .68*** | -.50*** | | |
| | (6.34) | (-8.35) | | |
| Change in entry | | .21*** | | |
| | | (6.58) | | |
| Change in exit | .49*** | | | |
| | (4.31) | | | |
| Lagged churn | | | -.09 | |
| | | | (-1.46) | |
| Lagged net entry | | | | -.77*** |
| | | | | (-11.63) |
| Country dummies | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes |
| Number of Observations | 1140 | 1140 | 1140 | 1116 |
| $R^2$ | .36 | .40 | .18 | .45 |

*Notes*: *, ** and *** denote significance at the 10%, 5% and 1% level. Robust t-statistics are reported in parentheses.

Studies of the effect of government on the entry and exit decision of firms are relatively sparse. Where such enquiries do exist they often focus on one country (the United States) and multinationals (see Devereux and Griffith, 2003). Existing studies also fail to account for the inter-dependence between entry and exit rates (for extensive evidence on this see Bartelsman and Doms, 2000). The existing evidence does not allow us to understand whether the effects of taxation, and by extension other forms of government intervention, on entry are symmetric to those on exit. To understand better which characteristics of government are correlated with entry and exit in Table 2.11 we decompose the size of government variable into the share of government consumption in total consumption, the share of government enterprises and investment in GDP and the top marginal income tax rate. An observation would be that crowding out and taxation are the main drivers of the government effect. Crowding out of private investment appears to reduce the entry rate and a 1% increase in the top marginal income tax rate results in 0.32% more exit. It may be that income and corporate tax rates are highly correlated meaning that the effect on exit may also capture the effect of corporation taxation.

As a further test of the importance of the policy variables we consider whether the interaction between policy environments and globalisation affects entry and exit rates. This might also explain some of the confusing results we found for how legal institutions and competition in domestic banking affect birth and survival. Some of the results for the regressions with the interaction terms are striking. For example, increasing market access in countries with good legal and property rights causes an increase in the entry rate and a decrease in the probability of exit. The net effect is to cause persistent net entry over the long run; perhaps a signal that good legal institutions lead to reductions in trade costs and broaden exporting opportunities for goods requiring relationship-specific investments as documented by Nunn (2007).

Financial factors are no longer found to significantly affect any of the dependent variables either through the competition in domestic banking variable or its interaction with market access. However, in countries with stable monetary policies the point estimate of 0.21 implies that more globalisation raises the exit rate. It may be that foreign firms target stable markets. Where they are drawn towards such countries the level of competition domestic incumbents face rises and more indigenous firms die. Although entry rates are lower and exit rates are higher in countries with more regulatory burdens the interaction between this variable and market access produces some perverse results. Increasing globalisation is associated with more entry and less exit in countries with more regulation. It could also be that the increase in expected profits from exporting or FDI that arise from global integration ameliorate to a certain extent the negative influence regulations have on entrepreneurship.

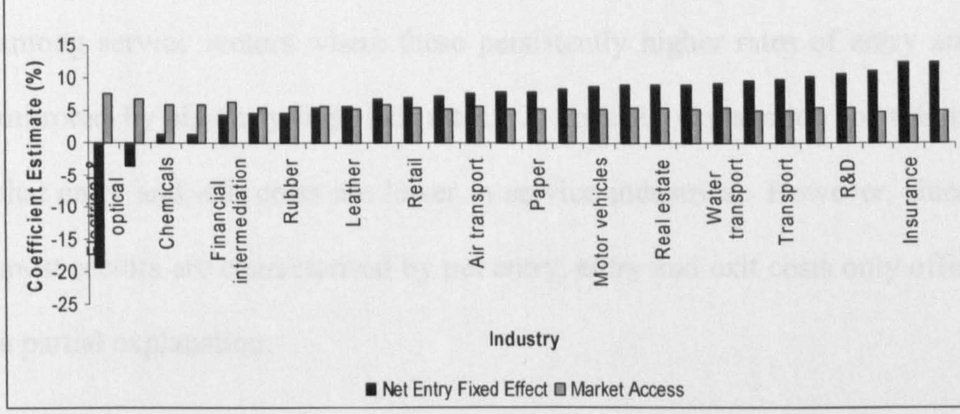
Our results show many interesting relationships between policy variables and entry and exit and cast light on a topic that has hitherto received little attention in the international trade literature. However, it is worth noting that the inclusion of the policy variables does little to reduce the magnitude of the country fixed effects. These remain large and, relative to the United States, range between 3.1% and 7.2% in the entry regression and -4.6% and 0.22% for the regressions using exit as the dependent variable. There are two implications of this. First, there are myriad country-specific factors that influence firm survival and death most of which even our broad policy measures do not capture. Second, conditional on the measures of policy the United States is not as entrepreneurial a country as is often presumed as evidenced by the fixed effects from the entry regressions.

Table 2.12: Interaction Effects between Policy and Globalisation

| | 1 | 2 | 3 |
|---|---|---|---|
| Sample | All | All | All |
| Indicator | Entry | Exit | Net Entry |
| Long run effect of | .70 | -1.49* | 1.52 |
| Market Access | (.37) | (-1.72) | (.87) |
| Short run effect of | 4.54* | -4.05** | 6.81*** |
| Market Access | (1.92) | (-2.34) | (2.68) |
| Size of Government | -.68 | .43 | -.77 |
| | (-1.51) | (1.31) | (-1.46) |
| Legal and Property Rights | -.59* | 1.27*** | -1.48*** |
| | (-1.71) | (4.64) | (-3.77) |
| Monetary Policy | 3.19** | -1.45** | 3.43*** |
| | (2.40) | (-2.36) | (2.75) |
| Regulatory Burden | -.64** | .57*** | -.93*** |
| | (-2.28) | (3.10) | (-3.20) |
| Competition in Domestic Banking | -.06 | .22 | -.14 |
| | (-.20) | (1.07) | (-.42) |
| Market access | | | |
| x Size of Government | -.04 | .04 | -.06* |
| | (-1.35) | (2.01) | (-1.65) |
| x Legal and Property Rights | .10** | -.08*** | .15*** |
| | (2.17) | (-2.60) | (3.14) |
| x Monetary Policy | -.19 | .21** | -.29* |
| | (-1.02) | (2.48) | (-1.68) |
| x Regulatory Burden | .05** | -.03** | .07*** |
| | (2.53) | (-2.15) | (2.89) |
| x Competition in Domestic Banking | .03 | .03 | -.00 |
| | (.87) | (1.12) | (-.09) |
| Lagged entry | -.53*** | .32*** | |
| | (-6.74) | (7.90) | |
| Lagged exit | .62*** | -.49*** | |
| | (6.19) | (-9.29) | |
| Change in entry | | | |
| Change in exit | .44*** | .19*** | |
| | (4.33) | (6.39) | |
| Lagged net entry | | | -.73*** |
| | | | (-12.06) |
| Country dummies | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes |
| Number of Observations | 1702 | 1702 | 1678 |
| $R^2$ | .32 | .34 | .42 |

## 2.5 Robustness Tests - Industry Factors

Figure 2.7: Industry Fixed Effects and Net Entry




*Notes*: The coefficient estimates come from regression 3 of Table 2.4. Industry fixed effects are measured relative to the machinery and equipment sector.

In Figure 2.7 we present estimated industry fixed effects from the net entry regression as well as the effect of market access in each sector. As was the case with country specific factors, the industry fixed effects are often large. For example, the electrical and optical sector has approximately 19% net exit relative to the machinery and equipment industry. However, the general tendency is for entry rates to be higher and exit rates lower in most industries relative to the benchmark. Market access has the effect of stimulating net entry in all sectors. While the magnitude of the effect varies it ranges between 4.05 percent (insurance) and 7.63 percent (electrical and optical). Another observation would be that at the industry level globalisation is considerably more important than at the country level.

The implication of Figure 2.7 is that in addition to globalisation and country factors industry-specific variables also determine the rate of firm birth and death. The effect of such factors appears to be particularly acute among service sectors where these persistently higher rates of entry are mirrored by similarly high exit rates. A possible explanation for this is that entry and exit costs are lower in service industries. However, since most sectors are characterised by net entry, entry and exit costs only offer a partial explanation.

To try to explain this we append equation (1.1) with three industry variables sequentially. To allow for differences in human capital intensity across countries and industries we use data on the share of total hours worked by high skill workers from the EUKLEMS database. Unfortunately data is not available for all countries and industries in the data set (data is missing for Estonia, Germany, Latvia, Lithuania, New Zealand, Norway, Switzerland and the U.S.). To account for this we group industries (industry codes 15-19; 20-26; 27-36; 50-59; 60-69; 70-74) and use instead the average for that group of industries in that country and year. Industry-level measures of information and computer technology (ICT) expenditure per worker and R&D intensity are also taken from the same source.[16] Summary statistics are detailed in Appendix Table A2.3.

[16] Although sunk costs have been found to be an important determinant of entry and exit rates (Bernard and Jensen, 1995; Clerides, Lach and Tybout, 1997; Greenaway, Gullstrand and Kneller, 2008) we do not include them in the regressions because finding an appropriate measure for both manufacturing and services proved impossible.

| Table 2.13: Industry Specific Factors | | | |
|---|---|---|---|
| Regression | 1 | 2 | 3 |
| Sample | All | All | All |
| Indicator | Entry | Exit | Net Entry |
| Human capital intensity | .02* | -.02* | .03** |
| | (1.87) | (-1.87) | (2.36) |
| *Number of Observations* | *1858* | *1858* | *1858* |
| *$R^2$* | *.33* | *.35* | *.38* |
| ICT expenditure per worker | -.00 | -.00 | -.00 |
| | (-1.49) | (-.31) | (-1.02) |
| *Number of Observations* | *2002* | *2002* | *2002* |
| *$R^2$* | *.30* | *.32* | *.35* |
| R&D intensity | .01 | .01 | -.00 |
| | (.95) | (1.63) | (-.08) |
| *Number of Observations* | *1998* | *1998* | *1998* |
| *$R^2$* | *.31* | *.32* | *.26* |

*Notes*: The regressions include the same controls as in Table 2.5 but we do not report these. Robust t-statistics reported in parentheses.

The results in Table 2.13 show that the human capital intensity of an industry significantly affects entry and exit rates although the results only hold at the 10% level of significance. The standardised effects are not identical however with the standardised effect estimated at 0.26 for entry and -0.15 for exit. However, increasing a sector's human capital intensity has a persistently positive effect on that sector's rate of net entry. This may partly explain the net entry observed in service sectors previously. ICT expenditure per worker and R&D intensity are not found to be significantly correlated with any of the dependent variables.

## 2.6 Conclusions

This chapter provides cross-country evidence on the role played by globalisation, country characteristics and industry characteristics in determining entry and exit. We find that globalisation opportunities make entry more favourable and, in contrast with many previous studies, also reduce the likelihood that a plant will die. However, the effects are small and confined to the short run. By comparison policy environments appear to have a greater influence upon churning rates. Countries with small governments, good legal institutions, low regulatory burdens and macroeconomic stability have, on average, net entry. In some cases these effects are mitigated through the interaction between policy and globalisation.

Other tests reveal industry-specific factors to also be important determinants of the process of creative destruction. A comparative advantage in exporting and the production of value added goods generates positive net entry by raising the expected profits of entry. This result confirms one of the core predictions of the Bernard, Redding and Schott (2007) model. In contrast to the country dimension, globalisation plays a more important role at the industry level although this may obscure cross-country differences in market access.

## 2.7 Appendix 2

Table A2.1: Source of Market Access, Entry and Exit

| Regression | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Sample | Manufacturing | Manufacturing | Services | Services |
| Indicator | Entry | Exit | Entry | Exit |
| Long run effect of | .15 | .09 | .25 | -.14 |
| Domestic Market Access | (.69) | (.60) | (1.40) | (-.86) |
| Short run effect of | -.69 | 1.38 | 2.31* | -.33 |
| Domestic Market Access | (-.38) | (1.34) | (1.70) | (-.31) |
| Long run effect of | .79* | .46 | -.32 | 1.68** |
| Foreign Market Access | (1.73) | (1.05) | (-.38) | (2.40) |
| Short run effect of | 5.53* | -3.64 | 4.40** | -.18 |
| Foreign Market Access | (1.65) | (-1.54) | (2.37) | (-.11) |
| Lagged entry | -.82*** | .12** | -.37*** | .28*** |
| | (-9.66) | (2.43) | (-7.51) | (4.92) |
| Lagged exit | .03 | -.67*** | .34*** | -.40*** |
| | (.44) | (-10.41) | (3.79) | (-5.36) |
| Change in exit | .17 | | .08 | |
| | (1.12) | | (.88) | |
| Change in entry | | .06 | | .05 |
| | | (1.56) | | (.84) |
| Lagged net entry | | | | |
| Country dummies | Yes | Yes | Yes | Yes |
| Industry dummies | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes |
| Number of Observations | 1043 | 1043 | 1072 | 1072 |
| $R^2$ | .44 | .41 | .31 | .28 |

Appendix Table A2.2: Country Variables

| Country/Variable | Size of government | Legal institutions | Monetary policy | Regulatory burden | Competition in domestic banking |
|---|---|---|---|---|---|
| Belgium | 6.00 | 7.50 | 9.70 | | |
| Czech Republic | 5.75 | 6.59 | 9.07 | 7.22 | 8.73 |
| Estonia | 3.62 | 6.57 | 9.33 | 4.35 | 6.60 |
| Finland | 6.01 | 9.17 | 9.61 | 2.84 | 8.10 |
| France | 6.60 | 7.67 | 9.60 | 7.72 | 6.70 |
| Germany | 5.41 | 8.89 | 9.60 | 5.56 | 8.00 |
| Hungary | 5.06 | 6.86 | 7.75 | 3.86 | 6.90 |
| Italy | 5.79 | 6.48 | 9.60 | 4.70 | 5.88 |
| Latvia | 4.07 | 5.87 | 9.03 | 5.68 | 5.10 |
| Lithuania | 4.40 | 5.40 | 8.13 | 5.57 | 5.80 |
| Luxembourg | 5.51 | 8.96 | 9.68 | 5.78 | 10.00 |
| Netherlands | 5.26 | 9.26 | 9.61 | 3.78 | 8.08 |
| New Zealand | 3.43 | 8.97 | 9.42 | 6.89 | 10.00 |
| Norway | 6.26 | 9.10 | 9.39 | 4.02 | 6.20 |
| Portugal | | | | | |
| Slovakia | 6.27 | 6.16 | 8.01 | 3.57 | 5.30 |
| Slovenia | 7.41 | 6.53 | 8.46 | 6.29 | 6.72 |
| Spain | 5.59 | 7.24 | 9.58 | 3.76 | 6.04 |
| Sweden | 6.89 | 8.77 | 9.59 | 3.69 | 7.40 |
| United Kingdom | 4.16 | 8.88 | 9.55 | 3.33 | 7.40 |
| United States | 2.86 | 8.59 | 9.78 | 3.20 | 7.92 |

Notes: The values in the indexes range between 0 and 10. Mean values reported in the table.

Appendix Table A2.3: Industry Variables

| Country/Variable | Revealed Comparative Advantage in: Exporting | Value Added | R&D | High Skill | ICT expenditure |
|---|---|---|---|---|---|
| Belgium | 1.00 | 0.99 | | 10.76 | 6.92 |
| Czech Republic | 1.09 | 1.00 | 1.89 | 10.90 | 7.05 |
| Estonia | 0.64 | 2.17 | | | |
| Finland | 1.05 | 1.01 | 1.87 | 28.40 | 2.90 |
| France | 0.89 | 1.13 | | 12.16 | 2.24 |
| Germany | 0.95 | | 0.54 | | |
| Hungary | 1.04 | 0.97 | 1.62 | 14.20 | 1.14 |
| Italy | 1.08 | 0.97 | 1.48 | 4.31 | 2.45 |
| Latvia | 0.80 | 2.16 | | | |
| Lithuania | 0.45 | 2.27 | | | |
| Luxembourg | 1.00 | 1.00 | 6.03 | 8.63 | 4.97 |
| Netherlands | 0.92 | 1.02 | 1.39 | 7.91 | 4.67 |
| New Zealand | 1.22 | | 11.06 | | |
| Norway | 1.16 | | 2.87 | | |
| Portugal | 1.34 | 0.97 | 3.68 | 7.44 | 3.43 |
| Slovakia | 1.27 | 1.00 | 1.69 | 11.18 | |
| Slovenia | 0.84 | 1.04 | | 15.08 | 2.72 |
| Spain | 0.89 | 1.03 | 3.50 | 19.26 | 2.96 |
| Sweden | 1.00 | 1.04 | 0.70 | 9.16 | 4.68 |
| United Kingdom | 0.83 | 1.04 | | 13.60 | |
| United States | 0.80 | 1.00 | 0.56 | | 6.84 |

Notes: For service sectors exporting RCA is assumed to be 1 due to lack of data on exporting. Hi9gh skill refers to the total number of hours worked by high skilled workers. ICT expenditure is defined as the share of ICT in total consumption in millions of euros measured in 2005 prices.

Appendix Table A2.4: Policy Variables

| Sample<br>Indicator | 1<br>All<br>Entry | 2<br>All<br>Exit | 3<br>All<br>Churn | 4<br>All<br>Net Entry |
|---|---|---|---|---|
| Size of Government | -1.82*** | .80*** | -1.21*** | -2.19*** |
| | (-5.50) | (3.04) | (-2.65) | (-5.65) |
| *Number of Observations* | *2254* | *2254* | *2254* | *2254* |
| $R^2$ | *.33* | *.28* | *.16* | *.40* |
| Legal and Property Rights | .18 | .39*** | .77** | -.10 |
| | (.83) | (2.75) | (2.49) | (-.43) |
| *Number of Observations* | *2254* | *2254* | *2254* | *2206* |
| $R^2$ | *.32* | *.28* | *.16* | *.39* |
| Monetary Policy | 2.09*** | .21 | 2.76*** | 1.66*** |
| | (4.33) | (.55) | (4.10) | (2.93) |
| *Number of Observations* | *2254* | *2254* | *2254* | *2206* |
| $R^2$ | *.33* | *.27* | *.17* | *.40* |
| Regulatory Burden | .14 | -.08 | .06 | .17 |
| | (1.06) | (-.78) | (.34) | (1.05) |
| *Number of Observations* | *2227* | *2227* | *2227* | *2179* |
| $R^2$ | *.32* | *.27* | *.16* | *.39* |
| Competition in Domestic Banking | -.02 | .29** | .41* | -.18 |
| | (-.10) | (2.32) | (1.89) | (-.81) |
| *Number of Observations* | *1702* | *1702* | *1702* | *1678* |
| $R^2$ | *.30* | *.32* | *.11* | *.40* |

# Chapter Three

# Closure within Multi-Plant Firms: Evidence from Japan

## 3.1 Introduction

Plants owned by multinational firms are known to possess characteristics that reduce their likelihood of closure compared to non-multinationals. Their plants are generally larger more capital intensive and more productive, all factors shown in numerous contexts to be negatively associated with the probability of exit. Conditional on these superior characteristics, multinational firms are however more likely to shut their plants. Bernard and Jensen (2007) find for example that in the United States multinational ownership increases the probability of plant death by 4.5%, controlling for a wide ranging set of plant and firm characteristics. Similar evidence has been found for manufacturing plants in Belgium by van Beveren (2007), Sweden by Bandick (2007), Japan by Kimura and Kiyota (2006) and Chile by Alvarez and Görg (2005). As a consequence of evidence such as this multinationals have become labelled as 'footloose'.

A similar effect has also been found for multiplant firms without overseas affiliates (Bandick, 2007; Bernard and Jensen, 2007). The tendency for multiplant firms to be more likely to close plants is widely recognised but far from understood. Lieberman (1990), for example, shows that larger multiplant firms are more likely to close plants in declining industries. Alternatively large diversified firms may encounter fewer agency problems when deciding upon plant closure, making their plants less likely to survive relative to standalone plants (Harrigan, 1980; Baden-Fuller, 1989). Related to this is the idea that strategic interactions within multi-plant firms may be the source of the higher failure rates. Where multi-plant firms expand output or cuts price to improve the profit of one of its plants, it generates a negative externality for the other plants within the group (Sutton, 1997).

The theories used to explain the 'footloose' nature of multinational firms emphasise vertical over horizontal FDI motives.[17] Under vertical FDI multinational firms change the geography of their production plants in response to changes in local costs (as in for example Antras and Helpman, 2004). They relocate low skill intensive activities for example, in countries that are low-skill abundant.[18] Empirically much of the literature has focused on the factors that make locations relatively attractive, either generally or specific determinants, rather than linking those FDI decisions and the closure of production units in a different location.[19] Cowling and Sugden (1999) argue that wage costs, labour unrest, tax incentives and

[17] Under horizontal FDI all stages of the production process are replicated in a different location. Models of this type include Markusen (1984) and Brainard (1997).
[18] In practice FDI decisions often contain elements of both horizontal and vertical motives. For theoretical models consistent with this view see Helpman (1984) Venables (1999) and Yeaple (2003).
[19] A more comprehensive review of this literature can be found in Blonigen (2005).

governmental subsidies are pivotal to the multinational location decision. This view is echoed by Hood and Young (1997) who stress that multinationals in the United Kingdom only have 'shallow roots' and are not fully integrated into the local economy.[20] Or more narrowly Devereux and Griffith (1998) alternatively focus on the roles of taxation and agglomeration. They find that conditional on producing in Europe, industries with lower effective tax rates attract more U.S. multinationals. Finally, recent theories of economic geography suggest that firms within the same industry may be drawn together through spillovers created by agglomeration effects. Evidence in support of these models can be found in Devereux and Griffith (1998) and Head et al. (1995).

A smaller number of papers have focused on the consequences of outward FDI decisions for other aspects of the firm. Head and Ries (2002), Brainard and Riker (1997a,b) and Braconier and Ekholm (2000) all find that firms undertaking outward FDI is associated with changes in employment levels and the skill-mix of workers at home. Most closely associated with this paper is the work of Simpson (2008). Using data for the UK she finds that overseas investment in low-wage economies leads to changes in the structure of firms; the closure of plants. These effects are found to be strongest for multinationals operating in low-skilled industries with affiliates located in low-skill abundant countries compared to firms in the same industry not investing in low wage countries.

[20] Similarly, the ability of multinationals to shift production across borders is emphasised by Rodrik (1997) as an explanation for multinational's relatively higher elasticity of demand for labour.

Another prominent finding in the literature has been the tendency for multi-plant firms to close plants. This has been found for Sweden (Bandick, 2007), the United States (Bernard and Jensen, 2007) and in numerous other contexts. A possible explanation of the 'footloose' effect could be that a high proportion of multinationals own more than one plant and hence the negative effect on survival could simply be capturing part of the multiplant effect.

We build on this literature to investigate additional aspects of the adjustment process made by multinational firms. Using data for Japan from 1994 to 2005 we firstly confirm that domestic multinationals are footloose. Plants belonging to a single-plant multinational face a 62% higher hazard rate while for those owned by multi-plant multinationals the value is 292%. We next explore the type of plants that are shut by multi-plant multinationals, their relative characteristics compared to the rest of the firm, but also the behaviour of multinationals with respect to other multi-plant firms that do not have overseas affiliates. The data on plants are sufficiently rich that we can do this for a wide range of characteristics including their size, capital intensity, average wage bill and material intensity. We find from this a certain degree of similarity in the type of pants that are shut. Plants are more likely to be closed if they are small. However, domestic multi-plant firms are more likely to keep open plants that are capital intensive and high wage relative to the rest of the firm, an indication that multi-plant firms without foreign affiliates are more concerned with closing the weakest parts of their operations. Finally, we explore whether it is this process of plant closure that explains why MNEs have been described as footloose. We find support for this view, indeed once we control for the characteristics of plants relative to the rest of the firm multinationals are actually significantly more likely to retain production in the home country. This also indicates that the footloose effect is not purely attributable to a high percentage of multinationals being multi-plant firms rather it is due to multinationals closing plants due to reasons related to their production chain. We also find that the tendency for domestic multi-plant ownership to increase the probability of exit is caused by the closure of the weakest plants within the group.

The rest of the paper is proceeds as follows. Section 3.2 describes the dataset we use. In Section 3.3 we investigate the magnitude of the "footloose" effect. Section 3.4 studies the determinants of exit within multi-plant firms. In Section 3.5 we address why multinationals are "footloose". Finally, conclusions are drawn in Section 3.6.

### 3.2 Data and Summary

Our primary data sources are the linked longitudinal data sets of the Census of Manufactures (COM) and the Basic Survey of Japanese Business Structure and Activities (BSJBSA) for the period 1994-2005. The COM data is an establishment-level dataset administered by the Ministry of Economy, Trade and Industry (METI). The COM data covers all plants with more than 3 employees located in Japan and includes information on plant characteristics, such as their location, number of employees, tangible assets, and value of shipments. Summary statistics of the main plant variables are provided in Table 3.1.

Table 3.1: Plant Variables across the Sample

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Plant size<br>Number of employees | 169590 | 225 | 489 | 10 | 21309 |
| Capital<br>Millions of Japanese yen | 169590 | 5119 | 23240 | .07 | 1052705 |
| TFP<br>Total factor productivity | 169590 | .96 | .35 | -4.81 | 4.36 |
| Wages<br>Millions of Japanese yen | 169590 | 4.84 | 1.79 | .03 | 90.55 |
| Intermediate inputs<br>Millions of Japanese yen | 169590 | 6669 | 39879 | .10 | 4276681 |
| Sales<br>Millions of Japanese yen | 169590 | 11321 | 54454 | 2.88 | 5855928 |

The plant data is linked to the BSJBSA, a firm-level survey also conducted by METI. The survey includes all firms with more than 50 employees or with capital in excess of 30 million yen. This data source provides information on corporate characteristics such as R&D activity, exports, imports, the foreign ownership ratio, foreign direct investment, and financial details. The use of the BSJBSA restricts our regression analysis to include only firms with more than 50 employees, while the lack of data on intangible assets, necessary in the construction of TFP, means we are also forced to exclude plants with less than 10 employees. Given our interest in the behaviour of multi-plant firms these are not thought to be serious exclusion restrictions. The average size of multi-plant firms within our dataset is 514, while for multinationals this figure is even higher at 2,549. In comparison single plant firms are approximately 7% of this size.

There are 23,100 observations of multinational firms within the data, 16,970 of multi-plant firms that are not multinational and 74,264 observations of single plant firms. These multinationals are mostly Japanese owned; foreign owned firms represent around 1 percent of all firms.[21] Summary statistics of the firm variables are shown in Table 3.2.

[21] Görg and Strobl (2003) also use the 50% criteria. The value rises (but remains low) to 1.8% if we define foreign ownership according to the International Monetary Fund's definition as being when a foreign firm holds in excess of 25% of capital.

Table 3.2: Firm-level Variables by Type of Firm

| Variable/Sample | Firm Type | | |
|---|---|---|---|
| | MNE | Multiplant | Single Plant |
| Observations | 23100 | 16970 | 74264 |
| Age<br>In years | 49 | 45 | 41 |
| Size<br>Number of workers | 1490 | 514 | 190 |
| Capital per worker<br>Millions of Japanese yen | 20.92 | 15.36 | 14.22 |
| Firm TFP<br>Total factor productivity | 1.01 | .96 | .95 |
| R&D complexity<br>R&D divided by firm sales | .02 | .01 | .01 |
| Intermediate inputs<br>Millions of Japanese yen | 71924 | 15410 | 5052 |
| Foreign ownership dummy<br>1 if a foreign firm holds more than 50% of equity | .01 | .01 | .01 |
| Export dummy<br>1 if the firm exports | .78 | .24 | .18 |
| Import dummy<br>1 if the firm imports | .65 | .19 | .15 |

*Notes:* The MNE group comprises both single- and multi-plant multinationals. 'Multi-plant' refers to domestic multi-plant firms.

In addition to the differences in average size multinationals and multi-plant firms are shown to be different in Table 3.2 across a number of dimensions. There is for example a clear decline in productivity and capital intensity from multinationals to multi-plant firms and standalone enterprises. Japanese firms appear to be highly globalised: 29% export, 25% import and 18% conduct FDI. However, these patterns are far from uniform across firm type. Some 78% of multinational firms export while only 18% of single plant firms have any sales abroad. Overall it would seem that Japanese MNEs display characteristics relative to other types of firm that are consistent with those found elsewhere in the literature (see for example the reviews in Greenaway and Kneller, 2007, and Wagner, 2007).

To identify plant entry and exit, we use a unique identification number given to each plant. A plant is deemed to have entered where it is observed at time *t* but was not observed in the dataset in the previous period, *t*-1. Equivalently, an exiting plant is one that was observed at *t-1* but not at time *t*. A limitation of the data is that it is not possible to identify firm closure separately from employment falling below 3 and therefore exit from the sample.[22]

In Table 3.3 we report the entry and exit rates for each year of our sample and by the type of firm. A general observation would be that the percentage of firms that either enter or exit in the sample is low in Japan. Throughout the sample there are 2,230 instances of entry and 3,392 observations of exit. This feature of Japanese manufacturing has been previously commented on by Caballero et al. (2003), Peek and Rosengren (2003) and Ahearne and Shinada (2005). It is however consistent with the high average age of firms reported in Table 3.2, which even for single plant firms is over 40 years. We conclude from this average age that the low rate of exit is not likely explained by the size threshold imposed on the Japanese census data of 3 employees.[23] This rate of exit is much lower

[22] We are more confident that we are not misclassifying mergers and acquisition as exit. The number of mergers in Japan is low. Shimizu (2001) (cited in Kimura and Fujii, 2003) reports that of all companies listed on the Tokyo Stock Exchange between 1949 and 1998 of 1273 only 78 have conducted mergers.
[23] Indeed the average exiting plant employs 131 workers and depending upon firm type employment at exiting plants ranges from 96 to 217 workers.

than that found for other developed countries such as the US, where Bernard and Jensen (2004) calculate 32 per cent of plants are shut over a 5 year period. Finally, the table also reveals that the rate of plant exit is similar amongst single, multi-plant firms and MNEs.

