Who Exports? A Firm-Level Study of the Characteristics of Exporters and the Determinants of Export Performance for Northern Ireland and the Republic of Ireland

Economic Research Institute of Northern Ireland /
The Economic and Social Research Institute

May 2006

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1.   Introduction

It is widely agreed that there is a strong positive relationship between export expansion and economic growth: as exports rise they inject additional income into the domestic economy and increase total demand for domestically-produced output. The increase in exports also fuels growth indirectly through a variety of mechanisms including efficient allocation of resources, greater capacity utilisation, exploitation of economies of scale and technological improvement in response to greater competition from abroad (Burney, 1996). This positive relationship between the exports of a country or region and its economic growth is well documented (Chow, 1987: Ghartey, 1993; Sengupta & Espana, 1994; Balassa, 1978; Burney, 1996; Al-Yousif, 1997: Abual-Foul, 2004) and explains why industrial policy typically incorporates some form of export promotion; for example, the World Bank, in a 1993 report, considered export-orientated growth to be the hallmark of a successful development strategy for less industrialised nations in East Asia (World Bank, 1993). However, policies to promote exports, particularly in more developed economies, typically involve enabling non-exporters to enter foreign markets (as well as expanding the export potential of those already engaged in exporting) so it is necessary to understand why some firms successfully enter export markets whilst others do not.

Export promotion has only become a policy priority in Northern Ireland relatively recently; traditionally industrial policy was concerned more narrowly with job generation. However the identification of major weaknesses in the economy (of which export performance was one) during the late 1980s led to a shift in policy in 1990 towards improving the competitiveness of the economy. ***Competing in the 1990s***

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(DED, 1990) marked this new departure in Northern Ireland's industrial policy. Government assistance to indigenous industry was to be restricted to cases of market failure with the main focus instead on achieving growth through measures to improve the competitiveness of the economy and the promotion of exports, particularly by indigenous firms, was to be a key element.

Acting under the remit of the Department of Economic Development (DED), the Industrial Development Board (IDB) and Local Enterprise Development Unit (LEDU) were responsible for delivering the export promotion policies under this new economic strategy, the latter taking responsibility for small local firms. They focussed on helping firms with their marketing, design and quality practices to enhance export potential, as well as organising trade missions and providing improved market intelligence. In addition, LEDU reorganised its client base and focussed assistance on a set of firms with strong growth potential and a commitment to growth in export markets, a policy referred to as 'backing winners', in which firms which were demonstrably competitive in indicators such as profitability, growth or market shares received further governmental support (Birnie and Hitchens, 1999). The central notion of this strategy i.e. improving competitiveness has remained in place since the early 1990s, despite the subsequent changes in departmental arrangements and the amalgamation of the development agencies. In fact the promotion of exports has remained a particular focus, with Invest Northern Ireland citing "being international" as one of three economic drivers for its client companies (Invest NI, 2005).

Within the Republic of Ireland export promotion policies, over the 1990s, were the key responsibility of An Bord Tráchtála, a state organisation that focussed on

developing the export potential of indigenously-owned and smaller firms. In 1998, the Republic's export and indigenous industrial development agencies were merged into one body, Enterprise Ireland, whose primary focus was to deliver integrated developmental supports to Irish enterprise and help Irish industry to achieve a sustainable competitive advantage. Export promotion and development was to be one of the key aims of Enterprise Ireland, cited as "the achievement of international success for its client companies", which includes both well established and start-up firms. The range of strategies used to encourage exporting include creating market awareness for individual companies; developing knowledge and understanding of markets and developing and building profitable sales and effective marketing capabilities.

The range of policy initiatives to promote and develop exports in both North and South is obviously well developed suggesting the importance of export performance to both economies, however despite this recognition, relatively little is actually understood, or certainly written, about the microeconomics of the process; the type of firms that export or the link between firm characteristics and export performance, which may appear surprising given that exporting takes place at the firm level, making the firm the central player in the process, and the instrument through which policy is implemented. This is not unusual however, despite the widespread use of export promotion policies, the relationship between exports and the individual firm has been little studied until quite recently,. The use of plant-level or firm-level data in particular has only appeared in the economics literature in the 1990s, with much of the pioneering work carried out for the US.

This study uses detailed data at the individual firm level for both Northern Ireland and the Republic of Ireland to investigate exporting behaviour. In particular the study seeks to answer two key questions: what are the characteristics of exporters and what determines the extent of firms' export sales, questions that are central to effective policy design for export promotion. The questions will be addressed separately for Northern Ireland and Republic of Ireland in the study, using separate data sources and samples, however similar methodologies will be utilised enabling comparisons to be drawn, thus allowing for more rigorous policy implications to be made. The study is laid out as following: section 2 sets the context for the study, detailing export performance in both Northern Ireland and the Republic of Ireland over the 1990s. Section 3 reviews the relevant literature. Sections 4 and 5 outline the methodology and data used in the study. Section 6 presents the results of the analysis. Section 7 then provides a summary and overall conclusion.

2. Export performance in Ireland

2.1 Northern Ireland's Export Performance 1998-2001

The collection of data on Northern Ireland's manufactured exports has been carried out annually since 1991/92, providing information on the value, destination and type of product sold externally and exported from Northern Ireland firms. Export sales are defined as those sold outside the UK (with sales outside Northern Ireland, that is including sales to GB, termed external sales) and have risen substantially in value terms since the records began, although growth rates have varied markedly year to year. Fig. 1 depicts the growth in real export sales (at 2000 prices) over the entire 1994/95-2004/05 period, over which total export sales more than doubled. Growth in exports was particularly strong in the period up to 1999/00 after which it levelled off. Exports fell for the first time after 2001/02, by 7%, as a result of large decreases in sales to the EU and rest of world, however the decline was followed by a sharp upturn during 2002/03.

Over the period of interest, i.e. the period for which our data covers - 1998/99-2001/02 - real export sales increased by 21% to £4bn, with the strongest annual growth experienced between 1998/99 and 1999/00, when export sales rose by 18%, driven largely by sales to markets outside the EU. Thereafter growth in exports was relatively slow, the growth in sales to the rest of the world just offsetting the decline in sales to the Republic of Ireland (RoI) and the rest of the EU in 2001/02. The overall growth in exports over the period, although strong, was slower than total sales from

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Northern Ireland firms, which increased by 24%, resulting in a one percentage point drop, to 31%, over the period in the ratio of real export sales to total sales in 2001/02.