Table 3.3: Annual Entry and Exit Rates

| Sample | Sample | | MNE | | Multiplant | | Single Plant | |
|---|---|---|---|---|---|---|---|---|
| Year/Indicator | Entry | Exit | Entry | Exit | Entry | Exit | Entry | Exit |
| 1994 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 1995 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 1996 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 1997 | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |
| 1998 | .03 | .03 | .03 | .03 | .03 | .03 | .03 | .03 |
| 1999 | .01 | .03 | .01 | .03 | .01 | .04 | .01 | .03 |
| 2000 | .01 | .03 | .01 | .03 | .01 | .03 | .01 | .03 |
| 2001 | .02 | .03 | .01 | .03 | .02 | .03 | .02 | .03 |
| 2002 | .01 | .03 | .02 | .03 | .01 | .02 | .01 | .03 |
| 2003 | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |
| 2004 | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |
| 2005 | .02 | - | .02 | - | .02 | - | .02 | - |

In Table 3.4 we compare the characteristics of continuing, entering and exiting plants, again separated by their organisational form. In general the table shows that continuing plants are on average larger, have higher capital intensities, have greater sales, use more intermediate inputs and are more productive than exiting or entering plants. They pay higher wages than entering plants, but lower wages than exiting plants. On average, continuing plants are the most productive. Exiting plants are smaller, use fewer intermediate inputs and have fewer sales than either continuing or entering plants. They also pay higher wages. On average Table 3.4

suggests that these plants are not as productive as continuing plants, but are more productive than entrants.

Ownership also appears to matter. There is considerable heterogeneity in the size, productivity and capital intensity of plants depending on their owners and whether they enter, exit or continue. Multinationals' plants pay higher wages, have higher sales and use more intermediate inputs, regardless of whether they are an entering, exiting or continuing plant. T-tests reveal that non-MNE owned plants are significantly smaller, less capital intensive and have lower TFP and wages than multinational owned plants.[24]

[24] T-tests are computed by subtracting the mean of group $j$ from the mean value of group $i$ to find the difference. A t-test is then run where the null hypothesis is that the differences between the means are zero.

Table 3.4: Characteristics of Continuing, Entering and Exiting Plants by Firm Type

| Variable/Firm Type<br>Sample | Firm Type<br>MNE | <br>Multiplant | <br>Single Plant |
|---|---|---|---|
| **Continue** | | | |
| Observations | 51381 | 40013 | 72699 |
| Plant size<br>Number of employees | 423 | 144 | 136 |
| Capital per worker<br>Millions of Japanese yen | 25.59 | 14.41 | 12.23 |
| Plant TFP<br>Total factor productivity | 1.03 | .94 | .92 |
| Plant wages<br>Millions of Japanese yen | 5.57 | 4.51 | 5.51 |
| Intermediate inputs<br>Millions of Japanese yen | 15558 | 3156 | 2530 |
| Plant sales<br>Millions of Japanese yen | 26275 | 5478 | 4320 |
| **Exit** | | | |
| Observations | 1316 | 1237 | 839 |
| Plant size<br>Number of employees | 207 | 76 | 97 |
| Capital per worker<br>Millions of Japanese yen | 28.22 | 14.77 | 11.76 |
| Plant TFP<br>Total factor productivity | 1.02 | .88 | .90 |
| Plant wages<br>Millions of Japanese yen | 6.16 | 4.56 | 4.53 |
| Intermediate inputs<br>Millions of Japanese yen | 6819 | 1678 | 1721 |
| Plant sales<br>Millions of Japanese yen | 11678 | 2904 | 3004 |
| **Enter** | | | |
| Observations | 680 | 798 | 752 |
| Plant size<br>Number of employees | 244 | 112 | 107 |
| Capital per worker<br>Millions of Japanese yen | 30.79 | 19.37 | 15.90 |
| Plant TFP<br>Total factor productivity | .95 | .86 | .89 |
| Plant wages<br>Millions of Japanese yen | 4.94 | 3.86 | 4.35 |
| Intermediate inputs<br>Millions of Japanese yen | 8205 | 2513 | 2197 |
| Plant sales<br>Millions of Japanese yen | 14447 | 4285 | 3480 |

*Notes:* The MNE group comprises both single- and multi-plant multinationals. 'Multi-plant' refers to domestic multi-plant firms.

### 3.3 What is the Magnitude of the 'Footloose' Effect?

To investigate the 'footloose' effect we employ survival analysis. The hazard function, $h(t)$, is defined as the rate at which plants exit in the interval between $t$ and $t+1$ conditional upon having survived until $t$. Failure is defined as when a plant exits and survival is the number of years the plant is present in the dataset. The hazard rate is specified as

$$h(t) = h_0(t)e^{X\beta} \tag{3.1}$$

where $h_0$ is the baseline hazard. $X$ is a vector containing plant, firm and industry variables. Throughout the analysis a Cox proportional hazards model is used due to its flexibility though we also use duration models to ensure our results are not a product of unobserved heterogeneity. Using a Cox model also implicitly incorporates entry into the model. A hazard ratio less than 1 indicates that an explanatory variable reduces the probability of exit while values in excess of 1 imply a greater risk of failure.

A range of plant, firm and industry variables such as plant size, firm export status and measures of import penetration are included in the regression to capture factors that have been shown to affect survival in other contexts. In order that we capture time-varying industry characteristics we measure the plant variables relative to the industry. For example, plant size is calculated as the natural logarithm of the number of workers in plant $i$ divided by the average number of plant employees in plant $i$'s industry. We construct similar measures for productivity, wages and capital and material intensity.[25]

Generally we find that the plants that are most vulnerable to closure in Japan are similar to those studied in other countries by Dunne et al. (1989), Görg and Strobl (2003), Mata and Portugal (1994), Bernard and Sjoholm (2003) and Bernard and Jensen (2007). Plants that are large, productive and capital intensive are less likely to exit. Of the plant characteristics it is size that has the strongest effect on reducing the hazard rate by 72.3% while the point estimates on the capital intensity and TFP variables are closer to one at 0.81 and 0.57. Contrary to Bernard and Jensen's (2007) findings for the United States, high-wage Japanese plants are more likely to exit. To capture the how the plant's position in the production chain affects its survival we also include a measure of the input intensity (or material intensity) of the plant relative to the firm. Input intensity is defined as the ratio of intermediate inputs to sales. We interpret higher values as indicating upstream production. The results suggest that firms are more likely to close plants producing intermediate inputs rather than final goods.

[25] When the plant variables are included by themselves, rather than relative to the industry, the results remain robust.

Unlike in studies of other countries we do not find firm exporting status to affect survival. Elsewhere in the literature exporters have been found to be less likely to close due to their superior characteristics (see The International Study Group on Exports and Productivity, (2007) for a cross-country comparison). Although exporters are often believed to be less vulnerable to closure, the reason why this should be is not necessarily apparent. However, international engagement matters when the firm imports. In this case a plant faces a hazard 23.2 percent above the baseline, a first indication that offshoring may be a motive behind the decision to shut plants. We also find that the firm's R&D intensity has little effect upon a plant's survival. However, when the plant characteristics are excluded in regression 3 R&D intensity becomes significantly negatively correlated with failure. This indicates that firms with high R&D intensities tend to own 'better' plants.

Conditional on these plant characteristics we also find evidence that multinational firms are 'footloose'. Within regression 1 we find than plants belonging to multinational firms face a hazard ratio that is approximately twice as high as that faced by plants owned by firms that operate exclusively in the domestic market. When the base category is set to domestic single plant firms in regression 2 we see that multinational ownership raises the risk of failure by 224%. Part of the explanation for this inflation in the hazard ratio is that we are now considering domestic multi-plant firms as a separate entity. We observe that multiplant status has the traditional effect of increasing the probability a plant will exit.

Across the sample there are 53,338 observations of multinational owned plants. Although 78% of this group are also multi-plant firms this means that there are still a large number of single-plant multinational firms. In later regressions we exploit this variation to investigate whether the 'footloose' effect is attributable to multinationals being predominantly multi-plant firms. A clear ordering of the probability of plant exit is found in regression 3 according to multiplant and MNE status. Relative to domestic single-plant firms we find that multiplant multinationals are the most likely to shutdown their plants followed by domestic multi-plant firms and then single-plant multinationals. The premium upon plant survival within the multinational category differs substantially according to whether the firm owns more than one plant: multiplant MNEs raise the hazard by 292% compared with 62% for single-plant multinationals. The existing evidence on the link between survival and multiplant ownership is ambiguous. After controlling for plant features, Bernard and Jensen (2007) find that there is no difference in the likelihood of exit for plants owned by a multiplant firm in the United States, while Mata and Portugal (1994) and Bandick (2007) find the contrary results for Portugal and Sweden respectively. For Japan we find that belonging to a domestic multiplant firm increases the hazard by approximately 134%. This indicates that patterns of exit are similar across multi-plant firms regardless of whether they have foreign affiliates and that the footloose effect is not confined to multinationals alone.

Table 3.5: Magnitude of the 'Footloose' Effect

| Variable/Regression | 1<br>Haz. Ratio | 2<br>Haz. Ratio | 3<br>Haz. Ratio | 4<br>Haz. Ratio | 5<br>Haz. Ratio | 6<br>Haz. Ratio |
|---|---|---|---|---|---|---|
| MNE dummy | 2.036 | 3.236 | | | | |
| | (11.70)** | (17.19)** | | | | |
| Multiplant MNE dummy | | | 3.92 | 3.911 | 3.19 | 4.086 |
| | | | (18.33)** | (17.56)** | (16.26)** | (14.21)** |
| Single plant MNE dummy | | | 1.623 | 1.647 | 1.391 | 1.498 |
| | | | (4.60)** | (4.62)** | (3.16)** | (3.21)** |
| Domestic multiplant dummy | | 2.296 | 2.338 | 2.308 | 3.149 | 4.216 |
| | | (14.58)** | (14.86)** | (14.17)** | (20.83)** | (16.53)** |
| **Plant Variables** | | | | | | |
| Size | 0.277 | 0.297 | 0.3 | 0.284 | | |
| | (28.46)** | (27.86)** | (28.13)** | (27.54)** | | |
| Capital intensity | 0.817 | 0.821 | 0.812 | 0.805 | | |
| | (8.81)** | (8.66)** | (9.15)** | (9.10)** | | |
| TFP | 0.542 | 0.561 | 0.568 | 0.55 | | |
| | (8.75)** | (8.17)** | (8.04)** | (8.22)** | | |
| Wages | 2.194 | 2.264 | 2.22 | 2.23 | | |
| | (9.31)** | (9.82)** | (9.60)** | (9.18)** | | |
| Material intensity | 0.72 | 0.732 | 0.745 | 0.732 | | |
| | (7.45)** | (7.18)** | (6.78)** | (6.86)** | | |
| **Firm Variables** | | | | | | |
| Export dummy | 1.038 | 1.008 | 0.993 | 0.99 | 0.929 | 0.906 |
| | (0.58) | -0.13 | (0.11) | (0.14) | (1.11) | (1.18) |
| Import dummy | 1.232 | 1.213 | 1.223 | 1.236 | 1.162 | 1.205 |
| | (3.23)** | (3.01)** | (3.09)** | (3.14)** | (2.39)* | (2.35)* |
| R&D intensity | 1.012 | 1.005 | 1.002 | 1.001 | 0.979 | 0.972 |
| | (4.18)** | (1.77)+ | (0.65) | (0.46) | (7.39)** | (7.69)** |
| **Industry Variables** | | | | | | |
| Grubel-Lloyd index | 0.882 | 0.884 | 0.885 | 0.879 | 0.91 | 0.868 |
| | (0.90) | -0.89 | (0.88) | (0.93) | (0.67) | (0.79) |
| LWPEN | 1.036 | 1.043 | 1.05 | 1.049 | 1.045 | 1.044 |
| | (0.33) | -0.4 | (0.46) | (0.45) | (0.41) | (0.33) |
| OTHPEN | 0.914 | 0.904 | 0.897 | 0.911 | 0.96 | 0.959 |
| | (0.52) | -0.58 | (0.62) | (0.53) | (0.23) | (0.18) |
| Sunk costs | 0.959 | 0.959 | 0.958 | 0.959 | 0.96 | 0.952 |
| | (2.85)** | (2.86)** | (2.89)** | (2.88)** | (2.76)** | (2.63)** |
| Theta | | | | 0.00 | | 16.72 |
| | | | | (0.39) | | (3.66) |
| Log pseudolikelihood | | | | | | |
| Number of observations | 131669 | 131669 | 131669 | 131669 | 131669 | 131669 |

*Notes*: Cox Proportional hazards model is used in regressions 1, 2, 3 and 5. A duration model is used in regressions 4 and 6 with the hazard parameterised using a Weibull distribution and unobserved heterogeneity assumed to be gamma distributed. Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

Of the remaining industry level control variables included in regression 3 of Table 3.5, only industry sunk costs are found to have a significant effect on exit. This supports evidence from Dunne et al. (1988, 1989) and Bernard and Jensen (2007) for the US, Geroski (1991a, 1991b) for the UK and Greenaway et al. (2008) for Sweden. For Japan we do not find industry measures of globalisation to affect exit. This contrasts with the evidence from Bernard et al. (2006) who found that imports from both low-wage and other countries increase the probability that a plant will die in the United States, and is a feature of the results discussed in greater detail in the previous chapter.

In regression 5 we test the extent to which the evidence for multinationals being more likely to close plants is conditional on the inclusion of other plant controls. We test this by excluding the other plant controls. We continue to observe that domestic multi-plant firms, multinationals and importers are significantly more likely to shutdown their plants. In contrast with Bernard and Jensen's (2002) findings for the United States we find that this view of multinationals as footloose is unconditional.

More generally multinationals are more likely to closedown their plants than single-plant domestic firms.

In the remaining regressions of the table we consider the robustness of our findings to different estimation techniques. A particular concern is that the results may be a product of unobserved heterogeneity. To control for this we estimate the model using a duration model with the hazard rate assumed to follow a Weibull distribution and unobserved heterogeneity parameterised by a gamma distribution. The results in regression 4 of Table 3.5 are robust to this change. We continue to find that large, capital intensive, productive plants with low wage costs are less likely to exit as are materially intensive plants. The firm-level variables are also unchanged. Importers and domestic multi-plant firms remain more likely to close plants, as are both types of multinationals. Sunk costs continue to be the sole significant industry-level determinant of exit. The duration parameter, theta, is found to be insignificant with a t-statistic of 0.39. Unreported cumulative hazard plots also show our model to be correctly specified. When we exclude the plant variables from the model in regression 6 the duration parameter becomes significant. However, the following regressions include the variables used in regression 3 which leads us to conclude the results are not an artefact of unobserved heterogeneity.

## 3.4 Exit within Multi-plant firms

Given that multinational firms have been shown to be more likely to shut their plants, an interesting question that follows from this is, can we identify the characteristics of those plants and the possible motives behind their closure. In Table 3.6 we consider these questions separately for multi-plant firms that only have operations domestically and those with foreign affiliates. In the following regressions in addition to the existing plant variables the plant variables are measured relative to the firm. For example, the relative size ratio is the natural logarithm of the number of plant employees divided by the number of workers employed by the firm. Similar measures are constructed for wages, capital and input intensity. Difficulties in comparing productivity across possibly different industries of the firm lead us to exclude this variable from this part of the analysis.

A feature of the results in Table 3.6 is the high degree of similarity between the type of plants that are closed by multinationals and domestic multi-plant firms. For example, regardless of whether the firm has affiliates abroad or not, plants that are large, high productivity and materially intensive are less vulnerable to closure. Moreover, plants that are large relative to the firm face significantly lower hazard rates although the effect is stronger for plants with domestic only owners. Plants that are capital intense relative to the firm are more likely to survive but only among domestic multi-plant firms. For both domestic multi-plant firms we continue to observe that plants paying high wages relative to the industry are approximately twice as vulnerable to close; an indication of outsourcing. However, conditional upon this plants which pay relatively high wages within domestic multi-plant firms face lower hazard rates. This may be an indication that domestic multi-plant firms tend to concentrate production among their best plants.

Table 3.6: Exit within Multiplant Firms

| Sample<br>Variable/Regression | MNE<br>1 | Multi<br>2 | Both<br>3 |
|---|---|---|---|
| Relative size | 0.804 | 0.738 | 1.202 |
| | (1.71)+ | (3.32)** | (1.67)+ |
| Relative capital intensity | 0.871 | 0.729 | 1.168 |
| | (1.50) | (5.04)** | (1.61) |
| Relative wage | 1.001 | 0.719 | 1.534 |
| | (0.01) | (2.01)* | (1.90)+ |
| Relative material intensity | 0.922 | 1.011 | 0.9 |
| | (1.52) | (0.32) | (2.28)* |
| **Plant Variables** | | | |
| Size | 0.382 | 0.312 | 1.155 |
| | (7.49)** | (11.75)** | (1.34) |
| Capital intensity | 0.811 | 1.032 | 0.815 |
| | (2.20)* | (0.51) | (2.06)* |
| TFP | 0.599 | 0.601 | 1.002 |
| | (4.37)** | (4.92)** | (0.01) |
| Wages | 2.306 | 2.056 | 1.028 |
| | (4.34)** | (4.63)** | (0.12) |
| Material intensity | 0.741 | 0.845 | 0.896 |
| | (3.19)** | (2.53)* | (1.06) |
| **Firm Variables** | | | |
| Export dummy | 0.965 | 0.878 | 1.186 |
| | (0.27) | (1.27) | (1.04) |
| Import dummy | 1.042 | 1.153 | 0.868 |
| | (0.37) | (1.31) | (0.93) |
| R&D intensity | 0.996 | 0.986 | 1.016 |
| | (0.49) | (2.92)** | (1.82)+ |
| Same industry dummy | 0.938 | 0.931 | 0.925 |
| | (0.69) | (0.90) | (0.68) |
| Multinational dummy | | | 0.332 |
| | | | (1.26) |
| **Industry Variables** | | | |
| Grubel-Lloyd index | 1.032 | 0.848 | 1.099 |
| | (0.12) | (0.73) | (1.10) |
| LWPEN | 1.152 | 1.094 | 1.052 |
| | (0.74) | (0.52) | (1.04) |
| OTHPEN | 1.029 | 0.602 | 1.021 |
| | (0.10) | (1.54) | (0.26) |
| Sunk costs | 0.934 | 0.983 | 0.951 |
| | (2.66)** | (0.70) | (1.66)+ |
| Theta | | | |
| Log pseudolikelihood | | | |
| Number of observations | 131669 | 131669 | 131669 |

*Notes*: Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. 'Multi' refers to domestic multiplant firms. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

We also include in the regression a variable indicating whether the plant operates in the same 3 digit industry as the firm itself. Kimura and Fujii (2003) have previously suggested that plant closure in Japan was attributable to firm's expansion into industries outside their core competencies in the 1980s. We do not find this to be the case. Similarly exporting status continues to be an insignificant determinant of exit but now so too is the import dummy. This suggests differences in hazard rates between multiplant and single-plant firms were driving this relationship in Table 3.5. Finally there are reasons to believe that that a firm's R&D expenditure may affect the markets in which a firm operates. Baldwin and Gu (2004) find Canadian exporters to perform more R&D than non-exporters. For Spain, Perez et al. (2004) find that R&D intensity lowers the hazard rate. Kimura and Kiyota (2003) also find Japanese firms which conduct R&D face lower hazard rates. R&D intensity lowers the probability of exit only among domestic multi-plant firms but the effect is small.

The effect of the industry-level variables remains similar to those found in Table 3.5, in particular the globalisation variables are again not found to affect closure among multi-plant firms. The sunk cost variable remains significant but only for multinational owned plants suggesting they tend to operate in more competitive industries.

In regression 3 we test whether the behaviour of MNEs and non-MNEs can be more formally accepted as different. We pool the observations on all multi-plant firms and then include a multinational dummy variable which takes the value of 1 if the firm is either a domestic or foreign multiplant multinational and zero if the owner is a domestic multiplant firm and then interact this variable with the plant, firm and industry variables. For reasons of space we report the coefficient estimates for the interactions between the multinational variable and the plant, firm and industry variables only.

The results from this regression confirm that multinationals and multi-plant non-MNEs behave similarly in their choice about which plants to shut. In this sense domestic MNEs are no more likely to shutdown plants than domestic multi-plant firms. The interactions only show a few significant differences between the criteria used to close plants across these firms. Specifically, multinationals are significantly more likely to close relatively large plants and those that are capital un-intensive. Likewise the R&D intensity interaction shows domestic multi-plant firms with high R&D intensities are significantly less likely to close plants than similar multinationals. We also find that industry sunk costs are more important within multinationals.

### 3.5 'Footloose' Multinationals?

The results in the previous section showed that multinationals are more likely to close relatively small plants; a traditional indication of weakness. Given that on average MNEs plants display superior performance characteristics compared to non-MNEs, in this section of the paper we consider two hypotheses. First, whether the footloose nature of multinationals can be explained by the attributes of the plants they close. The second test builds on the evidence in Table 3.6 and asks whether it is this process of closing plants that are weaker *relative* to the rest of the firm that explains why MNEs were found to be footloose in Table 3.5.

The introduction of interactions between the plant variables and the multi-plant MNE, single-plant MNE and domestic multi-plant firm indicators in regression 1 of Table 3.7 is capable of explaining the footloose nature of single-plant multinationals. Conditional on plant, firm and industry characteristics single-plant MNEs, it is the material intensity of plants closed by single-plant multinationals that explains their footloose nature. Specifically, exit is decreasing in the plant's material intensity. We also find that large plants face higher hazards when owned by single-plant firms but this result is conditional and due to the inclusion of the plant size variable.

While plant characteristics are capable of explaining why single-plant multinationals are found to raise the probability of plant death the same cannot be said for multi-plant MNEs and domestic multi-plant firms. However, we do see that the plant characteristics do affect survival. For example, conditional upon plant characteristics, larger, productive and high wage plants face higher hazard ratios when owned by multi-plant multinationals. Among domestic multi-plant firms more productive plants are more liable to closure. However, these results largely reflect the absolute differences between plants owned by these firm types relative to the base category, domestic single-plant firms.

We return to the issue of whether it is the characteristics of plants relative to their parent that explains why multi-plant firms in general are associated with lower survival rates. To examine whether there is a specific footloose effect or whether this is attributable to the multiplant characteristics of many MNEs we introduce an interaction term between the multiplant MNE (0/1) indicator and the plant relative to firm variables from Table 3.6. If multinationals are inherently footloose then we would expect to observe similar hazard ratios for the multiplant and single-plant MNE variables when we control for the type of plants that are closed within multiplant multinationals. Similar interaction effects are included for domestic multi-plant firms as well.

A comment on the results in column 2 of Table 3.7 would be that multi-plant multinationals appear to be concerned with their production chain while domestic multi-plant firms close their weakest plants. For example, plants that are large and capital intensive relative to the firm are less vulnerable to exit when owned by a domestic multi-plant firm. However, among multi-plant MNEs these variables are insignificant but plants that are relatively material intensive within the group have higher survival rates. Given that one motive for closing upstream plants producing intermediate inputs is to take advantage of lower production costs abroad it would seem that this has predominantly affected multinational firms within Japan.

When the relative plant variables are included in the regression multiplant multinationals are no longer footloose. Rather plants belonging to multiplant MNEs face a hazard 89.2% lower than the baseline. Hence, when we condition upon the process of plant closure among multiplant multinational firms we find that rather than being footloose they are significantly less likely to close their plants. This residual impact may be due to superior organisational characteristics. For example, pan-national organisations possess managerial capabilities to enable the coordination of production across borders. Alternatively, where a multinational decides to locate more than one plant in a country may be an indication of the importance of that market to the MNE or that it is favourable to produce in that country. Finally, the characteristics of plants relative to their parents render the domestic multi-plant dummy insignificant. The literature suggests that multi-plant ownership raises the probability that a plant will die. Our results suggest that this trait of multi-plant ownership is due to the closure of the weakest plants by domestic multi-plant firms and changes in production chains by multi-plant multinationals.

Table 3.7: Differences in Hazard Rates between Groups

| Base category | S DOM Haz. Ratio | S MNE Haz. Ratio |
|---|---|---|
| Multiplant MNE dummy | 3.813 | .108 |
| | (5.93)** | (3.27)** |
| Singleplant MNE dummy | 1.926 | 2.057 |
| | (1.54) | (1.66)+ |
| Domestic multiplant dummy | 1.546 | .578 |
| | (2.04)* | (.98) |
| *Plant relative to firm variables interacted with multi-plant MNE dummy* | | |
| Relative size | | .993 |
| | | (.08) |
| Relative capital intensity | | .926 |
| | | (.96) |
| Relative wages | | 1.165 |
| | | (.99) |
| Relative material intensity | | .847 |
| | | (4.44)** |
| *Plant relative to firm variables interacted with domestic multi-plant dummy* | | |
| Relative size | | .833 |
| | | (2.27)* |
| Relative capital intensity | | .778 |
| | | (4.23)** |
| Relative wages | | .782 |
| | | (1.61) |
| Relative material intensity | | .955 |
| | | (1.41) |
| *Multiplant MNE dummy interacted with* | | |
| Size | 1.421 | 1.241 |
| | (4.05)** | (2.13)* |
| Capital intensity | 1.025 | .984 |
| | (.42) | (.17) |
| TFP | 1.543 | 1.353 |
| | (2.20)* | (1.51) |
| Wages | 2.069 | 1.325 |
| | (3.32)** | (1.07) |
| Material intensity | .942 | 1.021 |
| | (.52) | (.18) |
| *Singleplant MNE dummy interacted with* | | |
| Size | 1.302 | 1.319 |
| | (1.66)+ | (1.71)+ |
| Capital intensity | 1.116 | 1.119 |
| | (1.02) | (1.02) |
| TFP | 1.165 | 1.148 |
| | (.40) | (.35) |
| Wages | 1.190 | 1.212 |
| | (.48) | (.53) |
| Material intensity | .582 | .569 |
| | (2.41)* | (2.43)* |
| *Domestic multiplant dummy interacted with* | | |
| Size | .945 | 1.008 |
| | (.67) | (.09) |
| Capital intensity | 1.030 | 1.225 |
| | (.56) | (2.88)** |
| TFP | 1.530 | 1.419 |
| | (2.22)* | (1.78)+ |
| Wages | 1.174 | 1.199 |
| | (.71) | (.77) |
| Material intensity | 1.184 | 1.167 |
| | (1.64) | (1.47) |

Table 3.7 continued

| Base category | S DOM Haz. Ratio | S MNE Haz. Ratio |
|---|---|---|
| **Plant Variables** | | |
| Size | .255 | .254 |
| | (18.53)** | (17.66)** |
| Capital intensity | .788 | .790 |
| | (5.59)** | (5.51)** |
| TFP | .399 | .417 |
| | (5.63)** | (5.18)** |
| Wage | 1.543 | 1.559 |
| | (2.35)* | (2.39)* |
| Material intensity | .722 | .755 |
| | (3.84)** | (3.22)** |
| **Firm Variables** | | |
| Export dummy | .994 | .980 |
| | (.10) | (.31) |
| Import dummy | 1.222 | 1.174 |
| | (3.06)** | (2.48)* |
| Firm R&D intensity | 1.002 | .992 |
| | (.73) | (2.57)* |
| **Industry Variables** | | |
| Grubel-Lloyd index | .897 | .906 |
| | (.78) | (.71) |
| LWPEN | 1.056 | 1.056 |
| | (.51) | (.51) |
| OTHPEN | .913 | .925 |
| | (.52) | (.45) |
| Sunk costs | .958 | .955 |
| | (2.91)** | (3.11)** |
| Log pseudo likelihood | -31035 | -30857 |
| Number of observations | 131669 | 131648 |

*Notes*: Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. 'Multi' refers to domestic multiplant firms. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

### 3.6 Conclusions

This chapter has sought to understand why MNE and domestic multiplant ownership are associated with lower plant survival despite the superior characteristics of their plants. Using unique Japanese data that links plant data with firm data we find that the 'footloose' effect of multinational ownership is attributable to multinationals choosing to close plants based upon production chain decisions. Specifically, the material intensity of exiting plants is capable of explaining the footloose characteristic of single-plant MNE ownership while when we control for the material intensity of the plant relative to the firm multi-plant multinationals are significantly more likely to keep their plants open. The results also illustrate that the positive link between plant death and multi-plant ownership that is found so often in the literature is also due to the relative characteristics of exiting plants. Domestic multi-plant firms are significantly more likely to close plants that are small and capital un-intensive relative to the other parts of the firm. When we control for this the domestic multi-plant dummy becomes insignificant suggesting that the traditional positive link is due to these firms closing their weakest units.

The results have a potentially interesting implication for aggregate productivity growth in Japan. Within the Melitz (2003) model of heterogenous firms and international trade, trade liberalisation is welfare improving because it leads to the death of the least productive firms. Subsequently, their output is then reallocated towards more productive firms within the industry which raises aggregate productivity. An assumption of the model is that the least productive firms will always be the ones that exit. However, our results suggest that when a plant is weaker compared to other units within the same firm, but both larger and more productive relative to other firms in the same industry, its death could disrupt the positive effect that increased globalisation is predicted to have on aggregate industry productivity. Based on a Griliches and Regev decomposition of aggregate productivity growth we find for Japan that this effect is small. Entry and exit account for 2 per cent of total aggregate productivity growth.[26] This is perhaps explained by the Japanese context however, which has been characterised by both low productivity growth and low rates of entry and exit (Caballero et al., 2003; Peek and Rosengren, 2003; Ahearne and Shinada, 2005). It would therefore be interesting to investigate this possible negative effect of globalisation in other contexts.

[26] This finding is robust to the use of a Foster, Haltiwanger and Krizan decomposition.