Fig. 1: Total Real Export Sales from Northern Ireland 1994/95-2004/05
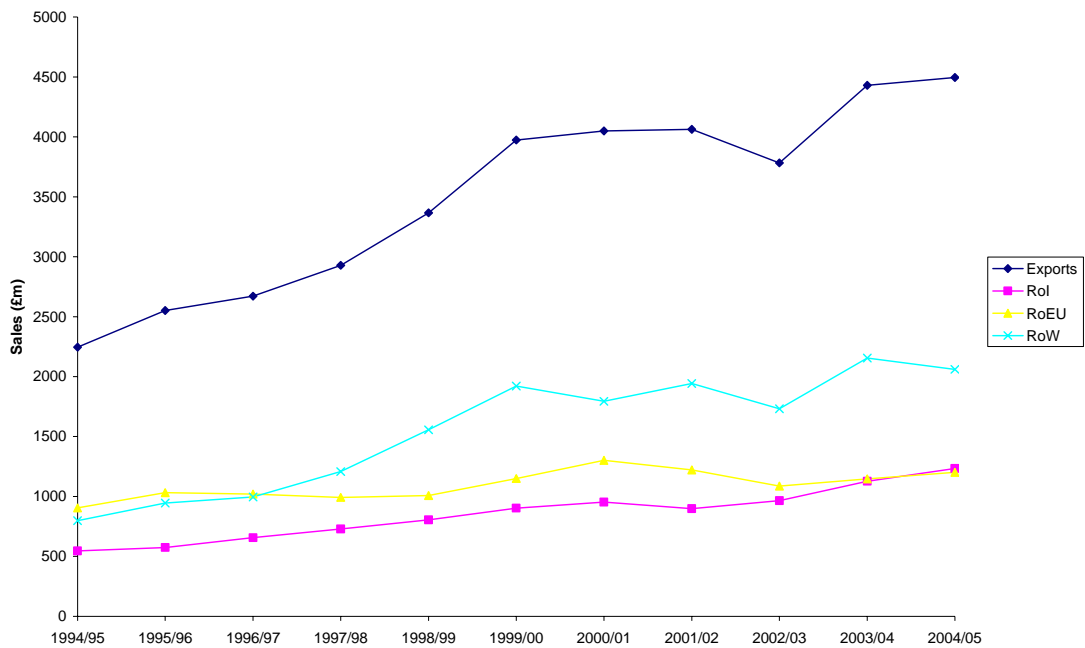
Great Britain is the main market for Northern Ireland's manufactured products, and the strong performance of sales there over the 1998/99-2001/02 period, increasing by 42% in real terms, drove the growth in total sales from Northern Ireland firms. However since these sales are within the UK, they are not considered exports. The largest single export market for Northern Ireland manufacturers has historically been the Republic of Ireland, accounting for approximately one quarter of all exports annually. Over the four year period to 2001/02 real export sales to the Republic of Ireland increased by 12% in total, to £899m, although this was largely a result of the strong growth between 1998/99-1999/00, as there was actually a decline in sales between 2000/01 and 2001/02 (although this has subsequently been reversed). Sales to the rest of the EU and the rest of the world, in particular, exhibited stronger growth

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than that to the Republic of Ireland over the period, with real sales increasing by 21% and 25% respectively, although sales to these markets are typically dominated by a few large firms and hence more susceptible to firms' internal management and marketing decisions rather than simply changes in global demand.

The largest single markets for Northern Ireland's manufactured products elsewhere in the EU, were, in 2001/02, the Netherlands, Germany and France, each with sales of over £200m. The US dominates the 'rest of the world' category, with Northern Ireland manufacturers selling over £700m there in 2001/02, around two fifths of all sales made to other world markets. It is likely that a proportion of sales made to these external markets are sales back to headquarters from foreign owned firms, however without detailed information it is impossible to ascertain, from the official statistics, the extent to which this is happening. The statistics do however provide a comparison between the export patterns of foreign versus locally[1] owned firms, which, as would be expected, differ markedly.

Information from both the 2000/01 and 2001/02 periods indicates that foreign owned firms sold two thirds of total sales in export markets. Of the total exported, sales to the rest of the world contributed the majority, followed by sales to the rest of the EU; sales to the Republic of Ireland accounted for just over 10% of export sales. The locally owned firms not only exported a smaller share of their total sales, at just 24%, but the pattern of export sales was reversed, with exports to the Republic of Ireland dominating, constituting half of the total; the other EU markets contributed around one third and sales outside the EU composed the remaining fifth. Given the

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[1] Locally owned firms are defined as those under UK ownership.

correlation between ownership and size, a similar pattern is found for large versus small firms. Large firms (those with employment of 50 or more) are more inclined to export, with two fifths of sales made to export markets compared to around one fifth for small firms in 2001/02. As with the foreign owned, large firms sold around half of all exports to markets in the rest of the world, whilst small firms made over two thirds of their export sales to the Republic of Ireland.

The aggregate figures can be decomposed into twelve two-digit SIC groups representing the manufacturing sub-sectors, all of which export to some extent. Historically the key exporting sectors were the manufacture of chemicals, metal goods and transport equipment with the former, in particular, exporting two thirds of its sales in 1990 (NIERC, 1992). The pattern for the period 1998/99-2001/02 is similar, with a few sectors, namely the manufacture of transport equipment, chemicals and electrical and optical equipment constituting the key exporters, exporting well over half their total sales every year. The manufacture of food, drink and tobacco remained the sector least reliant on export markets with 20%, or less, of total sales made to export markets every year over the period.

Three sectors accounted for the bulk of total exports, although their rankings altered over the period. In both 1998/99 and 1999/00 the manufacture of transport equipment contributed the majority of export sales from Northern Ireland, accounting for just under one quarter; electrical and optical equipment followed, contributing around one fifth of export sales with the food, drink and tobacco sector accounting for a further 15% (although this sector was shown to be least reliant on export markets, the sheer size of the sector in terms of sales results in it being one of the largest contributors to

total exports). By 2001/02 the largest contributor was the manufacture of electrical and optical equipment, which accounted for over one quarter of total exports. The food sector contributed an unchanged 15%; however the decline of transport sector resulted in a contribution of just 13% to total export sales, which was almost a ten percentage point drop from four years earlier. It must be emphasised though, that due to the dominance of a few large firms within particular sectors in Northern Ireland, the changing fortunes of any one firm can have a huge impact on sectoral performance, therefore the decline or improvement in any one sector may not necessarily be reflected across all firms within that sectoral grouping. In fact the dominance of such large firms must be borne in mind when considering total export sales from Northern Ireland, as extreme increases or decreases in total export sales can be the result of an increase/decrease in the particular performance of one firm.

2.2 Republic of Ireland Export Performance

Data on exports from the Republic of Ireland are available from the Central Statistics Office. Since 1973 total exports grew in value (real 1990 terms) on average at about 10% per annum. The second half of the 1990s experienced the largest growth rates with year-on-year growth rates up to 20%; since 2001 growth rates have returned to the 1-digit region.

Fig. 2: Exports of the Republic of Ireland by Major Destination in Real 1990 terms
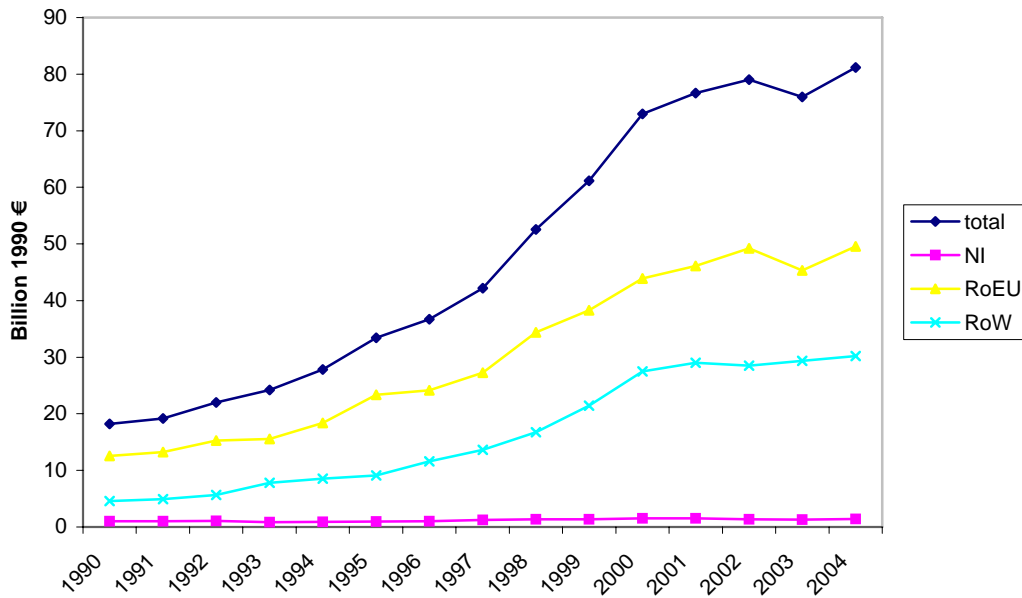
Figure 2 shows the evolution of the Republic's exports from 1990 to 2004 in real 1990 terms. It also breaks up the exports by broad destinations. The main destination for exports from the Republic is the European Union. In 2004 about 25% of these exports went to Great Britain (excluding Northern Ireland). This figure has steadily decreased since 1990 when about 40% of the exports with EU destinations went to Great Britain.

In 2003 and 2004 the next largest export destinations for the Republic of Ireland in the EU were − by decreasing order of magnitude − Belgium, Germany, France, Italy, Netherlands, Spain. The remaining exports went to the rest of the world. In 2004 about 50% of these went to Canada and the USA. This share has increased over the time period from 35% in 1990. To what extent this is due to the EU enlargements, which may have shifted accession countries from the 'rest of the world' category to the 'rest of EU' category during the period under consideration is not clear from the

data. However, the increase in exports to North America over the 15-year period is too large to be driven by statistical changes only.

The share of the Republic's exports going to Northern Ireland is small; it has increased from about €1bn in 1990 to just over €1.4bn in 2004 in real terms. However, it has not kept pace with the overall increase in exports. While in 1990 the Republic exported about 6% of its merchandise to Northern Ireland, by 2004 this share was reduced to 1.75%.

Recent work at the plant level (local units) by Lane and Ruane (2006) provides detailed information on the differences in exporting behaviour between domestic and foreign-owned plants in the Republic of Ireland for the year 2003. Of the Republic of Ireland-owned plants in the manufacturing sector only 46% export, however between 90 and 100% of the foreign-owned plants are exporters. Of the plants that have owners in the UK 82.6% are exporters. Of those that do export, Republic of Ireland- and UK-owned plants sell, respectively, 47.6% and 57.3% of their output in export markets. For plants with foreign owners in other countries this figure lies between 80 and 98%. In particular US- and Japanese-owned exporters sell almost all of their output in export markets. This highlights the Republic's status as an export platform to the EU and indeed more than 50% of the exports of Japanese, US, Swedish, Danish and Canadian firms go to the EU. Republic of Ireland-owned exporting plants sell almost 50% of their output to the UK and another 30% to the EU. UK-owned exporters in the Republic sell 40% of their output to the USA and they ship about 34% of it back to the UK.

In the service sector most firms are more oriented towards the local market. Of the Republic of Ireland-owned plants 17.8% are exporters in 2003. The figures for plants with owners in the UK and the Euro Area are 34.4% and 36.2%, respectively. For plants with Swiss, US, Canadian and Japanese owners around 55% are exporters. The Republic of Ireland-owned firms sell 15.4% of their services abroad; again over 50% of this is to the UK. The exporters with owners in the Euro Area sell 80% of their services in export markets, with 86% of it going back to the EU. For UK-owned exporters in the service sector the export intensity is a mere 11%, surprisingly, however they sell most of this outside the EU: 20% to the UK, 29% to the rest of the EU, 8% to the US and the remaining 43% to other countries. The US- and Canadian-owned plants export 73% of their services, where the EU is the major destination (25% to the UK and 60% to the rest of the EU).

The same publication by Lane and Ruane (2006) also gives an idea of the sectoral composition of exports in 2003 by 2-digit NACE codes. There is also a marked difference between Republic of Ireland- and foreign-owned plants at this level. Over 50% of the exports in manufacturing by Republic of Ireland-owned firms are from the food, beverages and tobacco sector; electronic products contribute 10%, and transport equipment and miscellaneous items 8.2%. In turn, the largest shares of exports by the foreign-owned plants are in the chemicals sector and electronic products sectors with 40% and 35%, respectively; another 12% are from the paper and printing sector and 8% are food, beverages and tobacco. A comparison with the figures on commodities according to the SITC classification published by the CSO, which does not exactly correspond to the NACE classification, suggests that the sectoral composition of exports has changed since 1990. In 1990 about 22% of the exports, according to the

SITC classification, are food, beverages and tobacco, by 2004 these products account for only 8% of total exports. The share of machinery and transport equipment declined only slightly since 1990, from 30% to 27%. Chemicals and related products more than doubled their share from 17% in 1990 to 46% in 2004. The share of miscellaneous manufactured articles[2] also remained relatively constant with 14% in 1990 to 12% in 2004.

In Services the sectors with the largest shares in exports (according to NACE codes) in 2003 are wholesale (33%), land, water and air transport (30.5%), software services (11.8%) and professional services (9.7%) for the Republic of Ireland-owned firms. For the foreign-owned firms they are software services (41.6%), communications (36.9%) and wholesale (8.4%).

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[2] This group contains products as diverse as prefabricated buildings; plumbing, electrical fixtures and fittings, furniture, travel goods, handbags, apparel and clothing accessories, footwear, professional, scientific and controlling apparatus, photographic apparatus, optical goods, watches and clocks.

3.   Literature Review

3.1   *Introduction*

Research into the export behaviour of firms has been ongoing since the 1960s, with various studies examining issues such as the benefits to the firm from exporting; barriers to exporting and, more recently, the profile of firms that become exporters. Early work touching on the latter was conducted by Snavely et al. (1964) and Cauvisgil (1987), who both concluded that exporters exhibited certain characteristics that were not apparent amongst non-exporters. However, it wasn't until the 1990s, as the topic of globalisation and regional economic competitiveness became increasingly important, that this strand of research took off with a growing body of literature using firm-level data to focus on the microeconomic effects of exporting, and more specifically the links between firm characteristics and exporting (Westhead, 1995; Roberts & Tybout, 1997; 1997; Jalvagi et al, 1998; Bernard & Wagner, 1998; Bernard & Jensen, 1999, 2001; Gourlay & Seaton, 2004). These studies typically sought to identify whether there was a profile that differentiates exporters from non-exporters, based on their firm-level characteristics; and overwhelmingly concluded that there does exist substantial differences between the two groups of firms. These differentials, which include measures such as performance, productivity, size and wages, indicate that exporting firms have preferable characteristics, and perhaps more importantly, these characteristics exist before exporting begins. Despite the consistency in the findings however, Bernard et al. (2003) have recently highlighted the fact that traditional international trade theory has little to say on these stylised facts, or in some cases is inconsistent with it, suggesting that in general, the empirical work tends to

focus on the microeconomics only and typically ignores its setting within macroeconomic trade theory.

3.2   Firm-Level Characteristics as Determinants of Export Performance

The literature suggests that the actual process of selling outside the domestic market necessitates a certain type of firm, hence explaining the particular characteristics exhibited by exporters. Roberts and Tybout (1997), for example, building on the work of Dixit (1989) and Krugman (1989), suggest that a certain amount of sunk costs are involved in entering new foreign markets, in the form of establishing distribution systems; market research about demand conditions abroad; and product modification and compliance. These entry, or sunk, costs are estimated to be substantial thus they argue that only efficient firms enter the export market as only they have the means to incur these costs. Fafchamps et al. (2002) arrive at the same conclusion, suggesting that, in the case of Morocco, firms that export are more productive before exporting starts and this is driven by the sunk costs in achieving market familiarity, whereby firms learn to design products that appeal to foreign customers. Hirsch (1971) and Clerides et al. (1998) also use the sunk costs argument in explaining why larger firms (in terms of sales volume and capital stocks respectively) are more likely to be exporters; they suggest that due to these fixed costs only producers of larger batches can keep unit costs low by spreading these fixed costs over a large number of units sold.

Alongside the sunk cost argument, research suggests that the exporting process requires firms to be efficient due to the fact that they are operating in a wider

marketplace, the argument being that participation in world markets exposes a firm to more intensive competition, thus firms need to learn how to produce domestically and reach high levels of productivity in the home market before they try and enter export markets (Bernard and Jensen, 1999). This hypothesis is also supported in development economics literature which states that product market competition in export markets is greater than competition in domestic markets, resulting in a lack of opportunities for inefficient firms (Aw and Hwang, 1995). Similar arguments are made in relation to those other characteristics which indicate firm superiority, for example the size, age, ownership and innovative nature of the firm, each of which has been found to have a particular influence on export performance, the latter of which is linked to technology-based models of competitive advantage.