### 3.7 Appendix 3

**Total Factor Productivity**

There are 48 manufacturing industries in our dataset. Total factor productivity (TFP) is calculated for each plant relative to the industry average. Following Aw et al. (1997), we define the TFP level of establishment $p$ in year $t$ in a certain industry in comparison with the TFP level of a hypothetical representative establishment in year 0 in that industry as follows

$$\begin{aligned} \ln TFP_{pt} &= \left(\ln Q_{ft} - \overline{\ln Q_t}\right) - \sum_{i=1}^{n} \frac{1}{2}\left(S_{ift} + \overline{S_{it}}\right)\left(\ln X_{ift} - \overline{\ln X_{it}}\right) \\ &+ \sum_{s=1}^{t}\left(\overline{\ln Q_s} - \overline{\ln Q_{s-1}}\right) - \sum_{s=1}^{t}\sum_{i=1}^{n}\left(\overline{S_{is}} + \overline{S_{is-1}}\right)\left(\overline{\ln X_{is}} - \overline{\ln X_{is-1}}\right) \end{aligned} \tag{1}$$

where $Q_{ft}$, $S_{ift}$ and $X_{ift}$ denote the gross output of plant $f$ in year $t$, the cost share of factor $i$ for establishment $p$'s input of factor $i$ in year $t$. Variables with an upper bar denote the industry average of that variable. We use 1994 as the base year. Capital, labour and real intermediate inputs are used as factor inputs.

The representative establishment for each industry is defined as a hypothetical establishment whose gross output as well as input and cost share of all production factors are identical to the industry average. The first two terms on the right hand side of equation (1) denote the gap between plant $f$'s TFP level in year $t$ and the representative establishment's TFP level in year $t$ and the representative establishment's TFP level in the base year. $\ln TFP_{ft}$ in equation (1) constitutes the gap between establishment $f$'s TFP level in year $t$ and the representative establishment's TFP level in the base year.

**Industry Variables**

Globalisation has been shown to cause exit. The source of import competition in the US affects plant survival and causes firms to adjust their product mix (Bernard and Jensen, 2002; Bernard et al., 2006). We disaggregate import penetration into low-wage import penetration (LWPEN) and import penetration from all other countries (OTHPEN)[27]. These measures are calculated as:

$$LWPEN_{it} = \frac{M_{it}^{LW}}{M_{it} + Y_{it} - X_{it}} \quad ; \quad OTHPEN_{it} = \frac{M_{it} - M_{it}^{LW}}{M_{it} + Y_{it} - X_{it}}$$

where $LWPEN_{it}$ represents low-wage country import competition in industry $i$ at time $t$, $M_{it}^{LW}$ is the value of imports from low-wage countries in industry $i$ at time $t$, $M_{it}$ and $X_{it}$ represents the value of total imports and exports in industry $i$ at time $t$ and $Y_{it}$ denotes output in industry $i$ during year $t$. $OTHPEN_{it}$ denotes imports from all countries except low-wage economies.

[27] Countries are deemed to be low-wage where they have a GDP less than 5% that of Japan.

Bernard et al. (2006) find that both forms of import competition raise the probability of closure. A one standard deviation increase in LWPEN increases the probability of plant exit by 2.2 percentage points which is considerably greater than the effect of OTHPEN. Similar results are found by Greenaway et al. (2008) for Sweden. In their results, the estimated coefficient on imports from outside the OECD is twice as large as that for OECD imports.

Intra-industry trade is often found to have a positive effect upon firm exit. As international trade grows firms diversify their product range which may lead them to enter new industries and exit sectors they operate in currently. It has been established by Greenaway et al. (2008) that firms do not just closedown their operations, they switch to new industries too. Using Swedish manufacturing data they find that intra-industry trade leads to exit through plant closure, and, mergers and acquisition. This is also found by Bernard et al. (2006) for the United States: firms which are confronted by low-wage import competition sometimes switch to more capital intensive sectors.

Our measure of intra-industry trade is constructed using the Grubel-Lloyd index:

$$GL_{it} = \left[(X_{it} + M_i) - |X_{it} - M_{it}|\right]\frac{100}{(X_{it} + M_i)}$$

where $GL_{ijt}$ is the Grubel-Lloyd index of intra-industry trade in industry $i$ in year $t$, $X_i$ are exports in industry $i$ during year $t$ and $M_{it}$ are imports in industry $i$ during year $t$.

The industry variables mentioned so far capture the influence of globalisation upon plant exit. We also include a measure of sunk costs. The empirical literature has identified sunk costs as being an important factor in shaping exit. Sunk costs also play a key role in determining exporting behaviour (Roberts and Tybout, 1997) and can affect the distribution of productivity in the industry (Aw et al., 2002).

Appendix Table 3.1: Industry-level Variables

| Variable | Obs | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| Grubel-Lloyd index<br>Trade that is intra-industry | 144739 | .50 | .27 | .01 | 1.00 |
| Sunk costs<br>Minimum of entry and exit rates | 155714 | .01 | .01 | .00 | .05 |
| Import competition<br>Imports divided by apparent consumption | 121760 | .09 | .09 | .00 | .67 |
| LWPEN<br>Low-wage imports | 121760 | .03 | .04 | .00 | .28 |
| OTHPEN<br>Imports from all other countries | 121760 | .06 | .06 | .00 | .55 |

Appendix Table 3.2: Multinational Interactions

| Variable/Regression | 1<br>Haz. Ratio | 2<br>Haz. Ratio | 3<br>Haz. Ratio | 4<br>Haz. Ratio |
|---|---|---|---|---|
| Multiplant MNE dummy | 1.838 | 3.813 | 3.93 | 0.091 |
| | (4.86)** | (17.70)** | (18.25)** | (6.75)** |
| Singleplant MNE dummy | 1.631 | 1.619 | 1.623 | 1.691 |
| | (4.66)** | (4.58)** | (4.60)** | (4.98)** |
| Domestic multiplant dummy | 2.426 | 2.34 | 2.337 | 2.315 |
| | (15.43)** | (14.88)** | (14.85)** | (14.62)** |
| **Plant relative to firm variables interacted with the multiplant MNE dummy** | | | | |
| Relative size | 0.741 | | | |
| | (7.25)** | | | |
| Relative capital intensity | | 0.94 | | |
| | | (1.37) | | |
| Relative wages | | | 1.033 | |
| | | | (0.28) | |
| Relative material intensity | | | | 0.839 |
| | | | | (10.94)** |
| **Plant Variables** | | | | |
| Size | 0.326 | 0.3 | 0.301 | 0.276 |
| | (24.08)** | (28.11)** | (28.11)** | (34.70)** |
| Capital intensity | 0.794 | 0.824 | 0.812 | 0.781 |
| | (10.10)** | (7.50)** | (9.11)** | (10.77)** |
| TFP | 0.574 | 0.566 | 0.568 | 0.56 |
| | (8.04)** | (8.00)** | (8.02)** | (8.33)** |
| Wages | 1.995 | 2.233 | 2.198 | 1.879 |
| | (8.40)** | (9.61)** | (8.45)** | (7.58)** |
| Material intensity | 0.753 | 0.744 | 0.745 | 0.795 |
| | (6.60)** | (6.73)** | (6.76)** | (5.32)** |
| **Firm Variables** | | | | |
| Export dummy | 0.987 | 0.995 | 0.993 | 0.979 |
| | (0.20) | (0.08) | (0.10) | (0.31) |
| Import dummy | 1.215 | 1.223 | 1.224 | 1.194 |
| | (3.03)** | (3.08)** | (3.11)** | (2.71)** |
| R&D intensity | 0.998 | 1.002 | 1.002 | 0.997 |
| | (0.57) | (0.57) | (0.68) | (0.85) |
| **Industry Variables** | | | | |
| Grubel-Lloyd index | 0.896 | 0.888 | 0.885 | 0.897 |
| | (0.79) | (0.86) | (0.88) | (0.78) |
| LWPEN | 1.046 | 1.053 | 1.049 | 1.043 |
| | (0.42) | (0.49) | (0.46) | (0.40) |
| OTHPEN | 0.911 | 0.9 | 0.898 | 0.915 |
| | (0.53) | (0.60) | (0.61) | (0.50) |
| Sunk costs | 0.956 | 0.958 | 0.958 | 0.956 |
| | (3.02)** | (2.90)** | (2.89)** | (3.07)** |
| Industry dummies | Yes | Yes | Yes | Yes |
| Year dummies | Yes | Yes | Yes | Yes |
| Log pseudo likelihood | | | | |
| Number of observations | | | | |

*Notes*: Z-scores are clustered at the firm level and reported in parentheses. The multinational dummy includes domestic and foreign multinationals. The industry dummies include controls for the both the plant and firm's industry. **, * and + indicate significance at the 1, 5 and 10 percent level of confidence.

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# Chapter Four

# Trade Costs: A Source of Comparative Advantage

## 4.1 Introduction

The goods a country exports are decided by numerous considerations that may be grouped under the broad banner of trade costs. The magnitude of trade costs is large: Anderson and van Wincoop (2004) report that the finished factory price of a good rises five-fold depending on the destination market. We estimate that even within Europe, the most integrated region of the world, trade costs have a tariff equivalent of 229% in 2006. Although traditional measures of protection such as tariffs and non-tariff barriers have been gradually eliminated through time, more difficult to observe factors such as language, information flows and bureaucracy continue to exert a highly distortionary impact upon trade.

In recent years many, often novel, attempts have been made to discern how certain facets of trade costs impact on trade flows. Barriers to trade have been shown to consist not only of traditional protectionist measures such as tariffs and non-tariff barriers, but to extend to more subtle aspects as well. While macroeconomic factors such as currency unions have been found to affect aggregate trade flows between countries (Rose and van

Wincoop, 2001) microeconomic considerations have attracted more attention. For example, shipping cartel monopoly power (Hummels, Lugovskyy and Skiba, 2009), firm level fixed exporting costs (Bernard and Jensen, 1995; Bernard and Wagner, 1997; Roberts and Tybout, 1997) and information flows between entrepreneurs (Rauch and Trindade, 2002; Felbermayr, Jung and Toubal, 2009) have been found to affect trade flows, and by extension, trade costs. Nor is it true that economic factors are the sole determinants of trade costs; geographic characteristics have been shown to be important as well. Gravity models invariably return a negative sign on the distance variable while the median landlocked country trades 55% less than the median coastal country (Limao and Venables, 1999).

Debate has thus far concentrated on quantifying the effect specific forms of trade costs have on the volume of trade and on the related issue of traded and non-traded goods. Until recently there has been relatively little consideration of how trade costs affect trade patterns and the sources of comparative advantage, either theoretically or empirically. However, Levchenko (2007) advances a theoretical model of how a country's institutions affect its export specialisation and then provides empirical evidence to support the theory by demonstrating that countries with good institutions export institutionally intensive goods. In another study Nunn (2007) constructs a measure of an industry's legal intensity and then establishes that countries with good legal institutions export relatively more goods which require relationship-specific investments.

The major premise presented in this chapter is consistent with the emphasis on trade costs shaping the pattern of trade in Levchenko (2007) and Nunn (2007). However, rather than focus on how a specific trade cost shapes trade patterns we expand the analysis to consider aggregate trade costs. We consider explicitly whether a country's trade costs may be treated as an endowment which shapes trade flows in similar fashion compared to traditional endowments such as human and physical capital. We then test to see whether trade costs are a source of comparative advantage that leads to specialisation in the export of goods that are sensitive to trade costs in the same manner as countries with large stocks of traditional endowments specialise in producing skill and capital intensive goods.

The analysis begins by demonstrating a means of measuring bilateral, and consequently aggregate, trade costs by adapting the gravity model to eliminate the multilateral resistances that have proven so difficult in quantifying trade costs. We then proceed to provide an overview of the behaviour of trade costs across 108 countries during the period 1980 to 2006. The analysis then proceeds to investigate whether trade cost endowments act as a source of comparative advantage using industry-level data from 26 OECD countries during the period 1988-2000. To do this we rely on data on the share of imported intermediate inputs used in the production of exports at the 2-digit ISIC level. This provides a window into the extent to which a good is affected by trade costs. In environments where trade costs are high the cost of producing a good which utilises a high share of imported intermediates in producing exports will be relatively more expensive than in a low trade cost setting and affect comparative advantage.

We find compelling evidence to support this hypothesis. Specifically, countries with 'good' trade cost endowments specialise in exporting goods that are trade cost intensive.[28] We also investigate whether comparative advantage begins within a country's region and conduct various robustness and endogeneity checks. Until now theoretical models have used melting iceberg trade costs as the mechanism through which countries move between autarky and free trade. The work in this chapter contributes to a new literature which demonstrates how trade costs by themselves may be a source of comparative advantage worthy of theoretical modelling. It also shows that firm entry into export markets is also influenced by institutional factors that have been largely neglected.

The rest of the chapter is structured as follows. In section 4.2 we provide an overview of the recent literature on trade costs and the pattern of trade. Section 4.3 provides a theoretical outline of a means of deriving a measure of trade costs from a gravity model. A summary of the dataset and the evolution of trade costs through time is provided in Section 4.4. The core hypotheses are formally investigated in section 4.5 while robustness tests

[28] Trade cost intensity is measured as the share of imported intermediate inputs used in the good's production.

are conducted in sections 4.6 and endogeneity tests in 4.7. Conclusions are drawn in section 4.8.

### 4.2 Literature Review

This section of the chapter reviews the existing evidence on how elements of trade costs influence trade patterns. For a comprehensive review of the literature on trade costs and their impact upon the volume of trade see Anderson and Wincoop (2004). The foundations of this chapter's approach may be traced back to the papers of Keesing (1966) and Baldwin (1971). In Keesing's paper a positive correlation is found between US export performance and industry skill intensities while in industry-level regressions of US net exports at aggregate and bilateral levels Baldwin demonstrated a range of significant relationships with cross-industry factor intensities. However, Leamer's (1980, 1984) critique that cross-commodity or industry comparisons had weak theoretical underpinning led to this strand of the literature becoming unpopular. Specifically, he showed that industry export performance did not depend in a strict Heckscher-Ohlin model on the input characteristics or factor intensities.

Despite these criticisms the cross-industry methodology has been revived. Among other things this has been driven by recognition of, and allowance for, non-factor price equalisation and cross country differences in production techniques and technology. With the factor price equalisation requirement removed the commodity (industry) of production and trade can be determined. Romalis (2004), for example, shows that conditional on factor prices, industry export performance in a quasi Heckscher-Ohlin model is determined by industry input characteristics. Or more specifically, in terms of the interaction of industry factor intensity and relative national factor endowments.

This provides a theoretical underpinning to empirical studies. In the empirical application of his model Romalis (2004) uses US import shares of 123 countries in 370 industries. He shows a strong influence between the relative skill intensity and abundance on each country's share of US imports: skill abundant countries capture greater market share of skill-intensive goods while the exports of countries with low human capital stocks tend to be concentrated on low skill-intensive industries.

Although Romalis's model does not include trade costs it provides a framework upon which they may be incorporated. One of the first studies to do so is Levchenko (2007) which addresses how institutional quality affects the relative share of goods a country exports. His model builds on Romalis (2004) by introducing institutions into the framework. Cross-sectional import data from the United States covering trade with 177 partners in 389 four-digit industries is then used to test the model's predictions. As in the Romalis set-up his regressions include interactions between capital abundance and capital intensity as well as skill endowments and the skill intensity of the industry. However, a further interaction between institutional endowments and the institutional dependence of the industry is further incorporated. Institutional dependence (or intensity) is captured by a Herfindahl index. Where production of a good relies upon a greater number of inputs it is deemed to be more costly to produce in institutionally inferior countries since a greater number of transactions must be made. Levchenko finds that where a country that moves from the 25$^{th}$ to the 75$^{th}$ percentile in institutional quality, the predicted relative import share in the good occupying the 25$^{th}$ percentile in institutional intensity decreases by 0.09 standard deviations. The predicted relative import share of the good corresponding to the 75$^{th}$ percentile in institutional intensity increases 0.18 standard deviations. Institutionally superior countries therefore specialise in exporting goods which are institutionally complex.

A similar study by Nunn (2007) studies a subset of institutional characteristics: the ability to enforce contracts. Where contracts are imperfectly enforced ex post there will be under-investment ex ante. Since countries with better contract enforcement will have less under investment, they will have a cost advantage in the production of goods requiring relationship-specific investments. To test whether this is the case he interacts the quality of a country's legal institutions with a measure of the extent to which each 6-digit industry relies on relationship-specific investments. To construct the latter Nunn uses data on the inputs used by each industry. Where these inputs are traded on open markets they are assumed to require fewer relationship-specific investments. A one standard deviation increase in the judicial quality interaction is found to increase exports by 0.33 standard deviations, providing support for his hypothesis. As in Romalis (2004) and Levchenko (2007), countries with large labour and capital endowments are found to export relatively more in sectors that utilise those inputs intensively.

We build upon these papers to consider whether it is the case that countries with good trade cost endowments export relatively more 'trade cost intensive' goods. Although trade cost intensity appears difficult to conceptualise we believe that the share of imported intermediate inputs used in the production of exports represents a valid proxy. First because it tells us about the proportion of a good's inputs which must be imported for it to be produced and therefore the extent to which the finished good's price is subject to trade costs. Another feature of the measure is that it is reported on a cross-country and cross-industry basis meaning that we capture technological differences which so plagued early empirical investigations of the Heckscher-Ohlin model (see Leontief, 1953; Bowen et al., 1987 and Trefler, 1993, 1995).

## 4.3 Theoretical Foundations – The Gravity Model

The gravity model has proven to be one of the most resolutely robust empirical relationships in economics. In spite of this, using the model to calculate trade costs has proven notoriously difficult, principally due to ambiguity surrounding how to quantify multilateral resistance. This has led authors to use proxies such as common borders and bilateral distance to circumvent reliance upon actual price data (Anderson and van Wincoop, 2003).

However, Novy (2008) presents a means of getting around these problems by demonstrating that multilateral resistance can be captured by intranational trade. The model begins with the familiar gravity formulation in Anderson and van Wincoop (2003) though Novy shows that the final result is invariant to whether the model is derived from a Ricardian (Eaton and Kortum, 2002) or heterogenous firms (Chaney, 2008; Melitz and Ottaviano, 2008) model of international trade.

$$x_{ij} = \frac{y_i y_j}{y^W}\left(\frac{t_{ij}}{\Pi_i P_j}\right)^{1-\sigma} \quad , \tag{4.1}$$

where $x_{ij}$ are bilateral exports between country $i$ and $j$, $y_i$, $y_j$ and $y^W$ are GDP in country $i, j$ and the world respectively, $t_{ij}$ represents bilateral trade costs between the two country pairs, $\Pi_i P_j$ denotes multilateral resistance and $\sigma$ is the elasticity of substitution.

The gravity model posits that all else being equal, bigger countries trade more with each other. Bilateral trade costs decrease bilateral trade but they are measured relative to multilateral resistances to trade: where the barriers between country $i$ and the rest of the world (multilateral barriers) are lower relative to bilateral barriers between $i$ and $j$, country $i$ will trade less with $j$ relative to all other destinations.

The innovation in Novy (2008) is that he shows a change in bilateral trade barriers does not only affect international trade but also intranational trade. For example, when the barriers to trade between country $i$ and all other countries fall some of the goods that were previously consumed domestically are now shipped to foreign countries. Hence, it is not just international trade that is shaped by trade costs but intranational trade as well.

Formally this can be seen through the representation of intranational trade as

$$x_{ii} = \frac{y_i y_i}{y^W}\left(\frac{t_{ii}}{\Pi_i P_i}\right)^{1-\sigma}, \tag{4.2}$$

where $x_{ii}$ is intranational trade and $t_{ii}$ represents intranational trade costs: domestic transportation costs. Through rearrangement equation (4.2) can be solved for inward multilateral resistance

$$\Pi_i P_i = \left(\frac{x_{ii}/y_i}{y_i/y^W}\right)^{\frac{1}{(\sigma-1)}} t_{ii}. \tag{4.3}$$

To eliminate the multilateral resistance terms from equation (4.1) Novy shows that the product of bilateral trade (xij*xji) is given as

$$x_{ij}x_{ji} = \left(\frac{y_i y_j}{y^W}\right)^2 \left(\frac{t_{ij}t_{ji}}{\Pi_i P \Pi_j P_{j_i}}\right)^{1-\sigma} . \tag{4.4}$$

Incorporating equation (4.3) into (4.4) leads to the eventual solution for bilateral trade costs by using a geometric average and subtracting 1 to give a tariff equivalent

$$\tau_{ij} \equiv \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1 \ , \tag{4.5}$$

where $\tau_{ij}$ measures bilateral trade costs, $t_{ij}t_{ji}$, relative to domestic trade costs, $t_{ii}t_{jj}$.[29] The intuition underpinning the bilateral trade costs is straightforward. The gravity equation tells us how consumers decide to allocate spending across different countries. If bilateral exports increase relative to domestic trade flows, it must have become easier for the two countries to trade with each other. The key advantage to this approach is that trade costs can then be captured using observable trade flows.

## 4.4 Trade Costs through Time

Using the framework outlined above we first analyse the behaviour of trade costs through time and across countries. We are able to compute $\tau_{ij}$ for a 181 countries using data on bilateral trade flows taken from the IMF

[29] Novy (2008) also derives trade costs using a Ricardian and two heterogenous firm models as the starting point. The relationship between bilateral trade costs and international and intranational trade is virtually identical. These are reported in the Appendix.

Direction of Trade Statistics database. Calculating intranational trade relies upon the UN's dataset and is calculated as

$$x_{ii} = y_i - \sum_{j=1}^{n} x_{ij} \qquad , \qquad (4.6)$$

where $y_i$ is output at basic prices in country $i$ and $x_{ij}$ denotes exports between country $i$ and its partner, $j$.[30]

There are 7 countries for which exports are recorded as being greater than output.[31] To avoid omitting these observations we use the methodology of Wei (1996) to calculate intranational trade. This relies on calculating the share of goods in GDP and multiplying this by the ratio of shipments-to-value added. Tests reveal a high degree of correlation (0.96) between this measure of intranational trade and that proposed above.

In total this provides 100,254 observations of bilateral trade costs over 108 countries and partners across the years 1980-2008. The panels are far from balanced, in part due to the creation of many countries in the aftermath of the fall of the Berlin wall and myriad declarations of independence.

[30] Where zero exports are reported between two countries a value close to zero is entered to permit calculation of trade costs between the pair.

[31] Austria, Ecuador, France, Greece, Italy, Portugal, Spain.

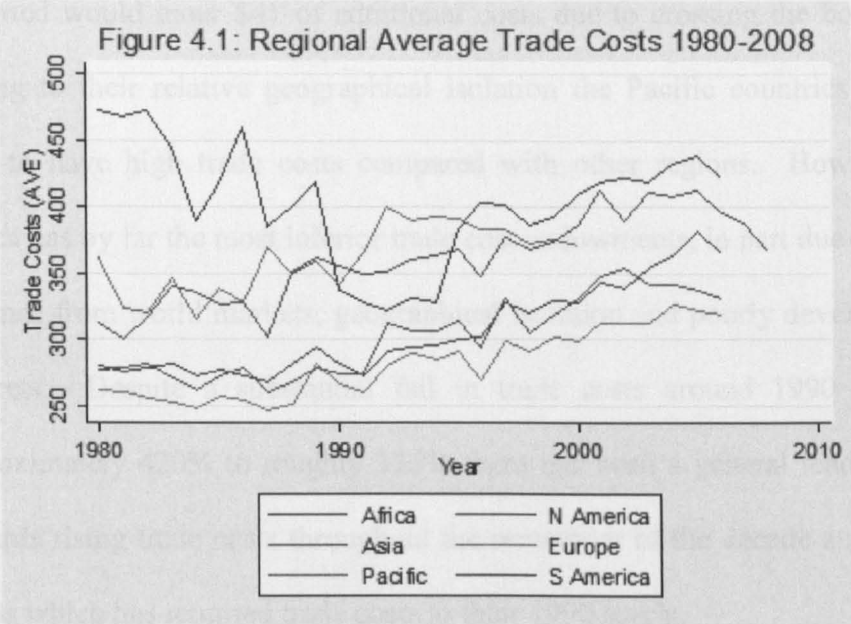
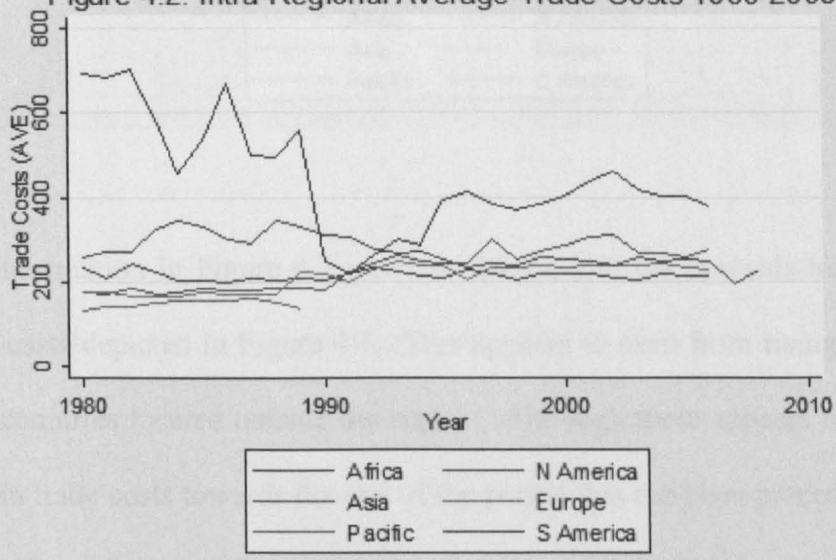


Figure 4.1: Regional Average Trade Costs 1980-2008

Figure 4.1 depicts the evolution of trade costs across broad continental groupings during the period 1980 to 2008. In the years following the fall of the Berlin Wall there is a general upward trend in average bilateral trade costs. However, there is significant heterogeneity according to location. For example, Europe has the lowest average trade costs during the period ranging between approximately 240% and 325%. This is despite the region being one of the most integrated and lying at the centre of international trade networks. A possible explanation for the rise in European trade costs during the 1990s is the entry of several countries which were previously Soviet satellites.

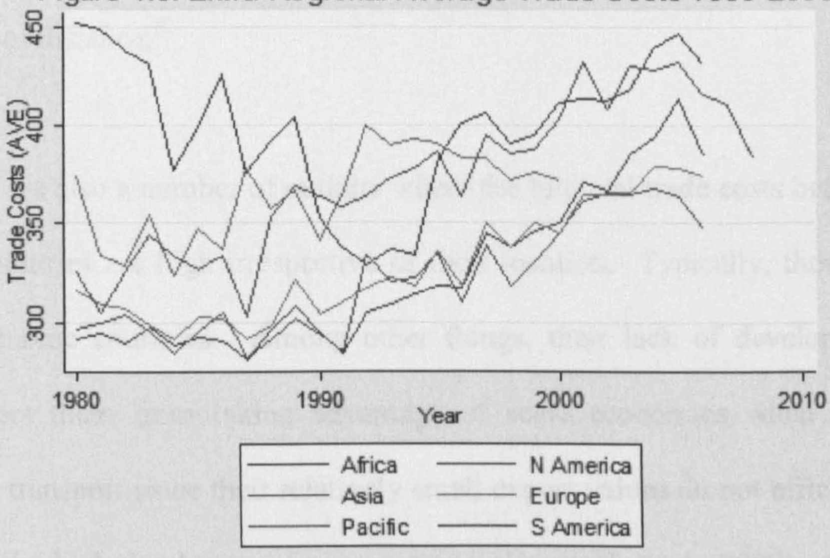
Asian and North American countries tend to have similar trade costs compared with Europe though they are marginally higher. In South America the ad valorem equivalent of the region's trade costs range between 300% and 410% implying that a good produced for \$10 and exported would incur $41 of additional costs due to crossing the border. Owing to their relative geographical isolation the Pacific countries also tend to have high trade costs compared with other regions. However, Africa has by far the most inferior trade cost endowments, in part due to its distance from world markets, geographical isolation and poorly developed markets. Despite a substantial fall in trade costs around 1990 from approximately 420% to roughly 325% there has been a general tendency towards rising trade costs throughout the remainder of the decade and the 2000s which has returned trade costs to their 1990 levels.

Figure 4.2: Intra-Regional Average Trade Costs 1980-2008




Part of the explanation for Africa's relatively high trade costs are barriers between countries within the continent. The data in Figures 4.2 and 4.3 indicate that the average African country faces substantially lower trade costs when dealing with external countries than with other African states. In contrast intra-regional bilateral trade costs in other countries tend to be fairly homogenous as depicted in Figure 4.2 with South America converging towards this standard during the 1990s. This may indicate one reason why regional and bilateral trade agreements have become popular.

Figure 4.3: Extra-Regional Average Trade Costs 1980-2008

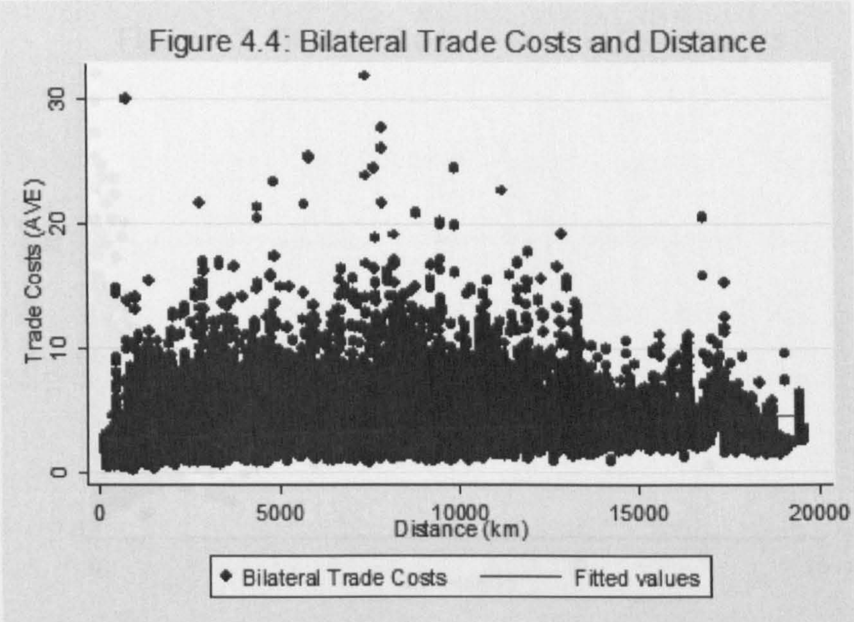



The information in Figure 4.3 provides insight into the upwards trend in trade costs depicted in Figure 4.1. This appears to stem from rising costs with countries located outside the region. Although there appears to be a drop in trade costs towards the end of the period this has been preceded by a significant increase in extra-regional trade costs during the preceding decade. This is particularly surprising given the advent of multilateral organisations such as the World Trade Organisation (WTO) that attempt to stem country's protectionist tendencies.

The geographical location of countries affects the cost of trade between them. Figure 4.4 suggests that transportation and informational costs are higher the greater the distance between two countries. However, the relationship is not as robust as one would imagine. This may reflect two possibilities. First, gravity model estimates have failed to show decreases in the distance coefficient in gravity models over time (Anderson and van Wincoop, 2004). Second, our trade cost measure is already absorbing the effect of distance.[32]

There are also a number of outliers where the bilateral trade costs between the countries are high irrespective of their location. Typically, these are low-income countries. Among other things, their lack of development hampers them from taking advantage of scale economies when using ocean transport since their relatively small export values do not efficiently cover the high fixed costs of transportation (Hummels et al., 2009). A lack of competition on shipping routes also raises the price of transporting goods due to monopolistic practices among shipping cartels. Hummels et al. (2009) find that exporters served by 2 ocean carriers face 21% higher shipping prices than when 8 carriers operate on the route.

[32] The correlation between bilateral trade costs and distance between trading partners is 0.06.

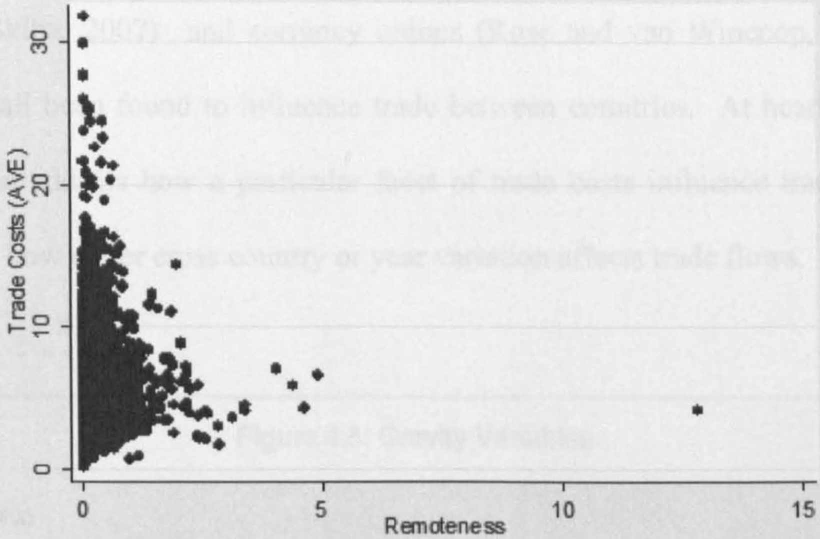



Proximity to major markets has been cited as a reason why some countries trade relatively more. This idea of economic remoteness is captured as

$$remoteness_{ij} = \left( \frac{y_i + y_j}{dist_{ij}} \right)^{-1}, \tag{4.7}$$

where $dist_{ij}$ is the great circle distance measured in kilometres between two countries and $y_i$ and $y_j$ are GDP in each country. Large countries are therefore less remote relative to small countries when distance is held constant. Equally small countries, such as the Netherlands, which are geographically close to large markets are less remote than those that are distant.

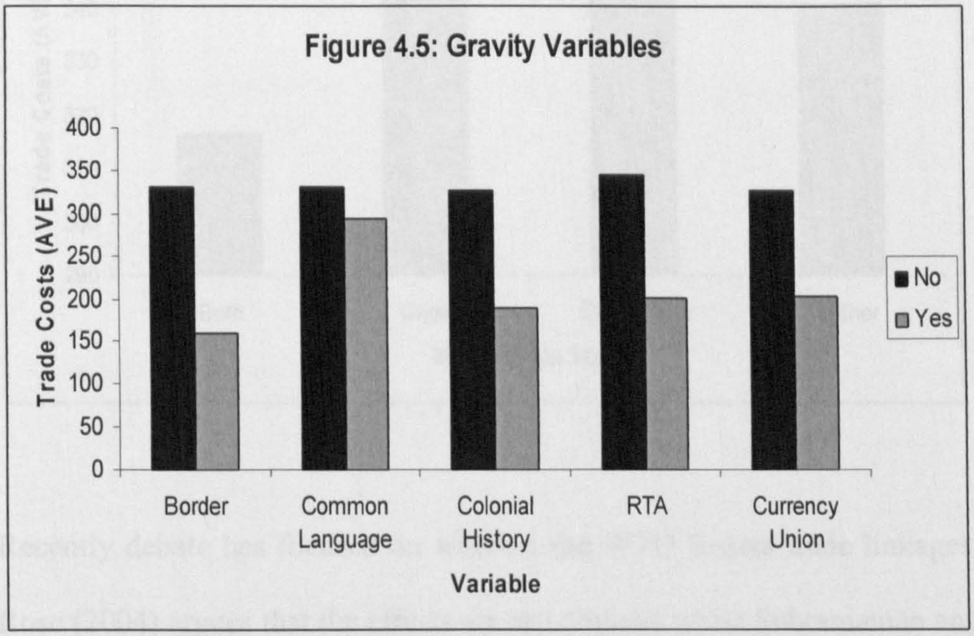
Figure 4.5: Bilateral Trade Costs and Remoteness



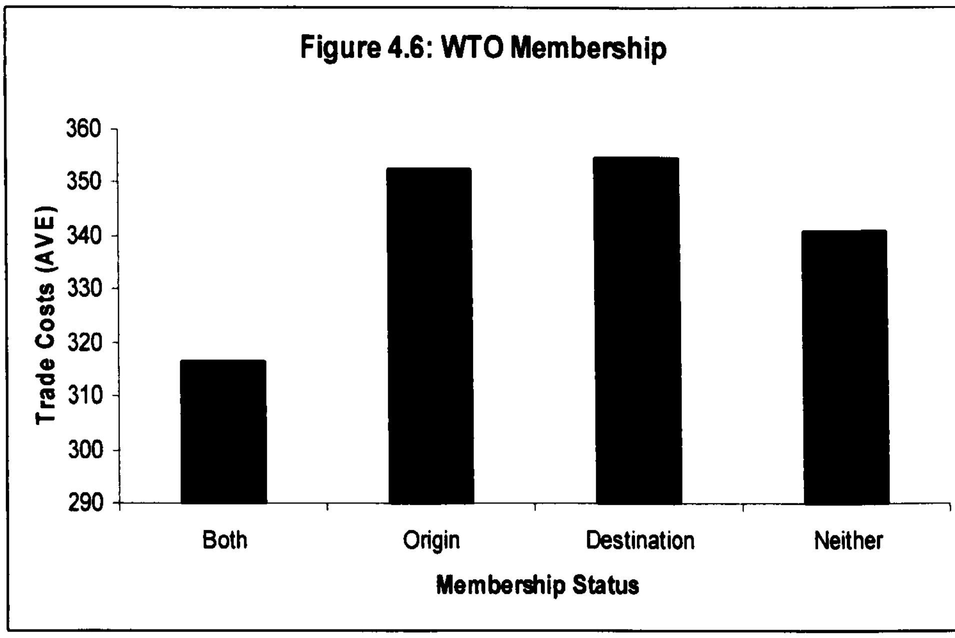

Owing to this one would expect that in addition to the effect of distance, bilateral pairs that are economically remote would also have higher bilateral trade costs. However, Figure 4.5 shows little relationship between the variables. This may be due to our trade cost variable capturing sources of trade costs well. For example, if trade flows between countries are highly determined by income in each then this will be absorbed as reducing trade costs. There are several countries which despite having low remoteness have high trade costs. This group is composed mainly of small island nations located in either the Indian or Pacific Ocean and sub-Saharan African or landlocked ex-soviet countries.

The gravity literature has sought to investigate how various aspects of trade costs affect the volume of trade. For example, borders (McCallum, 1994), information flows (Rauch and Trindade, 2001; Felbermayr, Jung and Toubal, 2009), transport costs (Limao and Venables, 1999), the World

Trade Organisation (Rose, 2004), shipping cartels (Hummels, Lugovskyy and Skiba, 2007) and currency unions (Rose and van Wincoop, 2001) have all been found to influence trade between countries. At heart these studies address how a particular facet of trade costs influence trade and study how either cross country or year variation affects trade flows.




The data in Figure 4.5 cast some light upon how some of the variables from the gravity literature affect bilateral trade costs. Countries bordering each other tend to have lower trade costs than non-contiguous countries but the border effect remains large: trade costs between average bordering pair raise export prices by approximately 150%. A shared colonial history, regional trade agreement, currency union membership and common languages also reduce trade costs. However, information flows appear to exert a large bearing on the cost of exporting. Even where countries share a common language the ad valorem equivalent of trade costs are approximately 300% compared with 340% when the pair predominantly speak different languages.




Recently debate has focused on whether the WTO fosters trade linkages. Rose (2004) argues that the effects are not obvious while Subramanian and Wei (2007) show that there is a strong trade creation effect but that this is uneven across countries. In Figure 4.6 we observe that, on average, WTO membership reduces trade costs but the effect is marginal. Where both trading partners are members the average bilateral trade cost between them is roughly 320% while where neither are members the value is 340%.

### 4.4.1 Sensitivity of Trade Costs to the Elasticity of Substitution

The calculation of trade costs is reliant upon the elasticity of substitution. Assigning sensible values is far from easy given the lack of data for several countries. Anderson and van Wincoop (2004) report in their survey on trade costs that the elasticity of substitution typically falls in the range 5 to 10. However, it does not help that there is little consensus in the literature about what the precise value should be. For example, Eaton and Kortum (2002) use a value of 8.3 while Chaney (2008) estimates a value of 2. Del Gatto, Mion and Ottaviano (2007) estimate magnitudes that are lower as do Helpman, Melitz and Yeaple (2004) who estimate the elasticity of substitution to be around unity. When studying bilateral trade costs between the United States and six major trading partners Novy (2008) uses a value of 8.

Table 4.1: Elasticity of Substitution

| | | Elasticity of Substitution | | | | | |
|---|---|---|---|---|---|---|---|
| Country | Partner | 5 | 6 | 7 | 8 | 9 | 10 |
| United States | Canada | 0.603 | 0.482 | 0.401 | 0.343 | 0.300 | 0.266 |
| United States | Zimbabwe | 4.200 | 2.951 | 2.247 | 1.802 | 1.499 | 1.280 |

The choice of the parameter value has important implications in calculating bilateral trade costs. As shown in Table 4.1 as the elasticity of substitution tends towards zero trade costs rise as consumers become more reluctant to consume foreign goods. The Table also shows that the estimates become increasingly erratic when the flow of exports between countries is low relative to intranational trade as demonstrated by the case of US trade with Canada and Zimbabwe.[33] Circumventing this problem is not easy. A common elasticity of substitution across all countries is also

[33] Exports from the United States to Zimbabwe are 4 orders of magnitude less than with Canada.

unrealistic since consumers in poor countries are less likely to purchase goods from outside the country. Changes in the variable through time are also possible as countries grow their demand for imports may also change. For the purposes of the work in this chapter we use a value of 8 as in Novy (2008).

### 4.4.2 Correlation between Aggregate Trade Costs and Existing Measures

Table 4.2: Correlation Between Trade Cost Measures

| Trade Cost | Correlation | Source |
|---|---|---|
| Market Potential | 0.317 | Redding and Venables (2004) |
| Market Potential | 0.343 | Head and Mayer (2004) |
| ICY Index | 0.429 | Hiscox and Kastner (2008) |

In the subsequent section we address the question of whether trade costs shape the pattern of trade. This relies upon using aggregate trade costs for each country which are calculated as the simple average of that country's bilateral trade costs with all partners. While it would be possible to calculate other permutations, such as export weighted trade costs, we refrain from doing so since trade costs between countries are high because they do not export. It is conceivable that in an environment of lower bilateral trade costs such countries may engage in trade. However, to weight aggregate trade costs according to the proportion of exports would produce a biased result since this would pay less attention to instances in which the bilateral barrier is high. Table 4.2 shows the correlation between our preferred trade cost measure and those of Redding and Venables (2004), Head and Mayer (2004) and Hiscox and Kastner (2008).

Some authors have provided novel ways of estimating trade costs. Some of these have focussed more on policy issues (Hiscox and Kastner, 2008; Kee, Nicita and Ollareaga, 2005, Sachs and Warner, 1995) while others have sought to quantify trade costs using indexes and direct measurements such as average tariffs (Economic Freedom Institute, 2006). Generally we find that there is a fairly low correlation between the existing measures (between 0.32 and 0.43). The low correlation is explained by the focus of Redding and Venables (2004) on geographical sources of market access and Hiscox and Kastner's policy orientated measure. Our measure captures both of these aspects as well as endowments and resources which may play a role.

### 4.5 Trade Costs: A Source of Comparative Advantage

To address whether trade costs affect the goods countries specialise in exporting, we construct a unique dataset using information drawn from several sources. We use 4-digit SITC (rev. 2) export data from the NBER described in Feenstra et al. (2005). This contains information for 192 industries for the year 2000. We weld this to a measure of aggregate trade costs derived using the data described in the previous section. The OECD STAN database provides information on human capital intensity (measured as the percentage of total hours worked by high skilled workers) and physical capital intensity (fixed capital per worker) for 26 countries during the time period.

Finding time-varying measures of human and physical capital endowment data proved elusive. Hence we are forced to use that reported in Hall and Jones (1999) which is for 1988. However, the results do not change if we use similar data provided by Antweiler and Trefler (2002). Finally, trade cost intensity is measured as the share of imported intermediates used in the production of exported goods produced at the 2-digit ISIC level. This is provided in the OECD's STAN Input-Output database. High values therefore indicate that the good will be more expensive to produce in countries where trade costs are high as opposed to where they are low. An attractive property of our measure of trade cost sensitivity is that it varies in both the country and industry dimensions. A concordance is used to map the 4-digit SITC industries to the ISIC industry classification listed on Marc Muendler's website. In order that we avoid possible endogeneity and simultaneity bias, we choose to apply the data on trade cost intensity for the United States from the year 2000 to all country-industry pairs and omit the US from the model. Identification is therefore attributable to changes in country-specific trade costs over time.

Further measures of trade costs are included to ensure that a particular definition of trade costs does not influence the results. The methodology outlined in Redding and Venables (2004) provides a means of estimating country-level market access and supplier access. These are derived by first estimating a gravity model of trade. Market access is defined as the distance-weighted sum of the market capacities of all partner countries. This captures all non-policy, or geographic, sources of trade costs. A gravity model of bilateral trade is estimated with controls for distance, common borders and country and partner fixed effects. The country and partner dummies then provide estimates for the market capacities while the distance and border coefficients are used to calculate bilateral transport costs. Similar measures are estimated by Head and Mayer (2004). Both the Redding and Venables (2004) and Head and Mayer (2004) estimates of market access are taken from CEPII's Real Market Potential dataset.

Table 4.3: Summary of the Trade Cost Variables

| Country/Trade Cost | Novy | R&V | H&M | ICY |
|---|---|---|---|---|
| Austria | 2.33 | .05 | .06 | 3.29 |
| Belgium | 1.58 | .05 | .05 | 2.12 |
| Canada | 2.41 | .05 | .06 | 3.22 |
| Czech Republic | 2.19 | .05 | .06 | |
| Denmark | 2.03 | .05 | .06 | 3.26 |
| Finland | 2.41 | .05 | .06 | 3.28 |
| France | 1.63 | .05 | .06 | 2.90 |
| Germany | 1.63 | .04 | .05 | 2.96 |
| Greece | 3.01 | .05 | .06 | 3.47 |
| Hungary | 2.17 | .05 | .06 | |
| Iceland | 3.84 | .06 | .07 | 3.39 |
| Ireland | 2.02 | .05 | .06 | 3.25 |
| Italy | 1.73 | .05 | .06 | 3.07 |
| Japan | 1.91 | .04 | .05 | 2.96 |
| Korea | 1.81 | .05 | .06 | |
| Netherlands | 1.58 | .05 | .05 | 2.63 |
| New Zealand | 2.74 | .05 | .07 | 2.93 |
| Norway | 2.43 | .05 | .06 | 3.46 |
| Poland | 2.57 | .05 | .06 | |
| Portugal | 2.76 | .05 | .06 | 2.92 |
| Slovakia | 2.88 | .06 | .06 | |
| Spain | 2.16 | .05 | .06 | 2.96 |
| Sweden | 2.13 | .05 | .06 | 3.28 |
| Switzerland | 2.01 | .05 | .06 | 3.12 |
| United Kingdom | 1.67 | .05 | .06 | 3.18 |
| United States | 1.82 | .05 | .06 | 3.03 |

The evidence in Table 4.3 shows clear differences between country's aggregate trade costs. For example, Belgium's trade costs are approximately half those in Greece according to our preferred measure (Novy). A one standard deviation reduction in the ICY index is equivalent to reducing trade costs from the level in the United Kingdom (3.18) to France (2.90). The different trade cost measures exhibit key differences. For example, Hiscox and Kastner's methodology attaches more weight to policy influences. This explains why the open and integrated markets of Belgium and the Netherlands rank among the lowest trade cost countries by this metric while on the other hand market access pays more attention to geographical considerations. Given its remoteness New Zealand appears as one of the highest trade costs when market access is used as does another remote island country, Iceland.

The stark differences between countries' trade cost endowments lead us to investigate whether this acts as a source of comparative advantage in a manner similar to traditional endowments. For example, countries with low trade costs have an incentive to capture market share in the production of goods which are highly sensitive to trade costs (Deardorff, 2004). Where a country's trade costs are sufficiently high then despite having a comparative advantage in producing good $x$ it may be a net importer of the good. In the previous section we observed that countries with lower endowments of trade costs tended to export relatively more in industries which imported intermediates are intensively used. The framework used is similar to that of Nunn (2007) and Levchenko (2007) whereby the basic framework of Romalis (2004) is augmented it include an additional interaction. An Ordinary Least Squares estimator is used to estimate the equation:

$$x_{ij} = \alpha_i + \alpha_j + \beta_1 t_{ict} T_{ct} + \beta_2 h_{ict} H_c + \beta_3 k_{cti} K_c + \varepsilon_{ict} \qquad (4.8)$$

where $x_{ij}$ is the log of the share of industry $i$'s exports in world trade, $\alpha_i$ and $\alpha_j$ are industry and exporter fixed effects, $t_i$, $h_i$ and $k_i$ are trade cost intensity, skill intensity and capital intensity in industry $i$ and $T_c$, $H_c$ and

$K_c$ are the exporting country's trade cost, skill and capital endowment. $\varepsilon_{ij}$ is a well behaved error term.

The model specified in equation (4.8) conforms to that used by Romalis (2004), Levchenko (2007) and Nunn (2007). Although the endowment and intensity variables are not included additionally these are captured by the country and industry fixed effects due to the cross-sectional nature of the data. The estimates of equation (4.8), reported in Table 4.4, confirm the view that trade costs act as an endowment in the same way as human and physical capital endowments. In regression 1 we find that countries with higher trade costs specialise in exporting goods with lower trade cost intensities. However, the hypothesis appears to be robust to the choice of how trade costs are measured. Compared to the estimates using the Novy trade cost variable the standardised coefficients are approximately half as small at -0.04, -0.03 and -0.04 when the Redding and Venables, Head and Mayer and Hiscox and Kastner variables are used respectively. A possible explanation as to why the coefficient estimates are relatively smaller is that the Novy (2008) methodology captures all sources of trade barriers while these are more concerned with either policy or geographical barriers.

Table 4.4: Global Comparative Advantage

| Variable | Regression (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $t_iT_c$ | -.08*** | -.04*** | -.03*** | -.04*** |
| | (-9.73) | (-4.50) | (-4.22) | (-4.34) |
| $k_iK_c$ | .00 | .01 | .01 | .01 |
| | (.95) | (1.37) | (1.39) | (1.37) |
| $h_iH_c$ | .03*** | .04*** | .04*** | .04*** |
| | (4.48) | (5.06) | (5.08) | (5.16) |
| Country Fixed Effects | Yes | Yes | Yes | No |
| Industry Fixed Effects | Yes | Yes | Yes | Yes |
| $T_{ct}$ | ICY | R&V | H&M | ICY |
| Number of Observations | 72869 | 72869 | 72869 | 66402 |
| $R^2$ | .34 | .34 | .34 | .27 |

*Notes*: The dependent variable is the log of the share of industry *i* of country *c* at time *t* in world exports. Beta coefficients are reported with robust t-statistics in parentheses. ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent, respectively.

We find some support for traditional endowment variables affecting the pattern of trade. Larger endowments of human capital lead countries to specialise in exporting goods that use such inputs intensively in production. In comparable regressions Nunn (2007) and Levchenko (2007) estimate the human capital interaction beta coefficient to be 0.085 and 0.11. Unlike Nunn (2007) and Levchenko (2007) we find that countries with larger physical capital endowments are no more likely to specialise in exporting capital intensive goods. A possible explanation is that resources are frequently misclassified as being physical capital endowments.

Since there is a time dimension in trade cost and exporting behaviour there are concerns about the non-independence of observations across time periods. Trade shares in 1995 may not be independent of what they looked like in 1990. To control for this we cluster the standard errors at the country-industry level. Although un-reported the results remain unchanged.[34] Clustering at this level also controls for the potential non-independence across SITC industries that is introduced by having a unit of observation (SITC) which is finer than the ISIC level. Since the independent variables are measured at the ISIC level or coarser there are repeated values for these variables across observations which again may introduce correlation between the residuals across observations.

### 4.5.1 Do Information and Infrastructure Underlie the Results?

It has been shown by Rauch and Trindade (2002) that the presence of Chinese migrants fosters trade. They attribute this effect to social networks improving cross-border information flows and thereby reducing barriers to trade. To investigate whether information flows between countries are driving the results in Table 4.4 we augment equation (4.8) to include an interaction between trade cost intensity and the stock of migrants taken from the World Bank's World Development Indicators (WDI). Another potential source of trade costs which has shown to be important by Limao and Venables (1999) is infrastructure. They demonstrate that the cost of shipping a standardised container from Baltimore incurs significantly different transport costs depending on the destination. To investigate whether this is driving the results we include

[34] The trade cost interaction coefficient estimate is -2.03 and the t-statistic is -1.88.

two further interactions. WDI data is used to construct interactions with the total length of the road and rail networks in each country.

Table 4.5: Infrastructure and Information Aspects of Trade Costs

| Variable | Regression (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $t_iT_c$ | -.08*** | -.14*** | -.16*** | -.18*** |
| | (-7.83) | (-9.36) | (-8.60) | (-9.05) |
| $k_iK_c$ | .00 | .01 | .00 | .00 |
| | (.95) | (1.22) | (.61) | (.31) |
| $h_iH_c$ | .03*** | .04*** | .03*** | .03*** |
| | (4.46) | (4.83) | (4.00) | (3.85) |
| $t_i$*Migration Stock | -.00 | | | -.07*** |
| | (-.01) | | | (-3.31) |
| $t_i$*Railroad kms | | .07*** | | -.06 |
| | | (5.39) | | (-.70) |
| $t_i$*Road kms | | | .10*** | .23** |
| | | | (6.06) | (2.29) |
| Country Fixed Effects | Yes | Yes | Yes | Yes |
| Industry Fixed Effects | Yes | Yes | Yes | Yes |
| $T_{ct}$ | Novy | Novy | Novy | Novy |
| Number of Observations | 72869 | 70472 | 56478 | 66402 |
| $R^2$ | .34 | .34 | .35 | .27 |

*Notes*: The dependent variable is the log of the share of industry *i* of country *j* at time *t* in world exports. Beta coefficients are reported with robust t-statistics in parentheses. ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent, respectively.

The results in Table 4.5 do not lend support to the view that information flows under pin the results. However, we do find that infrastructure plays a role. Countries with larger road and rail networks tend to specialise in exporting more trade cost intensive goods.[35] It may be that transportation costs are a significant factor in the cost of producing these goods and a

[35] The results are robust to controlling for country size. That is railroad kilometres per hectare.

widespread transportation network reduces the costs of transporting imported intermediate inputs to factories within the country. While these interactions enter as significant determinants they do little to affect the main result: trade costs remain a source of comparative advantage.

### 4.6 Robustness Testing - Alternative Model Specification

To check that we are picking up genuine national trade cost effects on the composition of global trade we explore a specification which interacts national trade costs with the traditional endowment factors. This allows us to investigate a weaker hypothesis: that trade costs modify, rather than determine, comparative advantage. To study this we include interactions between the trade cost variables and the traditional endowment interactions. One would expect that countries with large endowments would specialise in exporting goods that use those factors intensively but that trade costs would reduce the effect.

The results in Table 4.6 lend at best limited support to this hypothesis. Regression 1 is the only instance in which the results are in line with expectations: human capital endowments lead to specialisation in skill intensive sectors but trade costs reduce the effect. The remaining regressions show no consistency or pattern. For example the signs are wrong in regression 2, there are no patterns in regression 3 and the final column shows the opposite of what would be expected.

Table 4.6: Alternative Model Specifications

| Variable | Regression (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $h_iH_c$ | .14*** | -.82*** | -.14 | .08 |
| | (4.71) | (-9.24) | (-1.23) | (1.34) |
| $k_iK_c$ | .02 | .08 | .03 | -.27*** |
| | (.73) | (1.18) | (.32) | (-5.87) |
| $h_iH_c$*$T_c$ | -.11*** | .87*** | .18 | -.03 |
| | (-3.42) | (9.85) | (1.61) | (-.58) |
| $k_iK_c$*$T_c$ | -.01 | -.08 | -.02 | .28*** |
| | (-.44) | (-1.07) | (-.22) | (6.08) |
| Country Fixed Effects | Yes | Yes | Yes | Yes |
| Industry Fixed Effects | Yes | Yes | Yes | Yes |
| $T_c$ | Novy | R&V | H&M | ICY |
| Number of Observations | 72869 | 72869 | 72869 | 66402 |
| $R^2$ | .34 | .34 | .34 | .35 |

*Notes*: The dependent variable is the log of the share of industry *i* of country *j* at time *t* in world exports. Beta coefficients are reported with robust t-statistics in parentheses. ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent, respectively.

Although it could be possible that the market access and ICY measures provide the most perverse results because of their geographical and policy focus we conclude that trade costs do not modify traditional sources of comparative advantage. Instead they independently shape export patterns.

### 4.6.1 Robustness Testing - Comparative Advantage at a Local level

Trade theory customarily explains trade by comparisons that are done globally. A country exports a good for which its own relative cost of production is low compared to the rest of the world, or it has a comparative advantage in goods that make intensive use of a factor it has relatively more of than the world. This may be appropriate if we believe both proponents and opponents of globalisation who seem to see us moving ever closer to an integrated world economy where trade costs are low. The numerous studies surveyed in Anderson and van Wincoop (2004) demonstrate that some aspects of trade costs have been falling through time but that they are far from negligible. The advent of regional supra-national bodies like the European Union and free trade agreements such as NAFTA and Mercosur suggest that trade costs may be falling more rapidly at the regional than the global level.

Deardorff (2004) has termed this form of export specialisation 'local comparative advantage'. Where trade costs are sufficiently high outside relative to within the region, a country's export bundle will be determined according to local comparative advantage. To explore whether comparative advantage is better defined locally we re-estimate equation (4.8) for Europe. The dependent variable becomes the share of exports to the other OECD countries in the dataset rather than the share of global exports. Given that our dataset is highly Eurocentric with all but five countries (Canada, Japan, Korea, New Zealand and the United States) coming from the region we use the OECD as the region to test for local comparative advantage.

Table 4.7: Share of Regional Exports

| Variable | Regression (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $t_iT_c$ | -.02** | -.00 | -.01 | -.01 |
| | (-2.11) | (-.46) | (-1.20) | (-1.40) |
| $h_iH_c$ | -.00 | -.00 | -.00 | -.00 |
| | (-.55) | (-.39) | (-.44) | (-.19) |
| $k_iK_c$ | -.00 | -.00 | -.00 | -.00 |
| | (-.51) | (-.24) | (-.24) | (-.65) |
| Country Fixed Effects | Yes | Yes | Yes | Yes |
| Industry Fixed Effects | Yes | Yes | Yes | Yes |
| $T_c$ | Novy | RV | HM | ICY |
| Number of Observations | 70264 | 67652 | 67652 | 63797 |
| $R^2$ | .11 | .11 | .11 | .11 |

*Notes*: The dependent variable is the log of the share of industry *i* of country *j* at time *t* in OECD exports. Beta coefficients are reported with robust t-statistics in parentheses. ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent, respectively.

Overall the local comparative advantage model does not perform well. It is only in regression 1 of Table 4.7 that the trade cost interaction enters significantly with the correct sign. Regardless of which model we use the human and physical capital endowment interactions are insignificant. The explanatory power of the model is also much reduced. The results may reflect the fact that OECD countries are heavily engaged in trade worldwide. When we condense the sample to include just the European countries in the sample the results do not change.