Firm size is one of the most commonly analysed characteristics in the related literature (Czinkota and Ursic, 1991, Westhead, 1995) and is universally regarded to be positively related to export activities (Miesenbock, 1988). It is understood that trading in external markets requires a certain amount of resources therefore larger firms can benefit from their size by engaging in economies of scale in production and also from bulk buying. Larger firms also have a greater ability to expand resources and absorb risks than smaller firms (Erramilli and Rao, 1993) and hence are more adaptable to selling to export markets. Bernard and Wagner (1998) further suggest that larger firms may have lower average or marginal costs and as a result be more likely to export.

Firm age is sometimes correlated with size and is typically linked to exporting, in that the longer a firm has been in business the more likely it is to look to export markets in

order to grow. However, this is not conclusively backed up by the empirics; whilst there is evidence that older firms are more likely to export than younger firms (Lee & Yang, 1990; Ali & Swiercz, 1991; Westhead, 1995; Javalgi et al., 1998) other studies have suggested the opposite (Ursic & Czinkota, 1984; Roper and Love, 2001), whilst some have found no effect at all (O'Reilly, 1993, Reid, 1982). The fact that younger firms have been found, in some cases, to be more likely to export is possibly linked to the growing body of literature which focuses on the characteristics of the owner/manager in the export decision. Several studies have indicated that the global orientation of managers significantly influences export behaviour and performance (Cooper, 1981; Miesenbock, 1988, Westhead, 1995, Zou and Stan, 1998). This is particularly the case for small firms in which managerial capability and orientation are found to be important factors in explaining export behaviour (Reid, 1981; Westhead, 1995; Lautanen, 2000). More recently, research has found increasing evidence of new firms, whose managers have a strong global orientation, beginning to export a short time after being established. These firms have been termed 'born globals' and are typically high technology start-ups whose managers have previous experience in managing firms with a foreign presence (Moen, 2002, Moen and Sevais, 2002).

The ownership variable is typically linked to exporting; the notion being that foreign owned firms are more likely to be exporters, sending goods either back to headquarters or to other plants within the branch, a distinction which recognises that an increasing proportion of world trade represents the flow of intermediate goods between multinational affiliates or between multinationals and their partners in subcontracting agreements (Kumar, 1994). Whilst the foreign ownership variable is typically significant (Bernard and Jensen, 2001; Roper and Love, 2001), Javalgi et al.

(1998) have questioned its usefulness in a policy context, particularly if the export orientation and strategy of foreign-owned firms is pre-determined outside the host country prior to start-up. They suggest that ownership in terms of public versus private is a more useful variable particularly if the policy goal is assisting non-exporters into export markets.

Finally, in terms of the alternative models of growth such as the trade theory models, innovation and technology are regarded as fundamental determinants of export performance (Posner, 1961; Krugman, 1979). Technological innovation is usually captured through an R&D measure, with Anderton (1999) suggesting that R&D improves the quality of products and hence the profitability of exporting. Linked to this is the wage variable, which is often used as a proxy for human capital, or labour quality, the hypothesis being that the quality of the workforce is a reflection of the quality of the good produced, and hence positively related to export entry (Bernard and Jensen, 2001).

3.3   *Empirical Findings of the Firm-Export Relationship*

Empirical analysis, across both developed and developing economies such as the UK, the US, Morocco and Colombia, have validated the relationship between firm-level characteristics and the ability to export. The empirical work typically involves the use of panel or cross-sectional data on manufacturing firms; a binary choice model is the general form used in identifying the factors that increase the probability of being an exporter, whilst export intensity, defined as exports as a proportion of total sales, is

the most common measure used when examining the determinants of export performance (Sousa, 2004).

Bernard and Jensen carried out most of the pioneering work on the subject of the firm-exporting relationship in the US, over the 1990s. Their 1997 paper, in particular, analyzes the factors that increase the propensity for exporting by examining several hypotheses in their sample of US manufacturing firms; they test whether characteristics of the firm are important for entry into foreign markets; they examine the evidence for sunk costs by looking at the effects of exporting yesterday on exporting today; they estimate the effect of spillovers from firms in the same industry and region and finally they examine the impact of government export promotion policies. Their sample is drawn from the Annual Survey of Manufacturers and contains 13,550 plants that were in continuous operation between 1984-1992. Due to this criterion their resulting sample is not representative of the population of manufacturing firms, as their plants are larger and more likely to be exporters.

Using a linear probability framework the authors find substantial evidence for plant-level effects in the export decision. Large, productive plants have higher probabilities of exporting, whilst high average wages and a high white collar employment share (proxying labour quality) also significantly increase the probability of exporting. Ownership of the plant by a US multinational increases the probability but being part of a multiplant firm does not. A recent industry switch by the firm is also positive and significant in the export decision. The evidence for sunk costs is also substantial with exporting last year increasing the probability of exporting today by 66%. Estimating the same model with fixed effects reduces the effect for sunk costs to 20% whilst the

productivity and white collar worker shares are no longer significant however, firm size, wages and product change remain positive and significant.

Estimating the same model with first differences, which is the authors preferred method, indicates that just two plant level characteristics are significant. Plant size is positively related to the probability of exporting, with a coefficient of 0.132, compared to 0.029 in the first model; product change also remains significant, increasing the probability of exporting by 3.3%. Lagged export status proxies sunk costs and, in this model, indicates that exporting in the last period increases the probability of exporting in this period by 39%, whilst exporting two years ago increases the probability by 12%. The evidence for spillovers is limited with the measures indicating the role of geographic and industry spillovers both negative and significant, suggesting that existing export activity may inhibit entry into exporting. The role of export promotion policies is also limited, with contemporaneous policies found to be slightly positive but insignificant.

Overall the authors conclude that entry costs into exporting are significant for US firms, and plant heterogeneity is substantial and important in the export decision. There is a lack of evidence for spillovers or impacts from state government export promotion in the study; although the authors suggest this may be due to their sample selection criteria which limited the analysis to large plants.

As a follow-up, their 1999 study again looks at the interaction between exporting and firm performance for a sample of US firms however they look at the direction of causality from both sides, examining whether good firms become exporters and/or whether exporting improves firm performance. The rationale for the study is to aid in

the selection of appropriate export related policies, for example, they state the need to understand how plants become exporters in order to set appropriate policy goals, and secondly, in order to set reasonable expectations about the impact of these export promotion policies, they emphasise the need to understand what happens to plants after they start exporting.

The data used in the analysis is drawn from the Longitudinal Research Database of the Bureau of the Census and covers the period 1984-1992. All plants in the Census of Manufacturers for 1987 and 1992 are included, as are all plants in the Annual Survey of Manufactures, for the intervening years, resulting in an unbalanced panel of 50,000-60,000 plants each year. In order to determine which plants become exporters the analysis compares the ex-ante plant characteristics and growth rates for exporters and non-exporters over two time periods, 1984-88 and 1989-92. They find substantial differences between the two sets of firms in both periods, firms that become exporters are 20%-45% larger in terms of employment, 27%-54% larger in terms of shipments, have 7%-8% higher labour productivity and 2%-4% higher wages. Most of these desirable characteristics are also found 2-3 years before the firms commence exporting. The results therefore suggest that future exporters have desirable performance characteristics.

In order to test the causal relationship between exporting and these firm characteristics, a linear probability model is used. The results confirm the hypothesis that prior success, measured by employment, productivity and wages, increase the probability that a firm will export; a 10% increase in employment, a 3% increase in wages and a 1% increase in productivity each increase the probability of exporting by

1%. Changing the product is also found to be highly significant, suggesting a strong relationship between product attributes and the decision to export.

In terms of the causal relationship examining whether exporting then improves firm performance, the results are mixed. Over annual horizons, exporters grow faster in terms of employment and shipments; however productivity growth is either the same, or grows more slowly for exporters, whilst wages also show mixed results. Over longer time frames, the advantages from exporting are more limited. Exporters still have higher employment growth rates, of around 0.4%-1.1% per year, however the growth in shipments is no longer significant and productivity growth is lower for initial exporters. However the authors do find that exporters have significantly lower failure rates than non-exporters with similar characteristics.