### 4.7 Endogeneity

An important concern with the results reported so far is endogeneity[36]. Countries that specialise in trade cost intensive industries may have incentives to reduce the trade costs their exporters face. To account for this we instrument trade costs using variables that reflect particular facets of trade costs. Indexes for freedom to trade and legal quality are extracted from the EFI (2002) data set. While it is easier to conceptualise how freedom to trade abroad may affect exports by altering trade costs, legal institutions are more complex. However, as shown by Nunn (2007) legal institutions affect a country's institutional environment and may therefore shape the type of goods it exports. The instruments may therefore be viewed as a subset of trade costs.

[36] When the residuals from regression 1 in Table 5.3 are regressed on the trade cost interaction the resulting t-statistic on the trade cost interaction is -25.98 indicating a statistically significant relationship between the residuals and regressor.

Table 4.8: Estimates using Instrumental Variables

| Variable/Regression | 1 | 2 | 3 |
|---|---|---|---|
| Second stage IV regression - dependent variable is share of world exports | | | |
| $t_iT_c$ | -.780*** | -.732*** | -.775*** |
| | (-4.29) | (-3.68) | (-4.24) |
| $k_iK_c$ | 1.593 | 1.601 | 1.594 |
| | (1.49) | (1.50) | (1.49) |
| $h_iH_c$ | 1.927*** | 1.94*** | 1.928*** |
| | (7.35) | (7.37) | (7.35) |
| Country Dummies | Yes | Yes | Yes |
| Industry Dummies | Yes | Yes | Yes |
| Number of observations | 70264 | 70264 | 70264 |
| $R^2$ | .55 | .55 | .55 |
| First stage regression - dependent variable is $t_iT_c$ | | | |
| $t_i$*Freedom to trade | 23.11*** | | 20.867*** |
| | (137.48) | | (36.71) |
| $t_i$*Legal quality | | 18.85*** | 1.986*** |
| | | (68.65) | (4.07) |
| F-test | 59684 | 8476 | 36384 |
| Overidentification test (p-value) | - | - | .46 |

*Notes*: The dependent variable in the second stage regressions is the log of the share of industry *i* of country *j* at time *t* in world exports. In the first stage regressions the dependent variable is the interaction between trade cost intensity and the freedom to trade or legal quality variables. Beta coefficients are reported with robust t-statistics in parentheses. ***, ** and * indicate significance at 1 percent, 5 percent and 10 percent, respectively.

In Table 4.8 we report the results of the first stage regression of the instruments on trade costs and the second stage results for the instrumented regression. We measure the index variables as their inverse so that countries with superior institutions have lower trade costs. The fist stage regressions show that the freedom to trade and legal quality interactions are positively correlated with the trade cost interaction an indication that they pick up similar characteristics. In the second stage regressions the estimated coefficient on the instrumented trade cost interaction is -0.78 and -0.73 when freedom to trade and legal quality are used respectively.

Having seen some evidence that our instruments work in an exactly identified model, we incorporate both instruments into the model in regression 3. Each enters the first stage significantly and with the expected sign. The second stage results continue to show a negative sign on the instrumented trade cost interaction and the over identification test confirms the validity of the instruments. A problem with the instrumental variables estimates is that the trade cost interaction is larger than when OLS is used; in regression 1 of Table 4.4 the coefficient estimate was -0.68. Since we envisage there to be potential reverse causality between exports and trade costs, the estimates using instrumental variables should be smaller than those computed using OLS. This would imply that our instruments are not entirely exogenous to the second stage error term and this biases the result.

### 4.8 Conclusions

The evidence presented in this chapter builds upon recent enquiries that have shown particular aspects of trade costs to affect a country's comparative advantage. We confirm that aggregate trade costs act in a similar manner and that countries with low trade cost endowments specialise in exporting goods which are more sensitive to trade costs. We show that this result is not driven differences in the type of goods rich and poor countries export nor does it arise at a local level. Instrumental variables confirm that endogeneity is not responsible for the patterns we observe though given that our instruments are a sub-set of aggregate trade costs concerns remain about what they capture. Owing to data limitations the analysis is restricted to observed trade and 32 countries. Although the results may not generalise across a wider spectrum of countries, what we lack in country coverage is offset by what we gain from using a cross-country, cross-industry measure of trade cost sensitivity: something which so plagued early empirical investigations of the Heckscher-Ohlin model.

The analysis also suggests that entry into export markets, particularly in terms of the extensive margin, are affected by institutional characteristics. Falling trade costs have implications upon the rate of churn in the domestic market as well as in foreign markets. As export opportunities emerge the expected profit from entry rises as in Melitz (2003) causing entry and more intense competition for market share.

## 4.9 Appendix 4

Expressions for bilateral trade costs derived from Ricardian model of international trade (Eaton and Kortum, 2002), Chaney (2008) and Melitz and Ottaviano (2008)

$$\tau_{ij}^{EK} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2\vartheta}} - 1 \qquad \text{(A4.1)}$$

$$\tau_{ij}^{Ch} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{\frac{1}{2}} \left(\frac{f_{ij}f_{ji}}{f_{ii}f_{jj}}\right)^{\frac{1}{2}\left(\frac{1}{\sigma-1}-\frac{1}{\gamma}\right)} - 1 = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2\gamma}} - 1 \qquad \text{(A4.2)}$$

$$\tau_{ij}^{MO} = \left(\frac{t_{ij}t_{ji}}{t_{ii}t_{jj}}\right)^{\frac{1}{2}} - 1 = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2\gamma}} - 1 \qquad \text{(A4.3)}$$

Hiscox and Kastner (2008) Trade Cost Measure

The ICY index provided by Hiscox and Kastner (2008) for 76 countries is estimated using a parsimonious gravity model is used to calculate an 'ICY' index of trade costs. As shown in equation (A4.4) the gravity model only encompasses trade between two countries, the GDP of each country and, crucially, country fixed effects.

$$\ln\left( M_{ijt} \Big/ Y_{it} \right) = \alpha_{it} + \beta \ln Y_{jt} - \delta \ln D_{ij} + \varepsilon_{ijt} \qquad \text{(A4.4)}$$

where $M_{ijt}$ is the volume of imports between $i$ and $j$ in $t$, $Y_{it}$ is country $i$'s GDP at $t$, $\alpha_{it}$ is the importing country-year intercept for country $i$ in year $t$, $Y_{jt}$ is exporting $j$'s GDP in year $t$, $D_{ij}$ is the distance between countries $i$ and $j$ and $\varepsilon_{ijt}$ is a well behaved error term.

The Hiscox and Kastner methodology relies on the country-specific fixed effects capturing all omitted variables that influence trade flows. Endowments, institutions, geographic location and policy factors as well as tariffs, non-tariff barriers and traditional trade cost measures are captured by the fixed effects. The simplicity of the model entails relying on a number of restrictive assumptions. For example, it is assumed that governments impose trade barriers in a bilateral fashion. This may be particularly severe since the partial equilibrium nature of the gravity model fails to account for how bilateral trade flows are influenced, not only by trade costs between the country pair, but also by other countries (Anderson and van Wincoop, 2003). Another issue is the omission of relevant variables, such as resource endowments, which could bias the estimates. Export restrictions in partner countries are also assumed to have a negligible impact. Hiscox and Kastner address many of these concerns in their paper by including robustness checks that include remoteness variables, resource endowments and country year fixed effects.

The results show the underlying coefficient estimates to remain highly correlated with their initial estimates.

# Chapter Five

# Globalisation, Hollowing out, Multinationals and Productivity in Japan's Lost Decade

## 5.1 Introduction

During Japan's 'Golden Age' (1956-1973) growth in output per worker averaged 8% per annum, four times the rate recorded in the United States over the same period. While capital flows doubtless played a part in resurrecting a country destroyed by war, the productivity miracle was ultimately responsible for the sustained economic successes which culminated in Japan becoming the world's second largest economy. During this period per capita income levels rose from 27% of US levels in 1956 to 69% by 1973 and 84% by the start of the 1990s.[37] The subsequent 'lost decade' has seen GDP growth stagnate and has been mirrored by equally sluggish productivity growth. In our sample we estimate that across the manufacturing sector productivity growth averaged just 0.5% per annum from 1994-2005, while per capita income is estimated to have fallen to around 72% of US levels.

[37] Data from Maddison (2009).

Numerous hypotheses have been advanced to explain Japan's soporific economic performance since the early 1990s. Often these emphasise macroeconomic factors, such as fiscal policy (both too little and of the wrong sort) or the liquidity trap (Krugman 1998a, 1998b).[38] Others have instead used micro level data and sought to explain the low rate of productivity growth that accompanied the lost decade, with the industrial structure of Japan, the banking sector and multinational firms often identified as key factors.[39]

A number of competing arguments are included here. Cowling and Tomlinson (2000) for example, argue that it was caused by the 'elite globalisation' strategies of Japanese MNEs.[40] They posit that the domestic manufacturing sector has been 'hollowed out' as multinationals have offshored production to lower wage economies in the rest of Asia. This has resulted in the closure of what were relatively productive domestic plants adding further drag to productivity.[41] A different explanation for the closure of more productive firms is offered by Nishimura et al. (2005), who focus on the role of banks in allocating financial resources to productive firms. They argue that during the 1996/7

[38] Makin (1996) for example cites the slow response of the Bank of Japan to reduce interest rates due to outdated inflation measures, and the impact this may have had on peoples' beliefs. Or alternatively, Krugman (1999) argues that the aging population's desire to save for their retirement, along with the country's risk adverse nature, demonstrated by its high savings rate and accentuated by the collapse of the bubble economy, reduced consumer spending.

[39] These are of course the same factors often used to explain its relative economic success up until that point.

[40] Over the period of study some 800,000 jobs have been shed by Japanese manufacturing firms.

[41] Nishimura et al. (2005) report that relatively productive firms were closed in Japan in 1996 and 1997, although they do not investigate whether these were multinational firms.

financial crisis this link broke down such that firms with relatively low productivity survived at the expense of those with higher productivity. Kimura and Fujii (2003) argue instead that excess plant closure during the 1990s reflected the reversal of the rapid expansion into new products and markets by Japanese firms during the 1980s.

Some in the literature have taken the opposite view that the rate of firm and plant closure has been too low, rather than too high. Caballero et al. (2003), Peek and Rosengren (2003), Ahearne and Shinada (2005) and more recently the Economist (2009) have argued that stringent bankruptcy laws, a unique industrial structure and government intervention have resulted in a plethora of what they label 'zombie' companies. Equipment, buildings and labour have been fossilised in firms that achieve relatively low sales and profit margins.

Finally, others emphasise the weak contributions to aggregate productivity growth from the within firm and between firm components of aggregate productivity change. Makin (2008) for example, discusses the effect from the weak balance sheets of Japan's banks, that resulted from the collapse of property and asset markets at the beginning of the 1990s, coupled with their close alliances with Japanese MNEs. According to this view, loans to firms outside of the keiretsu networks were limited, preventing investment in profitable projects such that the rate of productivity improvement within firms was too low. Finally, Kwon et al. (2009) return to the theme of zombie lending, but to show how this led to resource reallocation towards firms with low productivity adding negatively to aggregate productivity growth.

In this chapter we investigate whether low productivity growth in Japan is due to the role played by increased globalisation and multinational firms using micro-level data drawn from the Japanese census of manufacturing. We begin by decomposing aggregate productivity growth to assess the relative contributions from productivity improvements within plants, those which arise through plant entry and exit and the reallocation of market shares across plants. We find that the weak contributions made from the entry/exit and within plant growth components appear to be the main contributors to the low aggregate growth.

Using the results from this exercise we then focus in detail on the determinants of these sources of productivity change. Within this we include questions prominent within the previous literature, but which have so far lacked formal quantitative evidence. This includes issues about the characteristics of plants that have been shut by Japanese MNEs. Throughout the exercise we compare our results with those found for similar questions for other countries and the previous evidence for Japan.

From this we identify a number of aspects of the Japanese economy where behaviour is very similar to that for other developed countries, as well as areas where the behaviour is different. With respect to the firms and plants that are closed down we find that, as in other country contexts, these firms are likely to be small and have low productivity. However, the estimated marginal effects are much smaller, a consequence of the very low rates of entry and exit from Japanese manufacturing. These low exit rates are at least in part explained by a striking difference between Japanese firms and those in other developed countries. Our results suggest that increased globalisation, including a measure of increased import competition from low wage economies, has had no effect on the entry and exit of firms and plants in Japan. An explanation for this result we find little support for is the strict rules on bankruptcy laws and 'zombie' loans, preferring instead an explanation that focuses on the regulations in place that prevents the entry of new plants.

The low rate of productivity growth in Japan is also often seen as a product of Japanese MNEs offshoring production and shutting plants that are, relative to others in their industry, high productivity. We find that this is true, plants shut by MNEs are relatively more productive than the industry average, but they are generally weaker elements of the MNE more generally. This behaviour is also not distinct to MNEs. Both MNEs and other multi-plant firms shut weaker plants. Indeed the behaviour of these two types of firm is very similar, including again their lack of response to increased globalisation. Finally, our analysis suggests that the rate of productivity growth within plants is also partly a consequence of low entry and exit rates. Generally we find that the determinants of productivity change are similar to those found for other countries, but that productivity improvement is lower in industries in which globalisation is higher. The low rate of entry and exit in Japan therefore means that this affects more firms than would otherwise have been the case.

The rest of the chapter proceeds as follows. Section 5.2 provides an overview of the literature on Japan and a history of the rise of manufacturing. Section 5.3 describes the data set we use and the decomposition of aggregate productivity. In Section 5.4 we investigate a host of hypotheses and report regression results. We address employment growth in Section 5.5 and the reasons for low within plant productivity growth in Section 5.6. The questions investigated in this section include the closure of plants and within firm productivity change. Finally, Section 5.7 draws conclusions.

## 5.2 A Brief History of Japanese Manufacturing

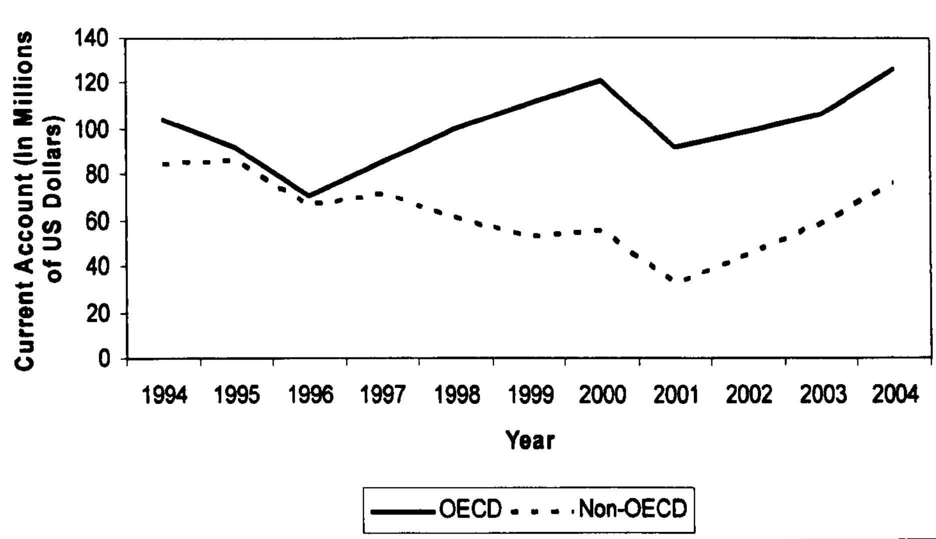
Between 1603 and 1868 the feudal Tokugawa shogunate that ruled Japan embraced a form of isolationism rarely seen. Owing to the perceived threat posed by Christian converts in Japan contact with the outside world was forbidden. Trade with foreigners was confined to a handful of the shogun's treasury agents who were allowed to purchase the goods brought by one Dutch boat and handful of Chinese merchants each year. By 1825, exports accounted for 1.4 cents per capita which was almost entirely made up of copper, camphor and seaweed (Bernhofen and Brown, 2005). Imports totalled a similarly paltry sum.

Today Japan could not be more different. The economy is one of the most globalised, and, following its phoenix-like rise following World War 2, it is the second largest in the world. Japanese firms have succeeded in conquering foreign markets through intensive exporting and operations abroad. Its brand names are instantly recognisable and by 1996 approximately 86,000 people were employed in Japanese manufacturing firms' foreign plants. However, since the late 1980s the Japanese economy has resided in the doldrums. Despite the windfalls global integration has bestowed on it there are now fears that multinationals have 'hollowed out' the economy. In this section we review the rise of Japan on the international stage and how this has affected productivity and firm survival.

### 5.2.1 The Ascent of Manufacturing

Throughout its modern era the bedrock of the Japanese economy has been the manufacturing sector accounting for as much as 44% of GDP (Statistical Handbook of Japan). As exemplified in Figure 5.1, the sector has been responsible for many of Japan's successes in international trade, running large, persistent current account surpluses. However, the underpinnings of such international competitiveness are not due to rapacious entrepreneurship or innovation alone. Indeed the Japanese Ministry of International Trade and Industry (MITI) has pursued an active industrial policy and played an interventionist role by designating specific industries as being 'strategic' (Johnson, 1982).

**Figure 5.1: Manufacturing Current Account**




*Source*: OECD STAN dataset.

Since the Second World War Japanese manufacturers have benefited from a raft of measures. Cowling and Tomlinson (2001) note that policy makers have granted direct subsidies, discriminatory tariffs, import restrictions and favourable industry regulation to manufacturing industries. MITI also helped stifle foreign competition through tariffs and quotas until 1971. Restrictions were imposed on inflows of foreign direct investment to protect infant industries yet Japanese firms were encouraged to collaborate, with foreign firms abroad.

A feature of manufacturing industries in Japan is their geographical concentration. For example, of Japan's 47 prefectures, 73% of machinery output occurs in 15 prefectures (Cowling and Tomlinson, 2001). The reason for this concentration is partly due to the large labour force and transportation links present. However, another explanation is the keiretsu industrial structure. Alongside favourable government policies, Japanese firms have relied heavily on close relationships and co-operation between suppliers (buyers) of their inputs (outputs) to reduce costs and satisfy demand. Consequently there are extensive linkages between upstream and downstream firms within the same industry. This results in specialisation by the majority of small keiretsu firms which supply intermediate inputs. For example, 56% of small Japanese firms are involved in some form of subcontracting (Whittaker, 1997). A product of keiretsu networks is the Just-in-Time (JIT) model of production. JIT was designed to minimise inventories yet respond to daily orders as quickly as possible. Production, the supply of parts and delivery are coordinated in a horizontal manner

(Aoki, 1990). This reduces production costs and maintains product quality.

The construction of keiretsu networks did not just extend to production. Banking keiretsu were also set up to provide finance to corporations. Aoki (1990) mentions that often a 'main bank' acts as the principle lender to the company and that it is responsible for closely monitoring the company's business affairs[42]. However, despite their financial ties main banks tend not to intervene while the corporation continues to make profits[43]. Ordinarily the role of the banking keiretsu was to provide low-cost, long-term finance.

Keiretsu networks were not mere coincidence. Rather they were propagated by MITI which sought to encourage a system of mass production with large corporations at the centre supported by keiretsu sub-contractors (Cowling and Tomlinson, 2001). As mass production flourished, domestic markets became saturated with consumer durables. Initially corporations overcame this by exporting. However, the resulting large trade surpluses led to retaliatory trade barriers. To overcome these barriers Japanese firms began to locate abroad.

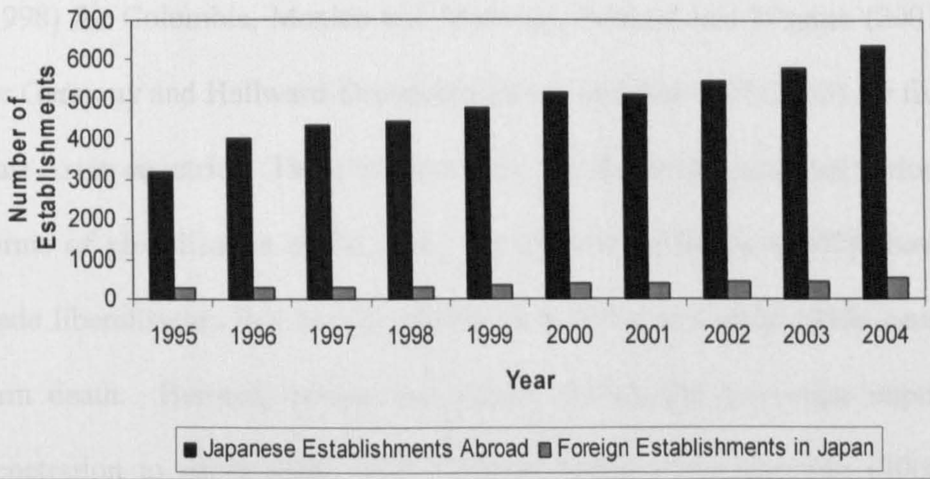
Since MITI relaxed restrictions on outward FDI in 1971 Japanese firms have steadily relocated production abroad. Between 1981 and 1995 $470

[42] Financial institutions as a whole (including insurance companies) own about 40% of the total outstanding stock of listed companies. However, the main bank has the closest ties with the firm, both in terms of cash-management, as well as short term credits.

[43] During crises the main bank would assume responsibility for conducting rescue operations (Aoki, 1990).

billion was invested by Japanese firms in foreign affiliates (Cowling and Tomlinson, 2001). Figure 5.2 also shows that this trend has continued in the subsequent decade. In 2004 the number of Japanese establishments located abroad had approximately doubled since 1995. Unsurprisingly the firms which have most vigorously embraced the benefits of globalisation were the 'national champions' around which keiretsu sub-contractors orbit.

**Figure 5.2: Japanese Firms Abroad and Foreign Firms at Home**




*Note*: Data obtained from OECD's The Role of Multinationals in OECD Economies

### 5.2.2 The Impact of Globalisation on Japanese Firms

The Melitz (2003) model of heterogenous firms in international trade demonstrates that trade liberalisation affects aggregate productivity and causes firm death. Increased export opportunities raise the incentive to enter the domestic market leading to more competition amongst firms.

Firms with productivity below some threshold can no longer survive and exit the market. This prompts reallocations of market share away from less productive, and towards more productive, firms leading to an increase in aggregate productivity. A model by Helpman et al. (2004) shows similar results when foreign direct investment is incorporated into the model.

Bernard and Jensen (1995) established that exporters in the United States are more productive than non-exporters. Similar findings have been observed in other countries: for example, Clerides, Lach and Tybout (1998) for Colombia, Mexico and Morocco, Bernard and Wagner (2001) for Germany and Hallward-Driemeier, Iarossi and Sokoloff (2002) for five East Asian countries. There is also a raft of evidence showing that various forms of globalisation affect exit. For example, Pavcnik (2002) shows trade liberalisation in Chile during the late 1970s and early 1980s cause firm death. Bernard, Jensen and Schott (2006) find low-wage import penetration to cause death in the United States while Simpson (2008) observes that offshoring increases plant death in the United Kingdom. With these ideas in mind, and the knowledge of how Japanese firms embraced globalisation we turn to the evidence on the type of firms which export and invest abroad and how this affects exit.

Using longitudinal panel data over the period 1994 to 2000 Kimura and Kiyota (2006) find that exporters are 3.54 percent more productive than non-exporters and firms which engage in FDI are 3.79% more productive than firms that do not have any foreign affiliates[44]. There also appears to be an ordering of firm's international orientation according to productivity. Firms with the highest TFP engage in both exporting and FDI, the next most productive only engage in foreign direct investment and firms which only export have the lowest productivity of globally engaged. Kimura and Kiyota (2006) also find that productive firms are more likely to become exporters or multinationals. Survival in foreign markets also affects firm productivity. Entering the export market increases firm TFP by 2.19% but firms which remain exporters between periods have 3.58% higher productivity.

The effects of globalisation upon firm survival in Japan have also been addressed to a certain extent. Using information on firm death, rather than plant death, Kimura and Kiyota (2006) find that exporting firms face hazard rates 7-18 percent lower than non-exporters. However, multinational firms face hazard rates 9-23 percent higher than non-FDI firms. Kiyota and Kimura attribute the negative effect of foreign direct investment on firm survival to the high financial or managerial burdens placed on small firms which are engaged in FDI.[45]

In another study Kimura and Fujii (2003) investigate the determinants of firm survival in Japan using firm-level data over 1994 to 1999. For firms with more than 100 workers they find firm size and R&D reduce the probability of exit while high wage firms are more likely to exit. Global

[44] Firms are considered to conduct FDI where they have at least one foreign affiliate.
[45] In Chapter Four we show that this is not the case. Rather it is the multi-plant component instead.

engagement is again found to affect survival. Exporters are less likely to close but firms which outsource from abroad are more susceptible to closure but as the firm becomes larger the effect vanishes. There is also evidence that firms relocate production across borders when they own foreign affiliates and that their high-wage, and low value added, Japanese affiliates are more likely to die.

The evidence presented by Kimura and Fujii (2003) and Kimura and Kiyota (2006) suggests that Japanese firms which engage in globalised activities have similar traits when compared with equivalent firms elsewhere. They also show that exporting and foreign direct investment affects the survival of Japanese firms. However, their regressions suffer from omitted variables: no controls are included for import penetration, multinational status or sunk costs. No mention is made of how firm exit or the entry into export markets affects aggregate productivity.

### 5.2.3 A Hollow Giant?

The collapse of the Nikkei stock market in 1989 heralded the start of a new era for the Japanese economy. In 1991 property values plummeted, growth stagnated and the country was periodically mired in recession (1991-1993 and 1998-1999). Unlike in any other developed country, deflation became normal. Arguments on why Japan met this fate have been varied. Krugman (1994) suggests that state sponsored investment propelled the high post-war growth rate rather than productivity improvements. The Bank of Japan's extremely hawkish monetary policy during the 1980s may also be a contributing factor. However, recently some commentators have propounded the view that the Japanese economy has been 'hollowed out' by multinationals which will lead to economic decline and stagnation.

The decision by post-war Japanese policy makers to pursue an institutional form of capitalism resulted in the construction of keiretsu networks. This was in part due to MITI's explicit favouring of large corporate groups to create economies of scale and thereby catch-up with foreign competitors. However, following the relaxation of restrictions on outward FDI in 1971 and the removal of currency controls in 1980, Japanese corporations began to establish foreign affiliates with gusto. The scale of this relocation of investment and production should not be underestimated. Between 1981 and 1995 the average annual growth in the outward flow of Japanese FDI was 22% and during which time the manufacturing sector shed 1 million jobs (Cowling and Tomlinson, 2000).

Japanese multinationals have been perceived to have taken advantage of the liberalisation of restraints on FDI to relocate production abroad. Indeed between 1985 and 1997 there has been a four-fold increase in Japan's aggregate overseas production ratio (Cowling and Tomlinson, 2000). Some multinationals have done so in order that they overcome export barriers, for example, the Japanese car manufacturers in the United States. Others have embraced offshoring as a means of cutting costs.

Much of this has been concentrated on the low-wage economies of East Asia. Cowling and Hollingsworth (1998) find that a 10% fall in real wages in East Asia reduces aggregate Japanese domestic manufacturing output by 3%.

The relocation of production abroad has had profound consequences upon the keiretsu firms. Between 1991 and 1996 the volume of orders placed by Japanese corporations halved (Japanese Small Business Research Institute, 1996). The plight of small domestic firms has been compounded by their weaker bargaining power since multinationals may threaten to purchase their intermediate inputs from their global supply chains. The keiretsu linkages led small firms to become highly specialised in production. Coupled with extensive customisation this leaves little opportunity to attract new buyers or enter new markets. On average, small firms' gross profit margins fell from 3.5% in the period 1986-1991 to 1.6% in 1992-1997 highlighting the competitive pressures they face (Japanese Statistical Yearbook, 1999).

Total factor productivity growth in all of Japan's industrial sectors has been declining since the 1980s (Cowling and Tomlinson, 2001). This could reflect Japan's proximity to the technological frontier following the productivity 'miracle'. However, during the 1990s TFP growth accelerated in the United States. Another explanation could be that the cross-shareholdings, the keiretsu networks and the long-term inter-firm relationships have made the cost of firms' exits extraordinarily high

(Kimura and Fujii, 2003). Low productivity firms have not exited the market and have held back aggregate productivity growth. However, Cowling and Tomlinson (2001) have advanced the view that hollowing out has been responsible through the relocation of productive multinational plants, and those of their keiretsu suppliers, abroad.

### 5.3 Decomposition of Aggregate Productivity

"*... the demise of the keiretsu relationships and the transfer of higher value added activities overseas will reduce both total factor productivity growth and international competitiveness.*" **Cowling and Tomlinson (2000)**

The data we use in this paper combines information from the Japanese "Census of Manufacturers" and the "Basic survey on Japanese Business Structure and Activities" (BSJBSA) conducted annually by METI. Further details on these datasets can be found in the Appendix to this chapter. The "Census of Manufacturers" (COM) comprises 169,590 plant-level observations from 1994 to 2005 for all establishments with more than 5 employees.[46] A lack of data on intangible assets, necessary in the construction of TFP, means we are also forced to exclude plants with less than 10 employees from the sample. We use this data to conduct a decomposition of aggregate productivity following the methodology outlined in Griliches and Regev (1995). This methodology provides the

[46] Entry and exit will therefore be defined by movement above and below this level.

contribution to aggregate productivity growth from that within plants, the between component (the reallocation of market share across plants in the industry) and that which follows from the entry and exit of plants in the industry. We link the COM plant-level data to the BSJBSA firm-level data. The use of the BSJBSA restricts our regression analysis later in the paper to include only firms with more than 50 employees, although it is worth noting that the lower limit on plants remains 10 employees.