Overall the authors conclude that success and new products lead to exporting and that exporting is associated with growth in plant size and higher plant survival rates, however they also suggest that firms entering export markets are unlikely to see any productivity gains. Their results thus imply that exporting per se may not enhance productivity, but rather it simply provides wider market opportunities for more productive firms and may result in the reallocation of resources from less productive to more productive activities. The more direct benefits lie in the creation of new jobs and, through higher survival rates, the stability of these jobs.

Outside the US several studies have also examined the relationship between exports and the firm in the UK and Ireland, which, for the most part, present similar results. Bleaney and Wakelin (1999) examine the sectoral and firm specific determinants of

export performance for a sample of 110 UK manufacturing firms quoted on the UK stock market. The aim of their research is to determine whether exporting generates learning that improves firm performance; whether exporting is more likely if more local firms are exporters and whether prior export experience matters. Using Tobit and OLS models (the latter run only for exporters), the authors find that technological innovation, measured by the first application of innovations, and through the usual R&D expenditure measure, is positive and significant, although the former is a better measure with a larger coefficient (2.092 in the Tobit) than the R&D expenditure one (1.344). Intra-industry trade is also consistently positive in each of the models, with a coefficient of around 0.2. The other factor endowments, such as average wage, proxying human capital, and physical capital intensity are only significant in one of the models, at the 10% level, the former with a positive coefficient and the latter a negative one. In terms of the firm-specific effects, which capture the firm's deviation from the sector average, the authors find that firms with higher wages, lower unit labour costs, higher capital intensity and higher R&D expenditures all have higher exports whilst firm size is also positively related to the propensity to export, although the marginal effect diminishes with firm size, at around 60,000 employees. Overall, the paper concludes that the findings are consistent with other studies which state that exporters are larger, more productive and pay higher wages, whilst they consider technological innovation to be one of the main determinants of export activity in the UK.

Gourlay and Seaton (2004) examine the determinants of export probability for a panel of 2,134 UK firms between 1988 and 2001. Their study makes three contributions to the literature; they allow for the role of industry heterogeneity by including industry

interactive effects; they include a variable to capture governance features of the firm (ratio of total director salaries to total sales) and they allow for a firm-specific reaction to the level and volatility of exchange rates. Using a combination of Probit and Logit models the authors find that firm size is positively related to export probability in the majority of industries although they find no evidence for a quadratic relationship. Innovation, proxied by R&D intensity; human capital, measured as average wages, managerial capital and product diversification are also all found to have positive effects for entry into export markets. However, for the majority of industries the exchange rate has no significant impact on export probability although the variance of the sterling-dollar rate does have a positive influence. The authors conclude that the empirical results are sensitive to both model specification and the procedure in finding a best-fit model.

The Tobit methodology is employed by Roper and Love (2001) who examine the determinants of export performance for manufacturing plants in Northern Ireland and the Republic of Ireland over the 1996-99 period. The main question addressed in the study is what factors determine export propensity in each area, where export propensity is measured by the proportion of plants' sales made outside the UK and Ireland. The sample of firms used in the study is drawn from two waves of the Irish Innovation Panel, resulting in an unbalanced panel of approximately 1,300 firms. Results from the entire sample suggest a strong positive effect from the strength of the firms' internal resource base, thus firms with a high proportion of graduate employees and plants with an in-house R&D capability have higher export propensity. The largest R&D effect is for plants with a structured R&D department, with a coefficient of 17.903 in the Tobit with random effects, compared to 10.373 for firms undertaking

informal R&D only. Plant size is found to be an important determinant, with a coefficient of 0.025, whilst a quadratic relationship is also found. In terms of the other plant characteristics, external ownership has a strong positive effect whilst younger firms are also found to have a higher export intensity. Plant location is important, with firms in the Republic of Ireland having significantly higher export propensity that their counterparts in Northern Ireland.

The authors perform the same analysis, splitting the sample by location, ownership and size. The latter is important in terms of policy and suggests some interesting results. For smaller firms (those with employment less than 50) both informal and more formally organised in-house R&D activity has a positive effect on export propensity, whilst for larger firms only more structured R&D has a significant impact. Export propensity in smaller firms is also found to be dependent on the size and age of the firm, with younger and larger small plants having higher shares of exports. For larger plants location is a significant factor, whilst for both types of firm being externally owned contributes significantly to export propensity.

These findings for Northern Ireland and the Republic of Ireland are also consistent with other studies which have focussed on the relationship between exporting and firms in the Irish Republic only, for example it has often been observed in a range of official and academic reports, particularly since the Telesis report (1982), that foreign-owned industry as a group is much more export-oriented than Republic of Ireland-owned industry, and that larger industrial firms as a group are more export-oriented than smaller industrial firms. More recently, Ruane and Sutherland (2002) found that over 92% of foreign-owned manufacturing companies in the Republic of Ireland were

exporters in 1998, compared to 58% of Republic of Ireland-owned companies. The foreign firms exported almost 92% of their output whereas the Republic of Ireland-owned firms exported 36% of their output. Focusing on Republic of Ireland-owned companies only, Ruane and Sutherland found that the exporting companies had higher average employment, earnings, gross output, net output, and net output per employee compared to the non-exporters. In addition, the exporting companies that exported to global markets beyond the EU ranked higher on these same criteria than those who only exported to the EU.

Ruane and Sutherland (2004) focused on Republic of Ireland-owned industrial firms and found that exporting enterprises were superior to those that did not export, in the sense of being larger and having higher productivity. Exporters that exported higher proportions of their output also had superior characteristics compared to exporters that exported smaller proportions of their output. Ruane and Sutherland (2004) also found that it was enterprises which were initially superior that tended to become exporters, whereas there was no evidence that firms developed superior characteristics as a consequence of exporting. In addition, they found that enterprises that exported predominantly to distant markets beyond the UK exhibited superior characteristics compared to those that exported mainly to the nearby UK market.

Ruane and Sutherland (2005) further investigated whether the exporting behaviour of Republic of Ireland-owned industrial firms is linked to the presence and exporting behaviour of foreign-owned enterprises in Ireland. They found that the probability of Republic of Ireland-owned firms becoming exporters and exporting more intensively is positively associated with the intensity of the presence of foreign-owned firms in

their sector. At the same time, they found that the probability of Republic of Ireland-owned firms becoming exporters and exporting more intensively is negatively associated with the export-intensity of the foreign-owned firms. As explanation for this latter point, it is suggested that when foreign-owned firms export a very high proportion of their output they generate little competition for Irish enterprises in the domestic market, and therefore they have little impact on the productivity or export behaviour of Irish enterprises.

Despite the seemingly overwhelming consensus on the superior characteristics of exporters relative to non-exporters, a recent study, also carried out on a sample of firms in the Republic of Ireland, has been one of the few to contradict the usual findings. Girma et al. (2004) use plant level data to compare productivity and profitability across three types of firm in the Republic of Ireland, namely firms serving only the domestic market, firms that export, and firms that engage in FDI. The methodology adopted employs the use of a non-parametric approach based on the principle of first order stochastic dominance, which allows the authors to compare and rank the distributions and measures of plant performance. The results indicate that the authors cannot reject the hypothesis of identical distributions of sales per employee, value added per employee and net profit per employee for exporters relative to non-exporters, which goes against the usual empirical findings. However they do find that domestic FDI firms stochastically dominate both domestic exporters and non-exporters in terms of labour productivity and profits per employee.

3.4 Empirical Findings of the Firm-Export Relationship for Small Firms

The above section details the country-findings for the general export-firm relationship however the literature suggests that the attitude of a smaller firm towards international operations is different from that of larger firms, that export behaviour in small firms is likely to be more affected by individual decision-makers and less subject to such structural arrangements as intra-group trading, territorial allocations and sourcing policies which are likely to be present in a large firm (Reid, 1981). This suggests that the influence of random factors on exporting operations is greater than in large firms therefore it is important to also examine those studies focussing on small firms only.

The study by Reid (1981) examines the empirical findings of the relationship between the firm, individual characteristics and foreign entry behaviour, and seeks to provide a conceptual model explaining the impact of the decision-maker on foreign entry and export expansion behaviour in small firms. In the study the export expansion process is regarded as similar to an innovation-adoption process, with a five-stage hierarchy consisting of export awareness, export intention, trial, evaluation and acceptance. At each stage specific firm and decision-maker variables play particular roles. The author states that viewing exporting as innovation adoption in this way provides a better insight into how exporting is initiated and developed.

Knowledge of the characteristics which account for differences in the way attitudes and information about foreign markets affect responses to export stimuli and subsequent export behaviour is critical to understanding the exporting process, suggesting the existence of decision-maker characteristics at the level of the firm.

However the author states that empirical evidence identifying these decision-maker characteristics in the context of foreign entry decisions is meagre. A number of studies have indicated that individual characteristics such as type and level of education, foreign nationality, ability to speak foreign languages and extent of foreign travel are likely to be associated with the exporting decision-makers existing stock of knowledge, his attitudes, and effective preferences concerning foreign markets. However, the author suggests that whilst the influence of the decision maker is important, the choice to export can only be made if resources exist to enable it to happen. Overall the paper concludes that research into the export behaviour of small firms must pay more attention to the individual characteristics of the decision-maker and how these affect the processing of export-related information.

Lautanen (2000) is one such paper which examines the export decision of small firms, using a sample of 76 small and medium sized manufacturing firms in Finland. In the paper the decision to export is modelled using the inter-firm spread of information on international marketing possibilities, and differences in firms' characteristics, to determine the preferred time of adopting the exporting strategy. The author states that the traditional literature on the export behaviour of small firms indicates that it is a slow learning process, and is best shown though the stages model of internationalisation. In this framework the firm increases stage by stage its international commitment, starting with being initially uninterested in exporting, then filling possible unsolicited export orders and exporting to psychologically close countries, and ending in committed involvement in international marketing. The incremental nature follows from greater perceived uncertainty and risk associated with international business decisions compared to home market operations. However,

the author concludes from his literature review that the internationalisation process of a small firm may not necessarily follow the stages proposed in the framework but has become more straightforward due to economic integration and an improvement in the information on international business operations. He further suggests that lack of resources and concentrated decision making may also be important sources of variation in the exporting behaviour of smaller firms.

The first hypothesis of his model is that firm-specific characteristics such as firm size, quality of its resources or perceived risk related to exporting will determine the expected revenues from exporting and thus influence the speed of the adoption process for each individual firm interested in exporting. The second hypothesis is that inter-firm and person-to-person transmission of information should be important sources of initial stimuli for exporting. The third hypothesis is that the improvement of profitability and feasibility of exporting over time should be reflected in lower costs of exporting and the speeding-up of the adoption processes because of the process of economic integration of Finland into Western Europe.

Preliminary results from the interviews conducted with managers indicate that the most important stimuli for exporting are getting an unsolicited order from abroad; starting exporting as part of a growth objective of the firm; getting the idea through a personal contact outside the firm or through an initiative by another domestic enterprise. In terms of the fixed costs from establishing exporting the three most important types are outlays for travelling; promotion and advertising abroad; and product development.

A probit model is used to find the firm-specific characteristics that affect the likelihood of adopting the exporting strategy quickly. The estimation results suggest that the larger the firm the smaller the probability of adopting exporting within 4 years of becoming interested in exporting. Firms with managers who have knowledge of more foreign languages have a higher likelihood of adopting exporting strategy quickly than firms run by managers with weaker language skills. Finally firms which started to export in the 1990s have a higher probability of adopting the exporting strategy faster, than firms which started exporting earlier. Apart from firm size, the coefficients are of the anticipated sign. The unexpected negative relationship between firm size and speed of export adoption may be due to the lack of economies of scale in the initial phase of exporting, or, as the author suggests, may be the result of a measurement error.

Overall the analysis suggests that the theory of innovation diffusion, such as the rank effects theory, seem to provide potential frameworks for theorising export behaviour amongst small firms. The main findings are that it does not appear that the financial risk related to exporting, nor the lack of experience nor the education level of the white collar staff is likely to determine which small firms develop their exporting quickly, but rather the language skills of the entrepreneurs, which again underlines the importance of the decision-maker to the small firm.

Westhead (1995) further looks at the small firm export decision and follows the usual export-decision analysis by comparing the characteristics and performance of firms that export and those that do not, however his analysis is carried out on new small firms only, in order to add to the knowledge base about the internationalisation of

small firms. His key aim is to determine whether there are any significant differences in the characteristics of new business founders and new business performance and growth between non-exporting and exporting firms which began trading between 1986 and 1990 in the UK. His hypotheses take into account the potential importance of both internal (firm characteristics, attitudes of the owner-manager) and external environmental influences (level of competition in the domestic market, policies encouraging new firms to export) on the decision to export amongst small firms.

The sample incorporates 267 new manufacturing and producer service firms in the UK, and using preliminary univariate analysis, reveals that the probability of being an exporter increases with firm size and being in the manufacturing sector, conversely, younger firms are found to be less likely to be exporters. Multivariate Logit analysis is also undertaken although it is only able to predict the characteristics of non-exporting firms; as a result, a matched pairs methodology is used to identify significant differences between the two groups of firms.

The results from the matched samples dataset suggest more similarities between the two sets of firms than there are differences. Both types of firms have similar financial bases, with no evidence to suggest non-exporting firms are disadvantaged in the raising of equity. No significant differences in sales revenues are recorded either, although exporting firms are considerably larger in terms of employment size. Differences are found with regards to the owner-manager, with founders of exporting firms having different work experiences and personal backgrounds than non-exporters, they are also older and have considerably more experience of previously establishing a new venture. Founders of exporting firms also have a significantly

greater propensity to perceive a more hostile environment at start-up, with important resources, such as skilled labour and local customers, perceived to be unavailable, suggesting a push factor into export markets.

3.5   Conclusion

In general, the literature can be summed up by the quote "exporters are better than non-exporters" (Bernard and Jensen, 1999), with the overall results suggesting noticeable differences between the two sets of firms. The suggestion is that there is a necessity for firms to be efficient in the face of increased competition in foreign markets, and to be already profitable so as their profits exceed the fixed costs associated with export entry (Girma et al., 2004). Following on from this, exporters have been found to be bigger, more productive and pay higher wages than their non-exporting counterparts, or in other words they are regarded as "good" firms, and, more importantly, they exhibit these desirable characteristics several years before they ship any goods abroad.

However, in terms of firm size the literature also suggests that the attitude of a smaller firm towards international operations is different from that of larger firms. The amount and quality of resources, such as managerial resources, education level of the employees, capital and capacity are crucial factors in such firms' internationalisation strategies. Differences in managerial capability and orientation, in particular, are important factors in explaining the exporting behaviour of small firms whilst there is also evidence to suggest that the initial stimulus for exporting in a small firm more often lies outside the firm. This suggests that in small firms the influence of random

factors on exporting operations is greater than in large firms, with the individual

characteristics of the decision maker crucial in determining the export decision.

4.   Methodology

The central aim of this study is twofold, firstly to examine the determinants of being an exporter and secondly, to examine the influences on export intensity (the proportion of sales that are exported), for firms located in Northern Ireland and, separately, the Republic of Ireland.   In identifying the factors that increase the likelihood of a firm being an exporter a binary model is the general form used in the empirics, with the dependent defined as a dichotomous exporter/non-exporter variable, however different frameworks and different sample types (cross-section / panel) are employed in its estimation.   Bernard and Jensen (1997, 2001), utilising a sample of continuously operating US plants from 1984-1992, model the decision to export through a linear probability model with fixed effects. They control for the lagged endogenous variables by estimating the model with first differences and instrumental variables, which also takes account of the problem of biased and inconsistent estimates, which are associated with such models.