As already discussed we estimate that the aggregate rate of productivity growth across the manufacturing firms within our sample was just 0.5 per cent per annum. This figure lies between the estimates for the Japanese economy as a whole of 0.8 per cent per annum (1990-1995) by Jorgenson and Motohashi (2005), 0.2 per cent per annum (1991-2000) by Hayashi and Prescott (2002) and 0.1 per cent (1991-2002) by Ahearne and Shinada (2005). Decomposing this growth using equation (3.1) suggests that all of the channels have contributed positively to the overall rate of productivity growth in Japan. Therefore none has been very fast as a consequence, such that all of the channels would appear to be relevant when discussing explanations behind the low rate of Japanese productivity growth.

$$\Delta P_t = \sum_{within} \bar{\theta}_i \Delta p_{it} + \sum_{between} \Delta\theta_{it}\left(\bar{p}_i - \bar{P}\right) + \sum_{enrty} \theta_{it}\left(p_{it} - \bar{P}\right) - \sum_{Exit} \theta_{it-k}\left(p_{it-k} - \bar{P}\right) \quad (5.1)$$

Table 5.1: Multinational and non-MNE Plant Productivity Decompositions

| Productivity Component | Obs | Rate | % Contributed by MNEs |
|---|---|---|---|
| **Average Annual Productivity Growth Rate** | 143725 | 0.5% | |
| **Of which** | | | |
| Within Plant | 143725 | .14 | 28.6 |
| Between Plant | 143725 | .83 | 32.5 |
| Plant Entry | 143725 | .01 | 0.0 |
| Plant Exit | 143725 | .02 | 50.0 |

*Note*: Multinational components include domestic and foreign multinationals

According to Table 5.1 the majority of this growth, 68 per cent, is contributed by non-MNE firms. This is disproportionate to the employment and output shares of such firms: non-MNEs account for 49 per cent of employment and 35 per cent of output. In this sense it would also seem that any explanation of the slow productivity growth in Japan is also likely to include both multinational and non-multinational firms. For both MNEs and non-MNEs aggregate growth primarily arose through the reallocations of market share from less productive to more productive firms. This form accounted for 82 per cent of productivity growth, or an average annual rate of 0.83 per cent per annum. Of interest this rate of growth is comparable to that reported for the US in Foster, Haltiwanger and Krizan (2001), which might be used to suggest that within firm and entry and exit are the main sources for slow growth in Japan relative to that found in other developed countries.

In support of this view, and in contrast to the fears of hollowing out through the closure of firms and plant, the effect of closure accounted for just 1% of total productivity growth. This, is as Ahearne and Shinada (2005) and The Economist (2004, 2009) suggested, and as we show in more detail below would appear to be explained largely by the very low rate of entry and exit that occurred within Japanese manufacturing. Finally, the contribution from within plant productivity growth was just 14 per cent, on average. To provide some context to this figure, Haltiwanger (1997) found within plant productivity changes in manufacturing industries generated 54% of aggregate U.S. productivity improvements between 1977 and 1987. For Israel, Griliches and Regev (1995) found the figure to be 83% for the years 1979-88.

The decompositions we present also broadly support those in Ahearne and Shinada (2005) that use data on firms listed on the Japanese stock exchanges on an industry-by-industry basis. While there are differences across sectors, they calculate that for the construction, wholesale and retailing industries in Japan that the between component of aggregate productivity growth was negative, while it was close to zero in most manufacturing sectors.

In the next section of the paper we explore the determinants of the different elements of aggregate productivity, starting with the question of why the rate of exit is very low in Japan and whether this is explained by the actions of MNEs or of the forces of globalisation. We separate this question into two parts. The first compares the closure of single and multi-plant firms in a single framework. We then consider the question of which plants within a firm are singled out for closure. The final section considers the rate of productivity growth within firms. Given the comparability with the contributions to overall productivity growth found in the US we choose to exclude the between component from further analysis.

### 5.4 Empirical Results

**Question 1:** What causes the closure of Japanese plants?

We identify exit from the sample using the unique identification number given to all firms and their plants. A plant is deemed to have entered when it is observed at time *t* but was not observed in the dataset in the previous period, *t-1*. Equivalently, a plant that exits is one that was observed at *t-1*, but not at time *t*. In Table 5.2 we report the rate of entry and exit within each year for the total sample and for MNEs, and for single and multi-plant non-MNEs. Throughout the sample there are 2,330 instances of entry and 3,392 observations of exit, with a median rate of exit of 1 per cent per annum.[47] The low rate of entry and exit is consistent with the high average age of firms in the sample, which is over 40 years. We use this to suggest that the low rate of exit is not a consequence of the size threshold imposed on the Japanese census data at 5 employees. It also

[47] These are line with the evidence for Japan reported in Caballero et al. (2003), Peek and Rosengren (2003) and Ahearne and Shinada (2005).

suggests that low entry and exit rates have been a feature of the Japanese economy for a very long period of time, and are therefore unlikely to be the reason that productivity growth declined in Japan after the 'golden age'. Finally, in contrast to any argument that they are a consequence of some form of active industrial policy in Japan, it is worth noting that they are a feature of the data that also holds across industries.

This rate of exit is much lower than that found for other developed countries. For the U.S. Bernard and Jensen (2004) calculate 32 per cent of plants are shut over a 5 year period. Indeed the rate of churn (entry plus exit) in Japan is most similar to that found for small, open developed countries such as Austria, Switzerland, Sweden rather than the typical large developed country. According to the Eurostat FEED[48] dataset the lowest rate of churn amongst European countries is 5.7 per cent in Switzerland, 9.3 per cent in Sweden and 9.7 per cent in Austria. For France, Germany and the UK the comparable figures are 11, 17 and 18 per cent respectively. Low entry and exit rates in smaller countries are usually explained as a result of the open nature of their economies, resulting in severe left truncating of the productivity distribution in a Melitz (2003) type of framework. A consequence of this is the high share of exporters in the total population of firms. Greenaway et al. (2008) report for Sweden that exporters account for over 80 per cent of the total number of firms. In our data the proportion of exporters is around 30 per cent, a figure it is worth noting is likely to be biased upwards because export information is

[48] Eurostat Firm Entry and Exit Data Dimensions.

available only for firms with more than 50 employees. Severe left truncating of the productivity distribution would not therefore appear to be a likely source of low entry and exit rates in Japan.

Table 5.2: Annual Entry and Exit Rates

| | Complete Sample | | MNE | | Multi (ex. MNE) | | Single Plant | |
|---|---|---|---|---|---|---|---|---|
| Year | Entry | Exit | Entry | Exit | Entry | Exit | Entry | Exit |
| 1994 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 1995 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 1996 | .01 | .01 | .01 | .01 | .01 | .01 | .01 | .01 |
| 1997 | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |
| 1998 | .03 | .03 | .02 | .03 | .03 | .03 | .03 | .03 |
| 1999 | .01 | .03 | .01 | .03 | .01 | .03 | .01 | .03 |
| 2000 | .01 | .03 | .01 | .03 | .01 | .03 | .01 | .03 |
| 2001 | .01 | .03 | .01 | .03 | .02 | .03 | .01 | .03 |
| 2002 | .01 | .03 | .01 | .03 | .01 | .03 | .01 | .03 |
| 2003 | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |
| 2004 | .01 | .02 | .01 | .02 | .01 | .02 | .01 | .02 |
| 2005 | .02 | - | .02 | - | .02 | - | .02 | - |

Entry and exit rates vary across firm types, with the highest rates identified in multi-plant firms and multinationals. While these rates of exit are low when compared to other countries, that they are higher relative to those found for single plant firms might explain why the rate of closure of plants is seen by commentators within Japan as high, although some cultural aversion to exit would be needed to claim that these are excessive. That the rate of exit is higher for multi-plant firms would appear consistent with the explanation of corporate restructuring by large Japanese firms as a result of their over-expansion in the 1980s by Kimura and Fuji (2003) or alternatively of offshoring of the production of intermediate inputs by Japanese multinationals.

As multi-plant and multinational firms are typically larger and more productive than single plant firms it would also appear consistent with the argument made in Nishimura et al. (2005) that this could have acted as a drag on aggregate productivity growth. We explore this point in Table 5.3 below where we report the average productivity of plants according to their ownership and if they exit alongside the averages for firms of different types as a whole. As expected, the table shows that, on average, plants owned by MNEs are some 7 per cent more productive than the average plant within the same industry and some 10 per cent more productive than the average non-MNE plant. It would also seem that, conditional on their ownership, plants that exit have lower average productivity compared to those that remain. In the case of MNE plants this difference is small at 1 per cent, but it is larger for non-MNE plants at 4 per cent. The table also confirms the view that the plants shut by MNEs are relatively productive compared to other plants in the manufacturing sector and could therefore contribute negatively to aggregate productivity growth. Plants shut by MNEs are on average 6 per cent more productive than the average plant in the manufacturing sector.

Table 5.3: Plant Productivity Across Firm Types

| Firm type | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Average Plant Productivity | 169590 | .96 | .35 | -4.81 | 4.36 |
| Average Plant Productivity if Owned by: | | | | | |
| Multiplant Multinational | 41690 | 1.03 | .40 | -4.81 | 4.36 |
| Single Plant Multinational | 11638 | .99 | .35 | -2.39 | 3.83 |
| Domestic Multiplant Firm | 41998 | .93 | .36 | -3.66 | 4.3 |
| Single Plant Domestic Firm | 74264 | .92 | .30 | -4.34 | 3.68 |
| Average Exiting Plant Productivity if Owned by: | | | | | |
| Multiplant Multinational | 1142 | 1.02 | .51 | -2.26 | 4.36 |
| Single Plant Multinational | 174 | 1.02 | .57 | -1.03 | 3.83 |
| Domestic Multiplant Firm | 1237 | .88 | .51 | -2.85 | 4.3 |
| Single Plant Domestic Firm | 839 | .90 | .47 | -2.12 | 3.44 |

What are the factors that explain which plants and firms are shut in Japan? In Table 5.4 we investigate the determinants of plant closure using a Cox Proportional Hazards model. In so doing we build on prior evidence for Japanese manufacturing found in Kimura and Fujii (2003) and Kimura and Kiyota (2006), which we extend to consider the role of firm and industry import penetration, the multinational status of the firm and industry sunk costs. We group the dependent variables into plant, firm and industry level determinants of exit. The plant level variables include measures of size (employment), capital intensity, TFP and average wage. Summary statistics of these variables can be found in Table A5.1 in the Appendix. The firm level variables capture the R&D intensity of the firm, its ownership (whether it is a foreign owned firm), and the extent of its engagement with global markets (whether it exports, imports or owns affiliates abroad). The industry level measures attempt to capture the effects of globalisation on the probability of survival more generally and are measured by import penetration and intra-industry trade. Summary statistics of these and the firm variables are reported in Appendix Table A5.2 and A5.3.

The hazard function, $h(t)$, is defined as the rate at which plants exit in the interval between $t$ and $t+1$ conditional upon having survived until $t$. Failure is defined as when a plant exits and survival is the number of years the plant is present in the dataset. The hazard rate is specified as

$$h(t) = h_0(t)e^{X\beta} \qquad (5.2)$$

where $h_0$ is the baseline hazard. $X$ is a vector containing plant, firm and industry variables. Throughout the analysis a Cox proportional hazards model is used due to its flexibility though we also use duration models to ensure our results are not a product of unobserved heterogeneity. Using a Cox model also implicitly incorporates entry into the model. A hazard ratio less than 1 indicates that an explanatory variable reduces the probability of exit while values in excess of 1 imply a greater risk of failure. Non-parametric estimators have proved popular in the plant exit literature with Mata and Portugal (2002) and Bandick (2007) employing them to describe the survival rates of Swedish multinational owned, and Spanish, plants.

The results in Table 5.4 suggest that the type of plants that are closed in Japan are similar to those found to exit in other countries. We find in regression 1 that the probability of exit is decreasing in the size, capital intensity and TFP of the plant and increasing in the average wage. This matches evidence reported in Dunne et al. (1989), Görg and Strobl (2003), Mata and Portugal (1994), Bernard and Sjoholm (2003), Bernard and Jensen (2007) for other OECD countries and Kimura and Fujii (2003) for Japan. The probit results in the table suggests however, that the effect of these variables on the probability of exit is very small, an artefact of the low rate of exit in the sample. A one unit increase in plant size, capital intensity or TFP reduces the hazard by 74%, 22% and 40% respectively. Upstream plants, which are more materially intensive, face 22% lower hazard rates relative to the baseline.

Table 5.4: Exit in Japan

| Variable/Regression | 1<br>Haz. Ratio | 2<br>Haz. Ratio | 3<br>MFX | 4<br>MFX |
|---|---|---|---|---|
| Estimator | Cox PH | Duration | Clolog | Probit |
| **Plant Variables** | | | | |
| Size | .27*** | .26*** | -.012*** | -.014*** |
| | (-34.70) | (-34.23) | (-37.02) | (-36.41) |
| Capital intensity | .79*** | .78*** | -.002*** | -.003*** |
| | (-10.51) | (-10.49) | (-9.76) | (-10.29) |
| TFP | .62*** | .60*** | -.005*** | -.008*** |
| | (-7.27) | (-7.41) | (-6.95) | (-8.44) |
| Wages | 1.90*** | 1.91*** | .007*** | .010*** |
| | (7.89) | (7.57) | (8.49) | (8.94) |
| Material Intensity | .78*** | .77*** | -.002*** | -.004*** |
| | (-5.80) | (-5.84) | (-5.48) | (-6.99) |
| **Firm Variables** | | | | |
| Export dummy | .01*** | .01*** | -.047*** | -.053*** |
| | (-7.55) | (-7.46) | (-4.80) | (-5.30) |
| Import dummy | .15*** | .12*** | -.015*** | -.019*** |
| | (-3.43) | (-3.53) | (-3.69) | (-3.97) |
| Firm exports | 1.17*** | 1.18*** | .002*** | .002*** |
| | (7.62) | (7.52) | (7.51) | (7.56) |
| Firm imports | 1.08*** | 1.09*** | .001*** | .001*** |
| | (3.68) | (3.78) | (3.65) | (3.82) |
| R&D intensity | 1.00 | 1.00 | .000 | .000 |
| | (-.27) | (-.49) | (.19) | (.33) |
| Domestic MNE dummy | 1.35*** | 1.35*** | .003*** | .004*** |
| | (4.00) | (3.86) | (3.68) | (4.10) |
| Foreign MNE dummy | 1.90** | 1.99** | .007 | .006 |
| | (2.00) | (2.11) | (1.27) | (1.04) |
| Multiplant dummy | 2.17*** | 2.13*** | .009*** | .011*** |
| | (14.87) | (14.06) | (13.44) | (14.40) |
| **Industry Variables** | | | | |
| Grubel-Lloyd index | .89 | .89 | -.001 | -.001 |
| | (-.81) | (-.86) | (-.60) | (-.39) |
| Low wage imports | 1.02 | 1.02 | .000 | .001 |
| | (.20) | (.18) | (.34) | (.43) |
| Other imports | .90 | .91 | -.002 | -.002 |
| | (-.59) | (-.50) | (-.83) | (-1.00) |
| Sunk costs | .96*** | .96*** | -.000*** | -.001*** |
| | (-3.00) | (-2.99) | (-2.67) | (-2.66) |
| theta | | .00 | | |
| | | (.59) | | |
| Log pseudolikelihood | -30965 | -13819 | -11588 | -11662 |
| Number of observations | 131669 | 131669 | 131669 | 131669 |

*Notes*: Hazard ratios reported in regressions 1 and 2. In regressions 3 and 4 the coefficients are marginal effects. Z-statistics, clustered at the firm level, are reported in parentheses with the exception of the theta variable for which the value in parentheses is a t-statistic. Industry dummies are defined at the three-digit level. ***, ** and * indicate significance at the 1, 5 and 10 percent levels.

We find a more limited role for firm characteristics in determining exit. There are reasons to believe that that a firm's R&D expenditure may affect the markets in which a firm operates. Perez et al. (2004) for Spain find that R&D intensity lowers the hazard rate, while Kimura and Kiyota (2003) find similar evidence for Japanese firms. However, the direction of the relationship is not obvious. Since R&D is associated with uncertainty, firms with high R&D intensities or which operate in R&D intensive sectors may face a higher risk of failure. This has been found by Audretsch and Mahmod (1995), Audretsch et al. (2000) and Segarra and Callejon (2002). Conditional on the plant variables we find no effect from the R&D intensity of the firm in determining the probability of exit. This result occurs as a result of the above average characteristics of plants that belong to firms that conduct R&D however. When we exclude the plant variables from the regression we find that firm R&D intensity reduces the probability of exit.[49]

We also find in Table 5.4 initial evidence that firm-level globalisation plays a role in firm closure. For example, plants belonging to exporting and importing firms face substantially lower hazard rates. This corroborates with evidence for the United States (Bernard and Jensen, 1995), the United Kingdom (Greenaway and Kneller, 2004), Belgium

[49] See regression 5 in Table 3.5 of Chapter Three.

(Muuls and Pisu, 2009) and Italy (Castellani, Serti and Tomasi, 2008). Such firms are believed to possess innate characteristics that guard against exit. For example, they are larger and more productive. However, the extent of the firm's engagement in international markets also matters. Offshoring, or international outsourcing, may be responsible for the significance of the firm import variable. The volume of firm exports also increase the probability of death.

Offshoring as an explanation for plant closure might also explain the significance of the indicators of the MNE status of the firm in the regression. In regression 1 we find that plants belonging to domestic MNEs and foreign MNEs are more likely to exit, with a stronger effect found for foreign MNE status.[50] This latter effect occurs despite the low levels of foreign presence of foreign firms within Japan. Of the 53,328 observations of plants owned by a multinational, only 761 observations relate to plants owned by a foreign multinational. Also of interest, we find that the behaviour of multinational firms is distinct from that of multi-plant firms more generally, which also have a higher probability of exit conditional on their firm and plant characteristics. If plant closure is due to the pace of entry into new products and markets during the 1980s, the pattern of its reversal is different between multinationals and non-multinationals.

[50] We measure foreign ownership as a binary variable equal to 1 if more than 50 percent of the firm's capital is foreign owned and zero otherwise The 50% threshold is also used by Görg and Strobl (2002). The results are robust to either the International Monetary Fund's definition of foreign ownership at the 25% level, or, to including the absolute percentage of capital which is foreign held (which may take a value between 0 and 100).

The behaviour of MNEs is again not inconsistent with that found for multinationals in other countries, where the effect of foreign ownership on the probability of survival has been found to be somewhat mixed. Using panel data on Chilean manufacturing plants, Alvarez and Görg (2005) find that foreign ownership has a positive effect on exit, but only during the significant recession of the late 1990s, while Bernard and Sjoholm (2003) find that conditional on their greater size and labour productivity, foreign plants are more likely to exit in Indonesia. Mata and Portugal (2002) in contrast find that conditional on firm characteristics, being foreign has no effect on the probability of exit in Portugal, while Ozler and Taymaz (2004) fail to find any difference in survival prospects between foreign and native firms for Turkey.

The most striking difference in the behaviour of Japanese firms with that found for other countries comes with respect to the industry level measures of globalisation. In other contexts greater industry level exposure to global markets has been found to be a cause of firm and plant death, see for example Bernard et al. (2006) and Greenaway et al. (2008). Greater exposure to foreign competition in industries in which the country has a comparative disadvantage leads to the closure of production plants. For Japan we find no such effects, irrespective of the source of that import competition. This is somewhat unexpected given that the measures of firm level imports were found to significantly affect the likelihood of exit. Firms that offshore, either through importing or their ownership of affiliates abroad, are significantly more likely to exit than other types of firms, but the greater levels of import penetration within the industry more generally has no effect on the likelihood of exit.

One explanation might be that import penetration levels in Japan are low and some threshold level is required to be reached before it affects plant closure. Such a view does not have strong support. While import penetration rates are lower in Japan compared to other OECD countries they are not drastically lower. Over the sample, on average, imports from non-low wage countries account for about 9 percent of production. In comparison, Bernard et al. (2006) report for the US that aggregate import penetration rose from 15 percent to 28 percent between 1977 to 1997. Moreover, the level of import penetration from low wage economies is more similar between these two countries. In the US import penetration from low wage economies increased from 2 percent to 6 percent whereas in our sample it doubled to 4 percent between 1994 and 2002.

Of the industry variables, only industry sunk costs are found to have a significant effect on exit. This supports evidence from Dunne, Roberts and Samuelson (1988, 1989), Bernard and Jensen (2007) for the US, Geroski (1991a,b) for the UK and Greenaway et al. (2008) for Sweden.[51] According to our estimates a one unit increase in industry sunk costs reduces the baseline hazard rate by 4%. In industries with high sunk costs

[51] We do not consider the question of whether sunk-costs and exit are correlated with entry into the Japanese manufacturing sector (Dunne, Roberts and Samuelson, 1988, 1989), or indeed whether there is a net rate of entry or exit into the industry.

potential entrants must draw a high productivity so that they may profitably produce (Hopenhayn, 1992; Melitz, 2003). Consequently there are fewer successful entrants and incumbents face a lower probability of exit.

This result points to the role of entry as an unexplored determinant of low exit rates in Japan. Strict bankruptcy laws, government regulation and 'zombie' lending by banks to relatively unproductive firms have been used to explain low rates of exit, however without similar restrictions on the ability of new firms to enter the market it is not clear why the rate of new entry would also be low. In support of this view, and of surprise given the discussion in the previous literature on the difficulties in closing firms, according to the World Bank's Ease of Doing Business Indicators Japan ranks as the country in which the costs of closing a business (measured as the recovery rate in bankruptcy) are *lowest* out of the 183 countries that make up the sample. For comparison the UK is ranked number 9, the US at 15, Germany at 35 and France at 42. In contrast Japan's ranking in the ease of opening a new business in that dataset is 91 (out of 183) in between Mexico and Uzbekistan. For this measure the US lies at number 8, the UK at 16, France at 22 and Germany at 84.

In the remaining regressions of the table we consider the robustness of those findings to different estimation techniques. Our preferred estimator is the Cox Proportional Hazards model due to its flexibility. We are confident that our results are not driven by unobserved heterogeneity. In regression 2 we re-run the model but use a duration model in which we parameterise the hazard rate using a Weibull distribution and unobserved heterogeneity is assumed to follow a gamma distribution. The results are almost identical to those obtained using the Cox model though the estimated coefficients are marginally higher. The t-statistic on the duration parameter, theta, is estimated to be 0.59 indicating that the model captures the relevant information and if there is unobserved heterogeneity, it is uncorrelated with the independent variables. Since the Cox model is a continuous time estimator we also experiment with its discrete time equivalent, the cloglog estimator in column 3. We report marginal effects which mirror the sign of those in regressions 1 and 2. A probit model is used in regression 4 which returns strongly similar results which is unsurprising given the asymptotic properties of survival analysis and binary estimators. The small marginal effects reflect the low rate of exit from the sample.

**Question 2: What are the Causes of Exit within Multiplant Firms?**

From Table 5.4 it is clear that plants that are small, have low productivity, low capital intensity etc. have a greater probability of closing down. However we also find that the marginal effect of these variables is small and that both multi-plant and multinational firms have a greater probability of exit. Motivated by the latter, in this section we focus on the type of plants that are shut by multinational firms and those multi-plant firms that have no overseas affiliates.

We now measure the plant variables relative to the firm average. For example, the size ratio is calculated as the natural logarithm of the number of plant employees divided by the number of people employed by the firm. Similar variables are constructed for capital intensity, material intensity and wages. Since multiplant firms may have operations in several industries, such that plant and firm TFP are not comparable, we choose to drop this variable from the regression. The remaining control variables are similar to those included in Table 5.4. Finally, we explore the Kimura and Fujii (2003) hypothesis that plant closure in the 1990s reflected the excessive growth of large Japanese firms in the 1980s. We capture this effect using a dummy variable that takes a value equal to one if the plant operates in the same 3-digit industry as the firm (and zero otherwise).

Table 5.5: Exit within Multiplant Firms

| | 1<br>Haz. Ratio | 2<br>Haz. Ratio | 3<br>Haz. Ratio | 4<br>Haz. Ratio | 5<br>Haz. Ratio | 6<br>Haz. Ratio |
|---|---|---|---|---|---|---|
| Sample | MNE | Multi | Both | MNE | Multi | Both |
| **Plant Variables** | | | | | | |
| Relative size | .45*** | .50*** | 1.00 | .33*** | .24*** | 1.36*** |
| | (-19.09) | (-16.92) | (-.08) | (-21.97) | (-23.02) | (4.22) |
| Relative capital intensity | .70*** | .73*** | .95 | .76*** | .81*** | .95 |
| | (-7.83) | (-10.04) | (-.98) | (-6.13) | (-6.90) | (-1.00) |
| Relative wage | 1.55*** | .99 | 1.65*** | 2.58*** | 1.73*** | 1.42* |
| | (3.72) | (-.12) | (3.46) | (7.33) | (4.15) | (1.94) |
| Relative material intensity | .77*** | .86*** | .96 | .71*** | .87** | .84* |
| | (-3.57) | (-2.99) | (-.49) | (-3.99) | (-2.28) | (-1.80) |
| Relative TFP | | | | .64*** | .61*** | 1.04 |
| | | | | (-3.82) | (-4.67) | (.27) |
| Same dummy | .94 | .86* | 1.06 | .89 | .89 | .96 |
| | (-.67) | (-1.76) | (.48) | (-1.29) | (-1.54) | (-.35) |
| **Firm Variables** | | | | | | |
| Export dummy | 23.68*** | .82 | 1.29 | .01*** | .01*** | .51 |
| | (15.25) | (.24) | (.28) | (-5.10) | (-4.36) | (-.59) |
| Import dummy | .90*** | 1.08 | 1.63 | .25* | .06** | 5.28 |
| | (-4.42) | (.07) | (.53) | (-1.75) | (-2.49) | (1.52) |
| Firm exports | .90*** | 1.00 | 1.01 | 1.16*** | 1.19*** | 1.02 |
| | (-4.42) | (-.01) | (.18) | (5.17) | (4.36) | (.43) |
| Firm imports | .91*** | 1.00 | .98 | 1.05* | 1.12** | .93* |
| | (-3.84) | (.05) | (-.49) | (1.78) | (2.71) | (-1.83) |
| R&D intensity | .98*** | .97*** | 1.02** | 1.01 | 1.00 | 1.01 |
| | (-3.10) | (-7.21) | (2.02) | (1.07) | (-.48) | (1.49) |
| **Industry Variables** | | | | | | |
| Grubel-Lloyd index | 1.01 | .95 | 1.08 | .98 | .84 | 1.09 |
| | (.03) | (-.24) | (.89) | (-.08) | (-.76) | (1.04) |
| LWPEN | 1.17 | 1.14 | 1.13** | 1.14 | 1.08 | 1.01 |
| | (.84) | (.69) | (2.56) | (.67) | (.48) | (.17) |
| OTHPEN | 1.06 | .63 | 1.04 | .98 | .62 | 1.07 |
| | (.20) | (-1.42) | (.49) | (-.06) | (-1.44) | (.84) |
| Sunk Costs | .94*** | .98 | .97 | .94*** | .99 | .98 |
| | (-2.45) | (-.98) | (-.99) | (-2.56) | (-.63) | (-.85) |
| Log pseudolikelihood | -9420 | -10.529 | -21425 | -9266 | -10268 | 20980 |
| Number of Observations | 31606 | 33406 | 65012 | 31613 | 33412 | 65025 |

*Notes*: In regression 1, 2 and 3 the plant variables are measured relative to the firm average. In regressions 4, 5 and 6 the plant variables are measured relative to the industry average. The coefficient estimates in regressions 3 and 6 show the interaction coefficient between each variable and the multinational dummy. Coefficient estimates are hazard ratios. Z-scores clustered at the firm level are reported in parentheses. The relative TFP variable is constructed as the logarithm of the plant's productivity relative to the average in its 3-digit industry. Industry dummies are defined at the three-digit level. ***, ** and * indicate significance at the 1, 5 and 10 percent levels.

Regression 1 reports the results for multinational firms and regression 2 for multi-plant firms without overseas affiliates. [52] We label these for ease as multi-plant firms. In many aspects the type of plants shut by these two types of firm are very similar, indeed it is not obvious from these results as to why multinationals have been singled out as the main cause of hollowing out in Japan. Conditional on unobserved 3 digit industry fixed effects for the firm and for the plant, the results of regression 4 show that multinational plants that are large relative to the firm are less likely to exit, as are more capital intensive plants. These are the same types of plant that are less vulnerable to closure within multi-plant firms. The effects of size and capital intensity are also similar for multinational and multi-plant firms, indeed we cannot reject the hypothesis that multinationals and multi-plant firms react identically to the same change in size, capital intensity and material intensity when we pool the observations into a single regression. We also find for both types of firm little evidence that those plants that lie within a different 3-digit industry to the firm are more

[52] The MNE firms include a small number of foreign multinationals. In unreported regressions we test to see whether the effect differs according to whether the multinational is domestic or foreign owned. The results are not substantively different to the MNE results in Table 5.5. When we test for differences in the coefficients between domestic and foreign multinationals no statistically significant differences are found at conventional levels.

vulnerable to exit. Increased focus on the core activities of the firm does not appear to have been a significant driver of exit over this time period.

The differences in the determinants of plant closure instead relate primarily to the variables that capture motives for offshoring. There is evidence from regression 1 that MNEs are more likely to shut high cost plants, for example, since the hazard ratio is 1.55. For multi-plant firms this factor was not important, perhaps reflecting the need under just-in-time delivery to be close to final producers. We also find that MNEs shut plants based on the capital and material intensity of the plant. MNEs are significantly less likely to shut plants that are capital and material intensive, which we take to mean further along the production chain relative to the rest of the firm. The effect of these variables is of a similar size to those for the other plant characteristics. We find for multi-plant firms that whether or not it is engaged in international markets is not a good predictor of the plants that are shut. This might occur because this variable is measured at the level of the firm, although, given that we find that the export status of the firm does affect the likelihood the firm will shut plants, perhaps a better explanation is that offshoring and importing of inputs are not identical concepts. However, plants owned by multinationals face substantially higher hazard ratios if the firm is an exporter but all other measures of firm-level globalisation ameliorate the threat of closure. Finally, the R&D intensity of the firm increases survival for plants owned by both firm types but sunk costs only act as a barrier to exit when the plant is part of a multinational.