Bernard and Wagner (1998) estimate the decision to export using an unbalanced panel of 6,400 German plants, with an average of 9 years worth of data. They follow Roberts and Tybout (1997) and Bernard and Jensen (1997) by modelling the decision to export as analogous to the decision to market a new product, thus the firm will export if current and expected revenues are greater than costs. In identifying an quantifying the factors that increase the probability of exporting a random effects probit is estimated (as was adopted by Roberts and Tybout), however the authors acknowledge that the assumption for random effects is likely to be violated in their model i.e. that the plant effects be uncorrelated with the regressors, and hence,

following Bernard and Jensen (1997) they also employ a linear probability model with fixed effects.

Gourlay and Seaton (2004) examine the determinants of export participation for their panel of 2,134 UK firms operating between 1988 and 2001. The authors include exchange rate variables along with the usual plant characteristics and employ both Logit and Probit models in the estimation. Westhead (1995), using a cross-sectional sample of 267 manufacturing and producer service firms in GB, employs univariate analysis to identify characteristic and performance differences between exporters and non-exporters, and follows this with a Logit to identify those factors which distinguish between exporting and non-exporting firms. However, uniquely he also makes use of matching techniques to further enable a better comparison between the two sets of firms. Javalgi et al. (1998) also incorporate manufacturers and manufacturing-based service providers in their cross-sectional sample of 20,000 firms based in Ohio in 1994. The Logit technique is used to determine the contribution of firm characteristics to the likelihood of exporting, and also to statistically test whether the pattern of Logit coefficients differs by industry type.

In order to estimate the determinants of export participation (and later the influences on export intensity) of Northern Ireland manufacturing firms, two sampling approaches are used. The first utilises a cross-sectional sample of firms from the population with full 2001 data; this is used to provide a wider sample, as the panel data constructed from the population contains a relatively small number of non-exporting firms (refer to section 5 for details). As a second approach, the balanced panel of 479 firms who survived between 1998-2001 is used, and although using this

panel is more restrictive in terms of the number of non-exporters included; its use has other benefits. Panel data enables firm heterogeneity to be controlled for in the analysis; in a cross-section there are a number of unmeasured explanatory variables that affect the behaviour of firms, similarly there are variables that affect firms uniformly but differently in each time period. Omitting these variables causes bias in the estimation, which is corrected using panel data. The use of such a dataset also creates more variability, by combining variation across plants with variation over time, thus alleviating problems of multicollinearity and also permitting more efficient estimation (Kennedy, 2003).

Following Gourlay and Seaton (2004), Westhead (1995) and Javalgi et al. (1998) a Logit model is employed in the cross-sectional estimation process; the binary dependent variable is defined, equal to one if the firm is an exporter and zero otherwise. An ordinary least squares (OLS) regression could be used to fit a linear probability model however, since the dependent variable is discrete, the assumptions of normality and homoscedasticity would be violated, whilst such models may also predict probability values beyond the (0,1) range. The logistic regression model is therefore used to appropriately estimate the factors which influence export participation. Maximum likelihood estimation (MLE) is the method used to calculate the logit coefficients; this method seeks to maximise the log likelihood, which reflects how likely it is (the odds) that the observed values of the dependent variable (exporting) may be predicted from the observed values of the independent variables (firm characteristics).

The decision to export is modelled as a function of firm-level and sectoral characteristics, thus the basic model is given as:

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + e_i \qquad (1)$$

Where Y is the decision to export, X is a vector of plant level characteristics and Z is a vector of sectoral characteristics. The model is estimated in the first instance for the cross-sectional sample of 727 firms with 2001 data. For the panel estimation the same basic model is applied, although given the nature of the data, a cross-sectional time-series Logit is utilised.

The second stage of the analysis is the estimation of the influences on export intensity. The dependent variable in this model is defined as exports as a percentage of total sales, therefore by definition, it lies between zero and one hundred percent (or zero and one). As before, similar to the drawbacks of using linear probability models with binary data, the use of OLS regression in this instance can result in estimates which imply predictions outside of the zero to one range. Given this, the econometric models typically used in its estimation is either that of a Tobit, as it is appropriate for censored data (Wagner, 1995; Bleaney and Wakelin, 1999; Roper and Love, 2001) or a two-step procedure which firstly models the decision to export, and then models the share of exports in total sales, for firms with positive exports only (based on the first equation) (Wakelin, 1997; Greenaway et al., 2004). However, Wagner (2001) has argued that there are theoretical and econometric flaws associated with using these methodologies for the export intensity model. Wagner asserts that Tobit is only appropriate when the value of the dependent variable can be less than a lower limit,

but observations with such values are not observed because of censoring; thus it is not suitable for instances when the dependent, as in this case, is bounded by zero and one by definition. As a result in his subsequent analyses of the firm size-exports relationship he employs fractional Logit models, the former on cross-sectional data (Wagner, 2001) and the latter on a panel dataset (Wagner, 2002). This methodology was developed by Papke and Wooldridge (1996) in a study of employee participation rates in pension plans, and basically enables models, for which the dependent variable is a fraction (thus bounded between zero and one), to be estimated without the need to adjust the data at the extremes, and which allows the predicted values to lie in the required range.

In modelling the export intensity of Northern Ireland firms, fractional logit is the preferred methodology, however it is only feasible to use in the cross-sectional model. Wagner (2002) utilises the methodology with a panel dataset, fitting an unconditional fixed-effects model, however this requires a dummy variable for each panel contained within the model. In the model for Northern Ireland firms, such a methodology would be inefficient as it would result in a significant loss of degrees of freedom. Fitting a random-effects fractional logit would have been preferred, as it postulates a different intercept for each firm and saves on degrees of freedom, thus producing a more efficient estimator of the slope coefficients than the fixed-effects model, however as yet there does not appear to be a suitable command within the Stata package to do so with panel data. In the absence of a suitable estimator, the methodology utilised for the panel dataset in this analysis is therefore that of a cross-sectional time-series Tobit, with Wagner's criticisms accepted; again a random effects model is selected.

As with that for export participation the basic model is given as:

$$I_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 Z_{it} + e_i \qquad (2)$$

Where I is export intensity, measured as exports as a share of sales, X is a vector of firm-level characteristics and Z is a vector of sectoral characteristics.

A broadly similar methodology is used for modelling the characteristics of exporters and the determinants of export intensity for the Republic of Ireland. In the first stage a Logit is employed on the pooled dataset; a cross-sectional time-series Logit is then used on the narrower dataset, containing only those firms that are observed over the entire time period, to estimate the determinants of export participation. For the export intensity model, a fractional logit is used on the pooled sample whilst an unconditional fixed-effects model is applied to the narrower sample, with the fixed effects element controlling for the unobserved heterogeneity within the firms.

5.   Data

5.1   Northern Ireland Data

5.1.1   Introduction

The dataset used was constructed from repeat cross-sectional data collected by the Department of Enterprise, Trade and Investment (DETI) through the Northern Ireland Annual Business Inquiry (ABI), the Manufacturing Sales and Export Survey (MSES) and the Business Expenditure on R&D survey. Annual datasets from the above surveys were supplied to ERINI, containing information on manufacturing plants in Northern Ireland over the 1998-2002 period[3]. Each dataset incorporated a particular range of data for the plant, alongside a unique statistical reference number which was common to each of the surveys. In constructing a single dataset, incorporating the above, matching was carried out using this reference number, resulting in a total of 1,793 plants, with one or more year's records.

Of the total number of plants in the dataset, 516 did not appear on the MSES, and therefore there is no information as to whether or not they are exporters, nor the value of any potential export sales. The remaining 1,277 consist of 1,004 who exported in at least one year over the period (i.e. they had sales outside Northern Ireland and Great Britain) and hence are termed exporters, the remaining 273 did not export in any of the years and are termed non-exporters. A varying number of firms had full ABI and MSES information, with the largest complete sample found for 2001.

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[3] The ABI and MSES were conducted annually however data from the R&D survey was only available for 1999, 2001 and 2002.