When we measure plant characteristics relative to the industry average in regressions 4 to 6 some of the results differ to those in columns 1 to 3. Among the plant variables we observe that multiplant firms are now more likely to close relatively high wage plants. The other plant variables remain essentially as before. The major differences occur at the firm level. Exporting and importing firms are now less likely to shut their plants while the volume of firm imports and exports raise the hazard rate by between 5% and 19% depending on the sample.

Consistent with the results in Table 5.4 we continue to find no role for the globalisation variables within any of the regressions. The level and the structure of trade have no effect on the volume of plant exit within Japan. Given the contrast between these results and those found for other OECD countries this again suggests some common institutional factors that limits the amount of exit (or entry) that occurs.

**Question 3: How does Multinational Concentration within the Industry Affect Exit?**

We extend the analysis to consider additional measures of globalisation, again at the industry level. We have observed that multinational plants are, on average, large, more capital intensive and more productive than domestic plants. They are backed by a firm structure which may open new markets and opportunities. Anecdotal evidence suggests indigenous firms struggle to survive when confronted by competition from multinationals while Bandick (2007) presents formal econometric evidence on how multinational concentration shapes exit in Sweden.

To address this we incorporate two measures of multinational concentration into our model to assess whether their presence in the industry imparts an externality upon other active plants. Multinational concentration is defined as the share of employees in multinational plants relative to total employment in the sector:

$$MNE\_Concentration_{it} = \left( \frac{Total\_MNE\_Employees_{it}}{Total\_Employees_{it}} \right)$$

where $Total\_MNE\_Employees_{it}$ denotes the total number of people employed in multinational plants in industry $i$ at time $t$ and $Total\_Employees_{it}$ is the total number of workers in industry $i$ at time $t$. As a robustness check we measure multinational concentration as the ratio of MNE plants to total plants in the industry at time $t$.

In Table 5.6 both concentration measures are disaggregated into domestic and foreign multinational parts. There is a large degree of heterogeneity in multinational concentration across industries regardless of which indicator we use. The average concentration of multinationals is 50 percent and 31 percent using the employee and plant measure respectively.

In the tobacco industry virtually the entire sector is comprised of multinationals and although multinationals comprise the majority of workers in 31 industries, there are 7 industries in which more than 50 percent of plants are MNE owned.

Table 5.6: Multinational Concentration by Industry

| Industry | Employees Domestic | Employees Foreign | Plants Domestic | Plants Foreign |
|---|---|---|---|---|
| **Sample** | .49 | .01 | .31 | .00 |
| Livestock products | .29 | .01 | .25 | .01 |
| Seafood products | .18 | .01 | .16 | 0 |
| Flour and grain mill products | .27 | .01 | .27 | 0 |
| Miscellaneous foods and related products | .32 | .01 | .20 | .00 |
| Prepared animal foods and organic fertilizers | .21 | .01 | .19 | 0 |
| Beverages | .42 | .01 | .31 | .00 |
| Tobacco | .99 | .01 | 1 | 0 |
| Textile products | .32 | .01 | .24 | .00 |
| Lumber and wood products | .20 | .01 | .15 | 0 |
| Furniture and fixtures | .40 | .01 | .20 | .00 |
| Pulp, paper and coated and glazed paper | .57 | .04 | .33 | .01 |
| Paper products | .29 | .01 | .25 | .00 |
| Printing, plate making for printing and bookbinding | .28 | .01 | .14 | .00 |
| Leather and leather products | .14 | .01 | .12 | 0 |
| Rubber products | .72 | .01 | .48 | .00 |
| Chemical fertilizers | .24 | .01 | .19 | 0 |
| Basic inorganic chemicals | .45 | .02 | .35 | .01 |
| Basic organic chemicals | .86 | .02 | .71 | .01 |
| Organic chemicals | .75 | .02 | .54 | .01 |
| Chemical fibres | .82 | .01 | .63 | 0 |
| Miscellaneous chemical products | .66 | .01 | .45 | .01 |
| Pharmaceutical products | .56 | .01 | .35 | .00 |
| Petroleum products | .44 | .01 | .41 | .01 |
| Coal products | .59 | .01 | .43 | 0 |
| Glass and its products | .57 | .04 | .35 | .02 |
| Cement and its products | .28 | .01 | .15 | .00 |
| Pottery | .66 | .03 | .30 | .01 |
| Miscellaneous ceramic, stone and clay products | .42 | .01 | .31 | .00 |
| Pig iron and crude steel | .82 | .06 | .52 | .02 |
| Miscellaneous iron and steel | .39 | .02 | .22 | .01 |
| Smelting and refining of non-ferrous metals | .57 | .04 | .46 | .02 |
| Non-ferrous metal products | .60 | .01 | .36 | .00 |
| Fabricated constructional and archtectural metal products | .38 | .01 | .18 | .00 |
| Miscellaneous fabricated metal products | .42 | .01 | .28 | .00 |
| General industry machinery | .68 | .01 | .33 | .01 |
| Special industry machinery | .57 | .01 | .32 | .00 |
| Miscellaneous machinery | .53 | .03 | .31 | .00 |
| Office and service industry machines | .62 | .01 | .35 | .00 |
| Electricat generating, transmission, distribution and industrial apparatus | .56 | .02 | .27 | .00 |
| Household electric appliances | .78 | .03 | .53 | .01 |
| Electroninc data processing machines, digital and analog computer equipment and accessories | .59 | .02 | .38 | .01 |
| Communication equipment | .68 | .02 | .41 | .00 |
| Electronic equipment and electric measuring instruments | .65 | .02 | .35 | .01 |
| Semiconductor devices and integrated circuits | .60 | .02 | .40 | .01 |
| Electronic parts | .55 | .01 | .40 | .01 |
| Miscellanoeus electrical machinery equipment | .68 | .02 | .45 | .01 |
| Motor vehicles | .84 | .05 | .52 | .02 |
| Motor vehicle parts and accessories | .71 | .02 | .44 | .01 |
| Other transportation equipment | .67 | .01 | .36 | .01 |
| Precision machinery and equipment | .59 | .01 | .39 | .00 |
| Plastic products | .47 | .01 | .35 | .00 |
| Miscellaneous manufacturing industries | .56 | .01 | .34 | .00 |

In regression 1 of Table 5.7 we study separately the effects of domestic and foreign multinational concentration. Neither variable has a significant impact upon plant exit. To examine whether we are obscuring the effect of multinational concentration by looking at the whole sample, we split the sample into MNE, multiplant and single domestic owned plants. We continue to find so significant relationship between plant death and either form of MNE concentration at conventional levels. A potential explanation for this could be that under keiretsu contracts domestic plants were reliant upon multinationals to purchase their output. If this is the case then multinationals would not be a primary source of competition. Instead plants serving the Japanese market would compete primarily with other domestic firms.

We calculate domestic plant concentration using the same methodology as was used for multinational concentration. The results are not reported since no significant effect is detected across any specification leading us to conclude that the concentration of multinationals and domestic firms within a sector do not determine plant exit. Rather it is plant and firm characteristics instead of externalities which govern exit.

Table 5.7: Multinational Concentration

| Variable/Regression | 1<br>Haz. Ratio | 2<br>Haz. Ratio | 3<br>Haz. Ratio | 4<br>Haz. Ratio |
|---|---|---|---|---|
| Sample | All | MNE | Multi | Single |
| **Plant Variables** | | | | |
| Size | .27*** | .32*** | .24*** | .20*** |
| | (-34.69) | (-23.22) | (-23.27) | (-17.10) |
| Capital intensity | .79*** | .77*** | .81*** | .78*** |
| | (-10.51) | (-6.28) | (-6.79) | (-5.68) |
| TFP | .62*** | .67*** | .63*** | .44*** |
| | (-7.27) | (-3.80) | (-4.54) | (-4.88) |
| Wages | 1.90*** | 2.38*** | 1.75*** | 1.40* |
| | (7.89) | (7.16) | (4.23) | (1.86) |
| Material Intensity | .78*** | .69*** | .87** | .78*** |
| | (-5.79) | (-4.49) | (-2.16) | (-2.63) |
| **Firm Variables** | | | | |
| Export dummy | .01*** | .01*** | .01*** | .09* |
| | (-7.55) | (-5.83) | (-4.38) | (-1.64) |
| Import dummy | .15*** | .22** | .06** | .02*** |
| | (-3.43) | (-2.10) | (-2.47) | (-2.86) |
| Firm exports | 1.17*** | 1.17*** | 1.19*** | 1.11* |
| | (7.61) | (5.85) | (4.38) | (1.77) |
| Firm imports | 1.08*** | 1.06** | 1.12*** | 1.18*** |
| | (3.67) | (2.17) | (2.69) | (3.04) |
| R&D intensity | 1.00 | 1.01 | 1.00 | 1.00 |
| | (-.27) | (1.02) | (-.49) | (.18) |
| Domestic MNE dummy | 1.35*** | .87 | | |
| | (4.00) | (-.41) | | |
| Foreign MNE dummy | 1.91** | | | |
| | (2.01) | | | |
| Multiplant dummy | 2.17*** | 1.85*** | | |
| | (14.87) | (5.52) | | |
| **Industry Variables** | | | | |
| Grubel-Lloyd index | .90 | .93 | .87 | .88 |
| | (-.78) | (-.28) | (-.63) | (-.39) |
| Low wage imports | 1.02 | 1.02 | 1.07 | 1.00 |
| | (.22) | (.09) | (.39) | (.01) |
| Other imports | .90 | 1.00 | .62 | 1.16 |
| | (-.59) | (-.01) | (-1.40) | (.42) |
| Sunk costs | .96*** | .94** | .99 | .96 |
| | (-2.99) | (-2.58) | (-.63) | (-1.51) |
| Domestic MNE concentration | .98 | .94 | .99 | .61 |
| | (-.09) | (-.13) | (-.04) | (-1.05) |
| Foreign MNE concentration | 1.00 | 1.00 | .99 | 1.00 |
| | (-.30) | (.11) | (-1.12) | (.20) |
| Log pseudolikelihood | -30965 | -10755 | -10265 | -6682 |
| Number of observations | 131669 | 39893 | 33412 | 58364 |

**Question 4: Do Plants Switch Industry rather than Exit?**

Given that exit has been not been found to be related to several measures of globalisation, we investigate whether plants switch industries instead. Heterogenous firm models such as Melitz (2003) and Bernard, Redding and Schott (2007) have emphasised firm exit through death. In such models firms which fall below a given productivity threshold can no longer cover the fixed costs of operating in the industry and exit. However, it has been observed empirically that exit through death is not the only means through which firms leave an industry.

Greenaway et al. (2008) find that exit through plant closure is the least likely form of exit in Sweden. In their study 35% of exit occurs through firms switching to another industry. Bernard, Jensen and Schott (2006) also find switching to be important in response to import competition from low-wage countries. Similarly, Bernard, Redding and Schott (2009) find that one half of firms alter their mix of five-digit SIC products every five years and that firms add and drop products over time.

We define industry switching as where plant $i$ is observed in the 3 digit industry $j$ at time $t$-$1$ but is present in a different 3 digit industry, $k$, at time $t$. As with exit, the number of plants that switch industry is low. Approximately 2.4% of plants in the sample switch industries over the period. There are also differences in the characteristics of plants which switch and those that exit. For example, switching plants tend to be larger, have higher sales and use more intermediate inputs. Exiting plants tend to have higher capital stocks per worker and pay higher wages.

Table 5.8 also highlights some differences in the firms which own switching and exiting plants. Switching plants are, on average, owned by relatively more productive firms but the firms tend to have lower sales and use fewer intermediate inputs than the owners of exiting plants. The incidence of multiplant ownership among the switching and exiting groups is 49% and 70%. There do not appear to be substantial differences between the firm types in terms of the incidence of multinational and foreign ownership. The same holds for importing and exporting behaviour.

Table 5.8: Switching Plant and Firm Characteristics

| Variable / Form of Exit | Switch | Exit | Continue |
|---|---|---|---|
| Observations | 4066 | 3392 | 141145 |
| **Plant Variables** | | | |
| Plant Size<br>*Number of Employees* | 241 | 131 | 228 |
| Capital per Worker<br>*Millions of Japanese yen* | 16.73 | 19.24 | 17.24 |
| Plant TFP<br>*Total Factor Productivity* | .93 | .94 | .97 |
| Plant Wages<br>*Millions of Japanese yen* | 4.99 | 5.17 | 4.87 |
| Plant Sales<br>*Millions of Japanese yen* | 10060 | 6333 | 11779 |
| Intermediate Inputs<br>*Millions of Japanese yen* | 6189 | 3683 | 6947 |
| **Firm Variables** | | | |
| Age<br>*In years* | 46 | 47.57 | 47.06 |
| Size<br>*Number of Employees* | 2167 | 2369 | 1627 |
| Capital per Worker<br>*Millions of Japanese yen* | 16.95 | 20.50 | 18.67 |
| Firm TFP<br>*Total factor Productivity* | 1.02 | .98 | .98 |
| Firm Sales<br>*Millions of Japanese yen* | 128598 | 146861 | 100788 |
| R&D Complexity<br>*R&D Expenditure divided by firm sales* | .02 | .02 | .01 |
| Intermediate Inputs<br>*Millions of Japanese yen* | 104135 | 120903 | 81512 |
| Foreign Ownership Dummy<br>*1 if foreign firm holds more than 50% of capital* | .01 | .01 | .01 |
| FDI<br>*1 if outward loans and investment >0* | .36 | .39 | .32 |
| Multiplant Dummy<br>*1 if the firm has more than one plant* | .49 | .70 | .49 |
| Export Dummy<br>*1 if the firm exports* | .46 | .43 | .39 |
| Import Dummy<br>*1 if the firm imports* | .37 | .38 | .33 |

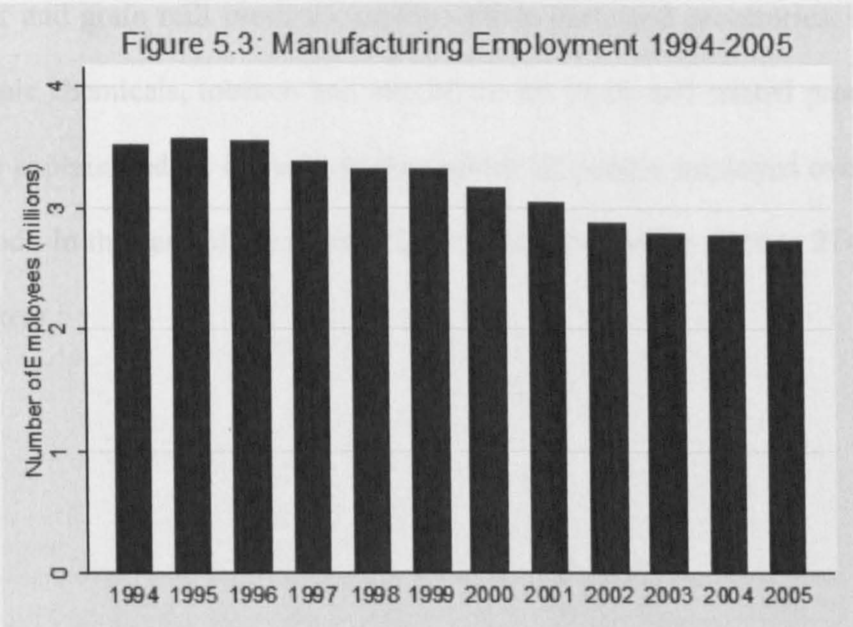
T-tests do not show a statistically significant difference between the level of low-wage import penetration in the switching plant's initial and final industry. In Bernard et al. (2006) this is cited as a fundamental reason why plants decide to switch industry. Similarly, switching plants do not move to an industry with statistically different capital intensities, intra-industry trade or import penetration from other countries.

### 5.5 Employment Growth

*The Economist* (20th June 2009) provided anecdotal evidence suggesting that a large number of Japanese firms are moribund shells which survive in name only. They highlight the role of government policy in prohibiting firms from declaring bankruptcy. We have also found that globalisation, either in its low-wage import penetration or other-country forms, has been consistently found not to affect plant death in Japan. This leads us to explore whether competition from abroad has manifested itself through job losses. Elsewhere it has been noted that "Hollowing Out" is not just mitigated through multinational plant closure, there are also employment effects (Cowling and Tomlinson, 2001). The closure of plants leads to the loss of employment among the workers of that plant. However, there are also indirect effects on suppliers who lose a customer. If keiretsu linkages are strong, then there may be further job losses among suppliers who rely almost exclusively upon one multinational to buy their output.

Indeed there has been a contraction in manufacturing employment between 1994 and 2005. In Figure 5.3 we see that over the period employment fell by 22% from approximately 3.5 million workers to 2.7

million. This is consistent with unemployment increases in manufacturing belts reported in Cowling and Tomlinson (2001).




Cowling and Tomlinson (2001) note that during the 1990s Japanese multinationals aggressively relocated production overseas. Simultaneously the number of people employed in Japanese plants fell substantially. Our data reveals that over the period 1994 to 2005 approximately 800,000 jobs were lost in the sector as a whole. Although the overwhelming pattern across industries was a reduction in the number of employees Table 5.10 shows that some sectors have suffered more serious job losses than others.

The chemicals fibres industry leads the way in terms of the percentage change in the number of people employed with a fall of 68%. Of the 52 sectors, 7 have shed half their workforce with the average contraction being 26%. In terms of absolute job losses, the textile industry has been most seriously affected with roughly 71000 fewer people being employed in 2005 compared with eleven years earlier. Some sectors have prospered. Flour and grain mill products, motor vehicle parts and accessories, basic organic chemicals, tobacco and miscellaneous foods and related products have experienced an increase in the number of people employed over the period. In the case of the latter employment increased by 27% to 214,722 workers.

Table 5.10: Industrial Employment in 1994 and 2005

| Industry | Employees | | | | Percentage Change | | Plant Closures | |
|---|---|---|---|---|---|---|---|---|
| | 1994 | 2005 | Change (%) | Jobs Lost | LWPEN | OTHPEN | MNE | Other |
| **Sample** | **3520785** | **2726144** | **-26.0** | **794641** | **551** | **540** | **1316** | **2076** |
| Chemical fibres | 16905 | 5396 | -68.1 | 11509 | 1580 | 150 | 5 | 8 |
| Miscellaneous manufacturing industries | 41022 | 15403 | -62.5 | 25619 | 128 | 9 | 33 | 75 |
| Leather and leather products | 4534 | 1775 | -60.9 | 2759 | 176 | -6 | 1 | 7 |
| Textile products | 123587 | 52627 | -57.4 | 70960 | 180 | -78 | 86 | 257 |
| Electroninc data processing machines, digital and analog computer equipment and accessories | 66249 | 28594 | -56.8 | 37655 | 1190 | 60 | 28 | 51 |
| Household electric appliances | 60565 | 26604 | -56.1 | 33961 | 465 | -33 | 28 | 44 |
| Fabricated constructional and architectural metal products | 71507 | 35250 | -50.7 | 36257 | 236 | -28 | 21 | 83 |
| Cement and its products | 28839 | 14584 | -49.4 | 14255 | 238 | 309 | 19 | 89 |
| Chemical fertilizers | 2577 | 1314 | -49 | 1263 | 620 | 120 | 1 | 4 |
| Pig iron and crude steel | 101499 | 55729 | -45.1 | 45770 | 6 | -57 | 8 | 9 |
| Communication equipment | 102684 | 58405 | -43.1 | 44279 | 343 | 96 | 43 | 73 |
| Pulp, paper and coated and glazed paper | 55219 | 31662 | -42.7 | 23557 | 531 | 447 | 15 | 44 |
| Lumber and wood products | 23107 | 14149 | -38.8 | 8958 | 89 | 44 | 10 | 55 |
| Electrical generating, transmission, distribution and industrial apparatus | 157088 | 100941 | -35.7 | 56147 | 405 | -31 | 47 | 134 |
| Electronic equipment and electric measuring instruments | 62831 | 40756 | -35.1 | 22075 | 1387 | 1491 | 29 | 61 |
| Petroleum products | 13379 | 8962 | -33 | 4417 | 6 | 460 | 5 | 12 |
| Semiconductor devices and integrated circuits | 131990 | 89518 | -32.2 | 42472 | 974 | 359 | 16 | 41 |
| Furniture and fixtures | 32701 | 22208 | -32.1 | 10493 | 283 | -18 | 11 | 50 |
| Precision machinery and equipment | 75767 | 53353 | -29.6 | 22414 | 259 | 283 | 32 | 66 |
| Organic chemicals | 69430 | 49259 | -29.1 | 20171 | 200 | 799 | 16 | 28 |
| Smelting and refining of non-ferrous metals | 13770 | 9788 | -28.9 | 3982 | 40 | 36 | 7 | 12 |
| Miscellaneous ceramic, stone and clay products | 26075 | 18623 | -28.6 | 7452 | 220 | -51 | 11 | 26 |
| Non-ferrous metal products | 68718 | 49248 | -28.3 | 19470 | 497 | -23 | 31 | 59 |
| Beverages | 30452 | 22141 | -27.3 | 8311 | 68 | 656 | 21 | 45 |
| Pottery | 20394 | 14878 | -27 | 5516 | 570 | 34 | 6 | 18 |
| Miscellaneous electrical machinery equipment | 63480 | 47593 | -25 | 15887 | 986 | 113 | 31 | 55 |
| Miscellaneous iron and steel | 74576 | 57642 | -22.7 | 16934 | 116 | 188 | 20 | 87 |
| Miscellaneous fabricated metal products | 105795 | 82598 | -21.9 | 23197 | 370 | 46 | 45 | 131 |
| Paper products | 39791 | 31275 | -21.4 | 8516 | 458 | 65 | 29 | 89 |
| Pharmaceutical products | 58112 | 46088 | -20.7 | 12024 | 67 | 2543 | 32 | 60 |
| Rubber products | 70535 | 56139 | -20.4 | 14396 | 189 | -59 | 22 | 43 |
| Motor vehicles | 226920 | 180773 | -20.3 | 46147 | 8759 | 941 | 12 | 29 |
| Livestock products | 55499 | 44736 | -19.4 | 10763 | 104 | 395 | 38 | 103 |
| Electronic parts | 137717 | 112419 | -18.4 | 25298 | 757 | -6 | 67 | 159 |
| Office and service industry machines | 60490 | 49667 | -17.9 | 10823 | 266 | -52 | 25 | 68 |
| Glass and its products | 30492 | 25171 | -17.5 | 5321 | 384 | 157 | 5 | 14 |
| Other transportation equipment | 77578 | 64146 | -17.3 | 13432 | 491 | 1203 | 14 | 39 |
| General industry machinery | 127751 | 107561 | -15.8 | 20190 | 533 | 176 | 40 | 83 |
| Coal products | 2273 | 1917 | -15.7 | 356 | 239 | -96 | 2 | 5 |
| Special industry machinery | 137767 | 118221 | -14.2 | 19546 | 710 | 666 | 71 | 132 |
| Basic inorganic chemicals | 18822 | 16145 | -14.2 | 2677 | 100 | 136 | 12 | 24 |
| Plastic products | 126875 | 110532 | -12.9 | 16343 | 429 | 51 | 82 | 185 |
| Seafood products | 25680 | 22786 | -11.3 | 2894 | 36 | -21 | 12 | 48 |
| Miscellaneous chemical products | 71140 | 63465 | -10.8 | 7675 | 286 | 550 | 31 | 58 |
| Miscellaneous machinery | 69732 | 63233 | -9.3 | 6499 | 223 | 209 | 26 | 67 |
| Prepared animal foods and organic fertilizers | 2869 | 2721 | -5.2 | 148 | 194 | 79 | 4 | 17 |
| Printing, plate making for printing and bookbinding | 64726 | 64229 | -.08 | 497 | 1006 | 581 | 30 | 140 |
| Flour and grain mill products | 3785 | 3894 | 2.9 | -109 | -60 | 124 | 3 | 5 |
| Motor vehicle parts and accessories | 295889 | 314830 | 6.4 | -18941 | 775 | 267 | 79 | 160 |
| Basic organic chemicals | 2194 | 2412 | 9.9 | -218 | -63 | 1288 | 0 | 2 |
| Miscellaneous foods and related products | 169408 | 214722 | 26.7 | -45314 | 61 | 58 | 54 | 238 |
| Tobacco | 0 | 62 | | -62 | | 13464 | 0 | 0 |

*Note*: A negative sign in the Jobs Lost column indicates an increase in the number of workers employed in that sector.

Although we have seen that the incidence of import penetration across the sample was generally low we observe large changes in the magnitude of both low-wage import penetration and competition from other countries. In most industries the percentage change in both import competition measures has been in triple digits. There is also some tacit evidence that the growth of import competition affects job losses. The correlation between low-wage imports and the number of job losses is 0.27. However, for imports from other countries the correlation is very weak.

In addition to plant closure and productivity losses 'Hollowing Out' has been linked to job losses through the offshoring of jobs and reductions in employment at upstream firms. Table 5.10 also lists the number of multinational plant closures in each sector over the period and the number of plants closed by other firms. The correlation between the number of MNE plant closures and the number of jobs lost is 0.21 while for the change in employment it is 0.15. For non-multinational plant closures the values are 0.15 and 0.21 respectively.

Table 5.11: Firm Type and Employment Changes

| Firm Type | Employees 1994 | 2005 | Change (%) |
|---|---|---|---|
| Multinationals | 1767897 | 1418035 | -19.8 |
| Domestic Multiplant Firms | 630844 | 382720 | -39.3 |
| Single Domestic Firms | 881300 | 637019 | -27.7 |

We find evidence that the magnitude of changes in employment over the period vary according to firm type. Despite concerns about hollowing out, multinationals have experienced the lowest percentage change in workers. In Table 5.11 we see that multinationals reduced their workforce by 19.8% while domestic multiplant firms and single-plant domestic firms saw contractions of 39.3% and 27.7%, on average. The sharper falls in employment amongst domestic firms may be partly due to the loss of business from MNEs as multinationals outsource abroad rather than domestically. It could also be that outsourcing by multinationals has been ongoing before the period meaning that the parts of the value chain most suited to outsourcing have already been moved overseas biasing the figures downwards.

During the last decade a literature has emerged which attempted to quantify the extent to which import competition as opposed to technological change has contributed to employment changes. Some of these studies have investigated whether technological upgrading has resulted in a greater share of non-production workers being involved in production (see Berman, Bound and Griliches, 1994). Others such as Morrison Paul and Siegel (2001) have been more ambitious and have sought to distinguish between the effect of technology, trade and outsourcing on employment and earnings.

To investigate the effect of technological change and trade on employment we follow Berman et al. (1994) by specifying a restricted labour cost function

$$\ln LC_{ijt} = f(\ln w_{ijt}, \ln K, \ln Y, t) \quad , \tag{5.3}$$

Where $LC$ is labour cost, $w_{ijt}$ is the wage paid in plant $i$ in industry $j$ at time $t$, $K$ is the stock of capital, $Y$ is output, $t$ is time and $f$ is assumed to have a translog form. Employment can then be derived as

$$emp_{ijt} = \frac{\partial \ln LC_{ijt}}{\partial \ln w_{ijt}} \quad , \tag{5.4}$$

by assuming cost minimisation, constant returns to scale and homogeneity of degree one on prices which guarantees that the sole solution will be the efficient outcome as well. Taking first differences yields

$$\Delta emp_{ijt} = \beta_0 + \beta_1 \Delta \ln\left(\frac{w_{ijt}}{w_{jt}}\right) + \beta_2 \Delta \ln\left(\frac{K}{Y}\right) + \varepsilon_{ijt} \quad , \tag{5.5}$$

where $\varepsilon_{ijt}$ is a well behaved error term. Berman et al. (1994) then append equation with two proxies for technological change: R&D intensity and the ratio of expenditures on computers to total investment.

We follow the Berman et al. approach by capturing technological upgrading through the change in plant productivity. The effect of trade is mitigated through changes in the import penetration ratio. In regression 1 of Table 5.12 we find that technology rather than trade has been responsible for job losses. A one standard deviation increase in the growth rate of plant TFP reduces employment by 0.13 standard deviations. This concurs with Morrison Paul and Siegel's (2001) findings for four worker groups defined according to education. Unlike Morrison Paul and Siegel, we find import penetration to be insignificant. We also find that a one standard deviation in the growth rate of plant wages relative to the industry causes a 0.38 standard deviation fall in plant employment. It is also evident that plants with higher capital usage relative to their output require fewer workers. For a one standard deviation increase in the capital to output ratio employment falls 0.19 standard deviations. This may also capture the effect of technology to a certain degree.

| Table 5.12: Employment Growth Regressions | | | | |
|---|---|---|---|---|
| | Regression | | | |
| Variable | 1 | 2 | 3 | 4 |
| Plant wages relative to industry averag | -.38*** | -.38*** | -.38*** | -.38*** |
| | (-38.81) | (-42.57) | (-42.53) | (-42.53) |
| Capital to Output ratio | -.19*** | -.00 | -.00 | -.00 |
| | (-25.46) | (-.82) | (-.84) | (-.84) |
| Plant TFP | -.13*** | -.35*** | -.35*** | -.34*** |
| | (-17.92) | (-40.52) | (-40.54) | (-39.95) |
| Industry Import Penetration | .01 | .01* | .01* | .01* |
| | (1.15) | (1.76) | (1.71) | (1.69) |
| Domestic Sales Growth | | .51*** | .51*** | .51*** |
| | | (52.61) | (52.63) | (52.61) |
| Foreign Sales Growth | | .00* | .01*** | .01*** |
| | | (1.91) | (3.00) | (2.98) |
| Import Penetration*Plant TFP | | | | .01 |
| | | | | (1.37) |
| Export Dummy | | | .00 | .00 |
| | | | (.29) | (.37) |
| Import Dummy | | | -.01*** | -.01*** |
| | | | (-2.94) | (-2.90) |
| Domestic MNE Dummy | | | -.02*** | -.02*** |
| | | | (-6.84) | (-6.71) |
| Foreign MNE Dummy | | | -.01** | -.01** |
| | | | (-2.13) | (-2.11) |
| Constant | .01** | .01*** | .01*** | .01*** |
| | (2.28) | (3.87) | (4.95) | (5.13) |
| Industry Dummies | Yes | Yes | Yes | Yes |
| Year Dummies | Yes | Yes | Yes | Yes |
| Number of Observations | 106916 | 106916 | 106916 | 106916 |
| $R^2$ | .19 | .33 | .33 | .33 |

In subsequent specifications we incorporate variables used elsewhere in the literature. For example, van Reenen (1996) finds market share affects wages in the United Kingdom. In regression 4 we find a one standard deviation increase in a plant's domestic sales growth increases employment growth by about half a standard deviation. Assuming that a plant's sales abroad are directly proportional to its parent firm's exports allows us to include a proxy for foreign sales growth. When we do not condition on firm characteristics in regression 2, foreign sales growth is only significant at the 10 percent level. Although highly significant in regressions 3 and 4 the growth in a plant's foreign sales has an economically small effect on plant employment growth.

Bernard and Jensen (1995) find exporting to potentially affect employment. Although we do not find a significant relationship between plant employment growth and firm exporting status, we find that importers and multinationals reduce employment growth among their plants. This may reflect offshoring and outsourcing. However, the effects are small. The coefficient estimate on the importer and foreign MNE dummy is -0.01 while for the domestic MNE dummy it is -0.02.

Finally in regression 4 we include an interaction term between plant TFP growth and import penetration. Morrison Paul and Siegel (2001) note that the effect of trade on employment growth may be mitigated through technological upgrading. For example, greater import penetration may lead plants to invest more in computers or capital. This would further 'hurt' low skill workers since the effect of openness to trade and technology upgrading is interrelated. However, the interaction term enters insignificantly suggesting that this is not the case in Japan. This is primarily a consequence of the long tail of firms with low productivity which fail to catch-up with the industry leader even when confronted by import competition. This explains why import penetration does not reduce x-efficiency and increase the speed of convergence as has been found in other contexts.

*Employment Growth across Firm Types*

In Table 5.11 we observed that while multinationals, multi plant firms and single plant firms all reduced the number of people employed, the reduction was far from uniform. We re-run regression 4 using an OLS estimator but split the sample according to firm type. The results are unreported (but are available on request) since they are similar and suggest broadly similar patterns across firm types. The only difference across firms is that importing firms significantly reduce employment growth at plants belonging to single-plant firms. At multinational and multiplant firms the importer dummy is insignificant.

## 5.6 Why has the rate of TFP growth within firms been so low?

Table 5.1 suggests slow within plant productivity growth to be one of the key restraints on aggregate productivity growth in Japan. Using a model similar to that in Griffith et al. (2003) we investigate the determinants of productivity growth within plants. A similar model is used by Bernard and Jones (1996) to investigate productivity convergence in industries across 14 OECD countries. The model begins with a neoclassical production technology,

$$A_{ijt} = KA_{jt}^{F} \quad , \tag{5.6}$$

where $i$ represents a given plant, $j$ indexes the industry in which the plant operates and $t$ denotes time. $A_{ijt}$ represents plant productivity, $K$ is a shift parameter and $A_{jt}^{F}$ represents total factor productivity at the frontier plant. A general dynamic relationship between plant and frontier productivity may be expressed as,

$$\ln A_{ijt} = \beta_0 + \beta_1 A_{jt}^{F} + \beta_2 A_{jt-1}^{F} + \alpha_1 A_{ijt-1} + \varepsilon_{it} \quad . \tag{5.7}$$

To arrive at the error correction model we must see when (5.7) would be consistent with (5.6). This requires that all factors which would cause divergence from equilibrium are equal to zero. Through rearranging (5.7) we obtain the error correction model,

$$\Delta \ln A_{ijt} = \beta_0 + \beta_1 \Delta \ln A_{jt}^{F} + \gamma\left(\ln A_{jt-1}^{F} - \ln A_{ijt-1}\right) + \varepsilon_{ijt} \quad . \tag{5.8}$$

The terms on the right hand side capture the effect of productivity transfer. The term $\Delta \ln A_{jt}^{F}$ allows plant productivity growth to depend directly upon productivity growth at the frontier plant. The frontier is assumed to be the plant with the highest TFP in the plant's 3-digit industry at time $t$. Plant productivity growth also depends on how far the plant lies behind frontier. The larger is $\left(\ln A_{jt-1}^{F} - \ln A_{ijt-1}\right)$ the greater the potential for technology transfer or productivity upgrading. Hence, $\beta_1$ denotes the strength of the link between productivity growth at the frontier establishment and non-frontier plants while $\gamma$ captures the speed of productivity convergence.

We then estimate the relationship posited above using OLS. A full set of time dummy variables are included to capture the effect of macroeconomic and stochastic shocks on productivity. The results show that Japanese plants behave in similar fashion to those in other countries. As in Griffith et al. (2003) we find a positive and significant effect of the growth in the frontier establishment on non-frontier plant's productivity growth. In regression 1 of Table 5.13 a one standard deviation increase in productivity at the frontier establishment causes a 0.91 percentage point increase in plant *i*'s productivity growth. As in the United Kingdom there is also evidence of productivity convergence. Plants operating behind the productivity frontier have, on average, 1.38 percentage points higher productivity growth.

Table 5.13: Productivity Catch-up

| Variable | () | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| $\Delta TFP_{Fjt}$ | .14*** | .15*** | .15*** | .14*** | .14*** | .15*** |
| | (31.25) | (28.54) | (28.44) | (30.37) | (31.71) | (28.22) |
| $TFPGAP_{ijt-1}$ | .31*** | .31*** | .29*** | .31*** | .30*** | .28*** |
| | (35.01) | (13.32) | (12.31) | (30.94) | (24.71) | (8.99) |
| $LWPEN_{jt-1}$ | | -.16*** | | | | -.18*** |
| | | (-6.49) | | | | (-6.81) |
| $OTHPEN_{jt-1}$ | | | -.10*** | | | -.03 |
| | | | (-3.61) | | | (-.93) |
| $GL_{jt-1}$ | | | | .02 | | .07*** |
| | | | | (1.28) | | (3.28) |
| FIRM R&D $INTENSITY_{ijt-1}$ | | | | | .05*** | .05*** |
| | | | | | (3.75) | (3.46) |
| **Interaction Terms** | | | | | | |
| $TFPGAP_{ijt-1}$ | | | | | | |
| x $LWPEN_{jt-1}$ | | -.01 | | | | .06 |
| | | (.44) | | | | (1.60) |
| x $OTHPEN_{jt-1}$ | | | -.04 | | | -.08** |
| | | | (-1.29) | | | (-2.20) |
| x $GL_{jt-1}$ | | | | -.01 | | -.04** |
| | | | | (-.49) | | (-2.25) |
| x FIRM R&D $INTENSITY_{ijt-1}$ | | | | | -.02 | -.02 |
| | | | | | (-1.61) | (-1.39) |
| Industry Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Dummies | Yes | Yes | Yes | Yes | Yes | Yes |
| Number of Observations | 141975 | 118715 | 118715 | 141975 | 141975 | 118342 |
| $R^2$ | .06 | .06 | .06 | .06 | .06 | .06 |

*Notes*: Beta coefficients reported. Robust t-statistics reported in parentheses. ***, ** and * indicate significance at the 1, 5 and 10 percent levels.

In regressions 2 to 6 we examine the effect imports, intra-industry trade and firm R&D intensity have on plant-level productivity growth. International trade has been shown elsewhere to affect productivity (see for example Keller and Yeaple, 2003 for evidence from the United States).

Of interest here, given the earlier results for the closure of firms and plants, we find import penetration to be a negative determinant of within plant productivity growth. A one standard deviation increase in imports from low-wage countries reduces plant productivity growth by 0.01 percentage points. Imports from other countries have a smaller effect: the point estimate is -0.001. Building on the evidence above that import penetration has not had a strong effect on the exit of firms or plants this would suggest that more firms have lower productivity growth because of increased import penetration than might otherwise have been the case. The industrial structure of Japan would appear to be part of the explanation behind the low rate of productivity improvement within Japanese firms. Despite this, the effect of import competition on productivity growth remains small.

Intra-industry trade is not found to affect productivity growth but we find that a one standard deviation increase in firm R&D intensity raises the productivity of its plants by 5 percentage points. When all four variables and their interactions with the TFP Gap variable are included in column 6 we continue to find that low-wage imports reduce productivity growth while firm R&D intensity increases it. However, the variable measuring imports from other countries is now insignificant but the coefficient on intra-industry trade estimate of 0.07 is robust. We now observe that intra-industry trade and imports from other countries reduce the speed of convergence by 4 and 8 percentage points, respectively.

In spite of these findings we continue to find convergence in TFP. It could be that Japan lay close to the productivity frontier and consequently the scope for improvement was limited. However, during this period productivity growth in the United States averaged between 2 and 3 percent per annum. It is worth noting that the elasticity on the TFP Gap variable (0.008) implies that the half life of the productivity gap between the average frontier productivity and the average plant productivity is approximately 87 years. This implies that the reason for the low rate of within plant change is not explained by a low elasticity on the TFP Gap variable rather country-specific factors are responsible.

## 5.7 Conclusions

This chapter has sought to understand the reasons for Japan's 'Lost Decade' using a microeconomic approach. In so doing we have addressed some of the anecdotal theories that have grown up surrounding the decline of the manufacturing sector and in particular those related to multinationals. Many of the results appear contrary to the arguments embodied within the 'Hollowing Out' hypothesis. Specifically, plant closure in Japan proceeds along similar lines as in other countries with the weakest establishments tending to exit. However, the core difference is that exit in Japan is rare and high barriers to entry prevent the death of underperforming plants which consequently chokes off potential productivity improvements.

It is also found that while multinationals close plants which are, on average, more productive relative to the manufacturing sector as a whole, they tend to close the weakest elements of the firm. However, it is not clear why these firms have attracted a disproportionate level of attention since similar patterns are found among multiplant firms that do not have foreign affiliates. Another accusation levelled against multinationals is that their offshoring strategies have been one of the fundamental causes of the contraction in manufacturing employment. We find that employment growth is slower among multinationals though the coefficient estimate is small.

Globalisation, in the form of imports, is not found to affect plant survival or employment. This is surprising since the incidence and level of imports do not differ substantially from the United States where low wage imports in particular increase plant death and switching. For Japan the effect of imports is mitigated through productivity declines suggesting that since plant death is rare imports affect productivity through losses in market share. Finally, when we investigate the factors underlying the slow rate of productivity growth during the period we find that the contributions from the entry, exit and within plant components are exceptionally low by international standards. Despite this, evidence of productivity convergence is found but due to country-specific factors the rate of convergence is slow.

## 5.8 Appendix 5

The data we use in this paper is from the Japanese "Census of Manufacturers" and the "Basic survey on Overseas Business Activities" conducted annually by METI. The "Census of Manufacturers" comprises 169,590 plant-level observations from 1994 to 2005. This longitudinal plant data set covers all establishments with more than 4 employees. Establishments with less than 10 employees do not report information on tangible assets, necessary for estimating TFP. This places a restriction on the plants that are included in the regression when investigating the causes of productivity change in Section 3 and should be born in mind when interpreting the results generated. Information is provided on the three-digit industry in which a plant operates[53]. The plant-level variables include size (measured by the number of employees), capital per worker, sales, TFP (measured relative to the industry and in logs), wage rates and the volume of intermediate inputs used. Summary statistics of the plant-level variables are provided in Table A5.1.

[53] A list of industries is included in Appendix Table A4

Table A5.1: The Plant-Level Variables

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Capital<br>Millions of Japanese Yen | 169590 | 5119 | 23240 | .07 | 1052705 |
| Exit<br>1 if the plant exits | 169590 | .02 | .14 | 0 | 1 |
| Entry<br>1 if the plant enters | 169590 | .01 | .11 | 0 | 1 |
| Intermediate Inputs<br>Millions of Japanese Yen | 169590 | 6669 | 39879 | .10 | 4276681 |
| Plant Size<br>Number of Employees | 169590 | 225 | 489 | 10 | 21309 |
| Sales<br>Millions of Japanese Yen | 169590 | 11321 | 54454 | 2.88 | 5855928 |
| TFP<br>Total Factor Productivity | 169590 | .96 | .35 | -4.81 | 4.36 |
| Wages<br>Millions of Japanese Yen | 169590 | 4.84 | 1.79 | .03 | 90.55 |

This data on plants is matched with that on firms from the "Basic survey on Overseas Business Activities" also conducted annually by METI. Firms with less than 50 employees are not required to submit information. Again this restricts the firms that can be used within the more formal econometric analysis. From this dataset we draw information on firm age, size, capital-labour ratios, whether it has multiple plants and whether the firm has any overseas investments (FDI). Summary statistics of the firm-level variables are shown in Table A5.2.

Table A5.2: The Firm-Level Variables

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Age<br>*In years* | 114334 | 43 | 15.77 | 0 | 161 |
| Size<br>*Number of workers* | 114334 | 501 | 2056 | 50 | 80500 |
| Capital per Worker<br>*Millions of Japanese yen* | 114334 | 15.74 | 26.42 | .00 | 2151 |
| Firm TFP<br>*Total Factor Productivity* | 114334 | .97 | .15 | -3.53 | 2.80 |
| R&D Complexity<br>*R&D divided by firm sales* | 114334 | .01 | .03 | 0 | 6.84 |
| Intermediate Inputs<br>*Millions of Japanese yen* | 114334 | 20100 | 133073 | 1 | 8210527 |
| Foreign Ownership Dummy<br>*1 if foreign firm holds more than 50% of capital* | 114334 | .01 | .09 | 0 | 1 |
| FDI<br>*1 if outward loans and investment >0* | 114334 | .20 | .40 | 0 | 1 |
| Multiplant Dummy<br>*1 if the firm has more than one plant* | 114334 | .25 | .43 | 0 | 1 |
| Export Dummy<br>*1 if the firm exports* | 114334 | .31 | .46 | 0 | 1 |
| Import Dummy<br>*1 if the firm imports* | 114334 | .26 | .44 | 0 | 1 |

The manufacturing establishments are split into 48 industries and TFP is calculated for each plant relative to the industry average. Following Aw et al. (1997), we define the TFP level of establishment $p$ in year $t$ in a certain industry in comparison with the TFP level of a hypothetical representative establishment in year 0 in that industry as follows

$$\begin{aligned}\ln TFP_{pt} &= \left(\ln Q_{ft} - \overline{\ln Q_t}\right) - \sum_{i=1}^{n} \frac{1}{2}\left(S_{ift} + \overline{S_{it}}\right)\left(\ln X_{ift} - \overline{\ln X_{it}}\right) \\ &+ \sum_{s=1}^{t}\left(\overline{\ln Q_s} - \overline{\ln Q_{s-1}}\right) - \sum_{s=1}^{t}\sum_{i=1}^{n}\left(\overline{S_{is}} + \overline{S_{is-1}}\right)\left(\overline{\ln X_{is}} - \overline{\ln X_{is-1}}\right)\end{aligned}, \quad \textbf{(A5.1)}$$

where $Q_{ft}$, $S_{ift}$ and $X_{ift}$ denote the gross output of plant $f$ in year $t$, the cost share of factor $i$ for establishment $p$'s input of factor $i$ in year $t$. Variables with an upper bar denote the industry average of that variable. We use 1994 as the base year. Capital, labour and real intermediate inputs are used as factor inputs.

The representative establishment for each industry is defined as a hypothetical establishment whose gross output as well as input and cost share of all production factors are identical with the industry average. The first two terms on the right hand side of equation (A5.1) denote the gap between plant $f$'s TFP level in year $t$ and the representative establishment's TFP level in year $t$ and the representative establishment's TFP level in the base year. $\ln TFP_{ft}$ in equation (A5.1) constitutes the gap between establishment $f$'s TFP level in year $t$ and the representative establishment's TFP level in the base year.

***Industry-Level Variables***

In the empirical section we investigate how both firm and industry level variables affect the decision to close a plant. Globalisation has been shown to cause exit. The source of import competition in the US affects plant survival and causes firms to adjust their product mix (Bernard and Jensen, 2002; Bernard et al., 2006). We disaggregate import penetration into low-wage import penetration (LWPEN) and import penetration from all other countries (OTHPEN)[54]. These measures are calculated as:

$$LWPEN_{it} = \frac{M_{it}^{LW}}{M_{it} + Y_{it} - X_{it}} \quad ; \quad OTHPEN_{it} = \frac{M_{it} - M_{it}^{LW}}{M_{it} + Y_{it} - X_{it}} \; ,$$

where $LWPEN_{it}$ represents low-wage country import competition in industry $i$ at time $t$, $M_{it}^{LW}$ is the value of imports from low-wage countries in industry $i$ at time $t$, $M_{it}$ and $X_{it}$ represents the value of total imports and exports in industry $i$ at time $t$ and $Y_{it}$ denotes output in industry $i$ during year $t$. $OTHPEN_{it}$ denotes imports from all countries except low-wage economies.

Bernard et al. (2006) find that both forms of import competition raise the probability of closure. A one standard deviation increase in LWPEN increases the probability of plant exit by 2.2 percentage points which is considerably greater than the effect of OTHPEN. Similar results are found by Greenaway et al. (2008b) for Sweden. In their results, the estimated coefficient on imports from outside the OECD is twice as large as that for OECD imports. Both sources of competition have a positive and significant effect on closure.

Intra-industry trade is often found to have a positive effect upon firm exit. As international trade grows firms diversify their product range which

[54] Countries are deemed to be low-wage where they have a GDP less than 5% that of Japan.

may lead them to enter new industries and exit sectors they operate in currently. It has been established by Greenaway et al. (2008) that firms do not just closedown their operations, they switch to new industries too. Using Swedish manufacturing data they find that intra-industry trade leads to exit through plant closure, and, mergers and acquisition. This is also found by Bernard et al. (2006) for the United States, firms which are confronted by low-wage import competition sometimes switch to more capital intensive sectors.

Our measure of intra-industry trade is constructed using the Grubel-Lloyd index

$$GL_{it} = \left[(X_{it} + M_i) - |X_{it} - M_{it}|\right]\frac{100}{(X_{it} + M_i)} \quad ,$$

where $GL_{ijt}$ is the Grubel-Lloyd index of intra-industry trade in industry $i$ in year $t$, $X_i$ are exports in industry $i$ during year $t$ and $M_{it}$ are imports in industry $i$ during year $t$.

The industry variables mentioned so far capture the influence of globalisation upon plant exit. We also include a measure of sunk costs. The empirical literature has identified sunk costs as being an important factor in shaping exit. For example, Aw et al. (2003) find that the nature of sunk costs result in very different productivity distributions in South

Korea and Taiwan. Sunk costs also play a key role in determining exporting behaviour (Roberts and Tybout, 1997).

Since exit rates tend to be highly correlated with the sunk costs of entry and exit we use the same measure as Bernard and Jensen (2002) and Greenaway et al. (2008b). For each industry and year, sunk costs are calculated as the minimum of either the entry or exit rate. In steady-state equilibrium, entry and exit rates should be equal and should vary with sunk costs. An increase in sunk costs would mean that the entry rate should fall, in equilibrium. However, to focus solely on entry rates could be misleading as an industry characterised by high sunk costs could experience a high entry rate due to high expected profits. By using the minimum of entry or exit, we circumvent this problem.

Summary statistics for the industry-level variables are provided in Table A5.3. Intra-industry trade accounts for approximately half of all trade over the sample. Sunk costs have an average value of 1 percent, that is, the average of the minimum of the entry and exit rates in an industry is 1 percent of the total number of operating plants. Imports represent 9% of Japanese output with a third of this coming from low-wage countries.

Table A5.3: Industry-level Variables

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Grubel-Lloyd Index | 157273 | .50 | .26 | .01 | 1.00 |
| Trade that is intra-industry | | | | | |
| Sunk Costs | 169590 | .01 | .01 | .00 | .05 |
| Minimum of entry and exit rates | | | | | |
| Import Penetration | 131669 | .09 | .09 | .00 | .67 |
| Imports divided by apparent consumption | | | | | |
| LWPEN | 131669 | .03 | .05 | .00 | .28 |
| Low-wage imports | | | | | |
| OTHPEN | 131669 | .06 | .06 | .00 | .55 |
| Imports from all other countries | | | | | |

Table A5.4: Three Digit Plant Industries in the Dataset

| |
|---|
| Basic inorganic chemicals |
| Basic organic chemicals |
| Beverages |
| Cement and its products |
| Chemical fertilizers |
| Chemical fibres |
| Coal products |
| Communication equipment |
| Electrical generating, transmission, distribution and industrial apparatus |
| Electronic data processing machines, digital and analog computer equipment and accessories |
| Electronic equipment and electric measuring instruments |
| Electronic parts |
| Fabricated constructional and architectural metal products |
| Flour and grain mill products |
| Furniture and fixtures |
| General industry machinery |
| Glass and its products |
| Household electric appliances |
| Leather and leather products |
| Livestock products |
| Lumber and wood products |
| Miscellaneous ceramic, stone and clay products |
| Miscellaneous electrical machinery equipment |
| Miscellaneous fabricated metal products |
| Miscellaneous food and related products |
| Miscellaneous food and related products |
| Miscellaneous iron and steel |
| Miscellaneous machinery |
| Miscellaneous manufacturing industries |
| Motor vehicle parts and accessories |
| Motor vehicles |
| Non-ferrous metal products |
| Office and service industry machines |
| Organic chemicals |
| Other transportation equipment |
| Paper products |
| Petroleum products |
| Pharmaceutical products |
| Pig iron and crude steel |
| Plastic products |
| Pottery |
| Precision machinery and equipment |
| Prepared animal foods and organ fertilizers |
| Printing, plate making for printing and bookbinding |
| Pulp, paper, and coated and glazed paper |
| Rubber products |
| Seafood products |
| Semiconductor devices and integrated circuits |
| Smelting and refining of non-ferrous metals |
| Special industry machinery |
| Textile products |
| Tobacco |

# Chapter Six

# Conclusions

The productivity growth triggered by the industrial revolution and sustained since the mid-18$^{th}$ century has translated into per capita income growth of the like never seen before, with the richest modern economies now ten to twenty times wealthier than the 1800 average (Clark, 2007). The entry and exit of firms has been a key component of this productivity growth through the introduction of new products and processes which replace inferior and outmoded ones. Creative destruction also fosters competition within the market forcing incumbents to become more productive as entrants strive to capture market share.

Globalisation has been found to affect the creation and death of firms by opening new opportunities abroad as well as generating competition from foreign firms. Melitz (2003) shows that this causes welfare gains as competition from foreign firms causes a Darwinian sorting that leads to the weakest firms exiting the market. Reallocations of market share towards 'better' firms result in productivity gains at the aggregate level.

The first contribution of this thesis is to examine the link between globalisation and institutional factors and entry and exit. To date the literature has focussed primarily upon the role of plant, firm and industry variables in shaping exit using microdatasets. This has generally shown various measures of globalisation such as trade liberalisation (Pavcnik, 2002), low-wage import competition (Bernard et al., 2006) and intra-industry trade (Greenaway et al., 2008) to increase the probability that a plant or firm will die. However, through the use of a cross-country industry-level dataset we are able to investigate the extent to which globalisation causes creative destruction relative to country-specific institutions. We find that the rate of entry is positively related to globalisation as exporting opportunities raise the expected profits of entering. Simultaneously, the profits accruing through greater market integration serve to reduce the probability that a firm will die. This result is in contrast to many findings in the literature (see Bernard, Jensen and Schott, 2006; Pavcnik, 2002; Greenaway and Kneller, 2007). However, it may be explained by the fact that we are measuring all of globalisation's components rather than specific facets such as import penetration.

A unique feature of our analysis is the use of an error correction model which captures the short- and long-term consequences of globalisation on the Schumpeterian process. We find that market integration only has a short-run effect on entry and exit. This confirms broad patterns observed across countries: entry and exit rates have remained fairly constant while globalisation has persistently increased through time. An explanation for variations in churning rates for which we find greater evidence are country-specific institutions. Unlike most existing studies we are able to exploit variation in country-specific factors to examine the link between policy environments and churn. Countries where the share of the governmental sector in GDP is high tend to be characterised by net exit. This is predominantly due to governmental consumption which causes crowding out. Regulatory burdens are found to act in similar fashion however macroeconomic stability allows entrepreneurs to form more accurate profit expectations causing net entry.

A second contribution this thesis has made to our understanding of entry and exit regards what causes the death of large plants. Entering and exiting cohorts tend to be primarily made up of small plants. According to Eurostat's FEED dataset up to 95% of exiting firms are small depending upon the country under inspection. However, most visible is the death of large plants since they frequently account for a large share of employment and output within a localised region. Using plant-level microdata from Japan we show that the causes of death among large plants are similar to those that lead small firms to exit. Unproductive plants, and those with low capital intensities, face higher hazard rates. Our analysis also sheds light on how firm characteristics affect death among plants within the group and yields insights into the process of closure among multi-plant firms.

Recent literature on firms-level adjustment to globalisation has shown multinationals to be 'footloose' indicating that plants belonging to such firms face higher exit likelihoods (Bandick, 2007; Kimura and Kiyota, 2006; van Beveren, 2007; Alvarez and Görg, 2005). We demonstrate that when we control for the process of exit within multiplant multinationals the 'footloose' view is no longer tenable. Indeed there appears to be a residual effect of multinational ownership that guards against closure. We are able to offer more firm conclusions about why multiplant ownership has been found in the literature to raise the probability of death (Bernard and Jensen, 2007; Bandick, 2007). Specifically, this is due to the firm pruning the weakest elements of the group. This has implications for trade theory related to Melitz (2003). Plant death is emphasised as one of the means through which productivity improvements occur. Although this has been shown by Bernard and Jensen (2004), Bartelsman and Doms (2000), Baldwin and Gu (2002), Disney et al. (2003a) to be an important source of productivity growth, in countries where a large fraction of output is produced by multiplant firms the same result may not hold. Multi-plant firms may base closure decisions upon profitability within the group rather than productivity relative to the industry. Where plants exiting from multi-plant firms are productive relative to the industry aggregate productivity may fall.

A third contribution this thesis makes is to empirically analyse the determinants of entry into export markets. This is motivated by the predictions made by recent theoretical models such as Melitz (2003), Bernard et al. (2003), Helpman et al. (2004) and Bernard et al. (2007). Those models postulate that as barriers to trade fall firms enter the domestic market as the expected profits of entry now include expectations about profits that accrue from exporting. Using a cross-country, industry-level dataset we find that industries that specialise in producing goods which are reliant upon imported intermediate inputs capture a greater share of exports when located in a country with low endowments of trade costs. To date the literature has emphasised the importance of firm productivity in determining selection into export markets (Bernard and Jensen, 1999, 2004; Aw, Chung and Roberts, 2000; Greenaway and Kneller, 2007). However, the results again emphasise the importance of institutional factors in affecting entry into export markets as also demonstrated by Nunn (2007) and Levchenko (2007). The probability of export market entry depends upon the country's trade costs as well as the type of good a firm produces. In turn the churning rate is affected by these variables: the incentive to enter is blunted when firms are confronted by high barriers to foreign markets.

Creative destruction has been shown to play a crucial role in generating productivity improvements (Bernard and Jensen, 2004; Disney et al., 2003a; Baldwin and Gu, 2002). We have also shown that when this process breaks down the aggregate outcomes can be severe. Using plant-level microdata covering Japan's Lost Decade we find that high barriers to entry result in unproductive plants remaining active. The low rates of entry and exit (both below 2%) mean that the contribution of creative destruction to aggregate productivity growth has been minute: approximately 2%. However, this also has implications for productivity growth within incumbents. Since they do not face stiff competition from entrants the incentive to innovate is diminished and within plant productivity growth has contributed merely 14% of aggregate productivity growth throughout the period.

A criticism of our work on Japan's Lost Decade would be that we are unable to distinguish the reasons why multinationals and keiretsu networks played such a vital part in the post-WW2 recovery but are now perceived as holding back the economy. To investigate these issues we would require a longer time series stretching back to at least the early 1980s. Regarding the work on the 'footloose' effect we are unable to say what explains the residual effect of multinational ownership. In an ideal world we would include controls for managerial capabilities and other organisational and headquarter features. Cross-country information may also shed light on how institutions affect multinationals' location decisions and the role played by incentives. It would also be interesting to know about the process of plant closure of multinationals' affiliates in foreign countries to see whether this has an impact upon closure in the domestic country.

The thesis has generated insights relevant to policy makers. Imports from abroad (Bernard et al., 2006) and competition from multinationals (Hood and Young, 1997) have been cited as being responsible for closure among domestic firms. However, this source of competition disciplines the market forcing firms to innovate. As demonstrated by our analysis of

Japan raising entry barriers can have a lasting, deleterious effect upon the economy's performance.

Despite the mixed evidence on spillovers, governments often court multinationals as a means of reducing regional unemployment and to expand the tax base (Devereux and Griffith, 1998). Frequently there is a suspicion that multinationals will relocate production to a lower-cost site once tax benefits have been phased out. In some instances there may be some truth in this but we find that multinationals are well embedded in the domestic economy. To form a better judgement would require more information on foreign multinationals but our evidence is consistent with that found by ~~~~ (2010) for Sweden.

Overall, we have demonstrated that the causes of firm creation and death are multidimensional. Institutional factors can raise the incentive to enter but may also create barriers to doing so. The process of creative destruction is shaped by globalisation but the effect is nuanced.

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