A panel dataset was constructed; the largest usable sample[4] consisted of those that had survived between 1998-2001 and had complete or almost complete ABI and MSES data for that period[5]. This resulted in a panel of 479 firms of which 404 are exporters (i.e. had recorded exports in at least one year over the period) and 75 are non-exporters (i.e. had never exported over the period). The number of exporters in the sample represents 40% of the total number of exporters held on the database, whilst the representation for non-exporters is lower at 27%. Due to the nature of its construction, the sample is also unrepresentative of the population of Northern Ireland manufacturing firms, with a stronger representation of exporters and larger firms. Nevertheless it should allow us to identify some of the key characteristics which differentiate exporters from non-exporters.

5.1.2   Descriptives

Tables 1-5 display various descriptive data about the firms contained in the panel dataset, details are given for both exporters and non-exporters. As would be expected exporting firms are on average larger than those not engaged in exporting, with an average employment in 1998 of 123, around 28% higher than that for non-exporters (Table 1) and an average turnover of £11m, more than double the non-exporters figure (Table 2). For both groups of firms the distribution of employment is heavily skewed, with a relatively small number of large firms contributing the majority of employment; this is particularly the case for non-exporters, whereby just 5% of firms

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[4] The chance of having full records for a firm over the entire period are affected by several factors: smaller firms (those with employment less than 20) were surveyed randomly each year (in both the ABI, and the MSES between 98-00) and these tended to be non-exporters; the MSES is a voluntary survey and therefore there is no obligation on firms to complete it annually; and non-exporters were less likely to complete the MSES questionnaire as it was concerned with exports.
[5] The number of non-exporting firms with complete data for 1998-01 was very small therefore data was estimated in cases where the firm was known to be in operation but the relevant data was missing.

have employment of 200 or more but account for almost two thirds of all employment in 1998 and over half in 2001.

Table 1: Distribution of Employment by Sizeband 1998 & 2001

	Exporters			Non-Exporters	
	% of Firms	% of Employment		% of Firms	% of Employment
Emp98					
1-49	44	12		72	17
50-99	24	13		17	11
100-199	18	19		5	9
200+	14	56		5	63
Total	100	100		100	100
Avg Emp	*-*	*123*		*-*	*96*
n. firms	*-*	*404*		*-*	*75*
Emp01					
1-49	41	11		72	23
50-99	27	16		19	18
100-199	17	19		4	8
200+	14	54		5	52
Total	100	100		100	100
Avg Emp	*-*	*122*			*75*
n. firms	*-*	*404*			*75*

A similar picture arises in terms of the distribution of turnover (Table 2); just one tenth of non-exporting firms have a turnover of greater than £10m yet they account for over two thirds of total turnover. As was the case with employment, there is a greater share of exporters in the high turnover sizebands, although their overall distribution is also somewhat skewed with 41% of exporting firms, with sales of £5m or more in 1998, accounting for 88% of turnover.

Table 2: Distribution of Turnover by Sizeband 1998 & 2001

	Exporters			Non-Exporters	
	% of Firms	% of Turnover		% of Firms	% of Turnover
Turnover98					
<999k	7	1		49	5
1m-4.9m	52	11		36	16
5m-9.9m	19	11		5	8
10m+	22	77		9	71
Total	100	100		100	100
Avg Turnover (m)	-	*£11.9*		-	*£4.8*
N firms		*404*			*75*
Turnover01					
<999k	6	0		36	3
1m-4.9m	49	10		48	17
5m-9.9m	19	10		5	6
10m+	26	80		11	73
Total	100	100		100	100
Avg Turnover (m)	-	*£13.6*			*£5.7*
N Firms	-	*404*			*75*

It can be seen from Table 3 that exporters are generally more productive than their non-exporting counterparts and also undertake more R&D, traits that may be expected amongst firms exposed to a wider competitive marketplace. Just under one quarter of exporters are externally owned (i.e. ownership lies outside the UK) compared to one tenth of non-exporters, and, on average, export around two-fifths of their turnover.

Exporters are concentrated largely within four sectors, namely Food, Drink and Tobacco; Textiles, Clothing and Leather; Metals and Other Metallic Mineral Products, and Rubber and Plastics, which combined represent around 60% of all exporters in the sample. Non-exporters are more heavily skewed with two-fifths alone

in the Food, Drink and Tobacco sector, although there are also significant concentrations in the Textiles, and Metals sectors.

Table 3: Characteristics of Exporting and Non-Exporting Firms 1998 & 2001

	Exporters			Non-Exporters	
	1998	2001		1998	2001
Mean Plant Size (employment)	123	122		96	75
Mean Turnover (£m)	11.9	13.6		4.8	5.7
Mean Labour Costs (£m)	2.1	2.4		1.1	1.1
Mean Productivity (£000's)	85	97		82	77
Mean Export Intensity (%)	41	44		-	-
Externally-Owned (% plants)	22	22		9	9
R&D undertaken (% plants)	27	26		5	7
	% Plants	% Plants		% Plants	% Plants
Food, Drink &Tobacco	19	19		40	39
Textiles, Clothing & Leather	11	11		12	11
Wood & Wood Products	5	6		1	1
Paper & Printing	9	9		9	9
Chemicals & Man-Made Fibres	4	4		3	3
Rubber & Plastics	11	11		3	3
Metals, Fabrication and Other Mineral	18	18		12	11
Other Machinery and Equipment	7	7		5	7
Electrical and Optical Equipment	7	6		5	4
Transport Equipment	4	5		3	3
Other Manufacturing	5	5		7	8
Other Non-Manufacturing	0	0		0	3
No. of obs	*404*	*404*		*75*	*75*

Table 4 further elaborates on the sectoral composition of the sample and, as is obvious, there is quite a variation between the sectors in terms of size and export intensity. The average size of exporters ranges from an employment of 50 in the Wood and Wood Products sector to almost 300 in the more labour intensive sector of Electrical and Optical Equipment. For non-exporters, and excluding the Textiles sector, the range is narrower, from an average of 19 in Chemicals to 86 in Paper and Printing.

As observed in Table 3 exporters are on average larger than non-exporters and this is true in every case except Textiles, Clothing and Leather[6], where non-exporters are around four times larger than their exporting counterparts. The primary market for many of the large Textiles firms located in Northern Ireland is Great Britain and, as this is part of the UK, it is not regarded, in this analysis, as an export destination, thus explaining the atypical employment pattern for firms in this sector.

The average export intensity (exports as a share of total sales) also varies markedly between the sectors. The majority export less than half their total sales, although this ranges from around 20% up to 43%. Just three sectors exceed the 50% mark, namely Chemicals and Man-Made Fibres, Electrical and Optical Equipment, and Transport Equipment, with the former two making around two thirds of all sales overseas.

Table 4: Exporting and Non-Exporting Firms by Sector 1998

Sector	No. obs	% Share Exporters	Mean Size Exporters	Mean Size Non-exporters	Mean Export Intensity (%)
Food, Drink &Tobacco	105	71	159	46	18
Textiles, Clothing & Leather	55	84	121	494	42
Wood & Wood Products	21	95	50	73	21
Paper & Printing	44	84	89	86	28
Chemicals & Man-Made Fibres	16	88	172	19	67
Rubber & Plastics	46	96	83	44	40
Metals, Fabrication and Other Mineral	80	89	68	25	21
Other Machinery and Equipment	33	88	106	30	43
Electrical and Optical Equipment	33	88	290	21	67
Transport Equipment	19	89	250	32	59
Other Manufacturing	27	81	61	21	28
Total	**479**	**84**	**123**	**96**	**41**

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[6] The average size of non-exporters in the Wood and Wood Products sector also exceeds that of exporters however this is most likely due to the small sample size.

Table 5 displays the growth in turnover and employment over the four year period. For both groups of firms employment fell between 1998-2001, which is consistent with a general decline in manufacturing in Northern Ireland over the period; however the decline was steeper for non-exporters at 8% per year compared to just 0.4% for exporters. Turnover rose for both groups over the period at approximately 5-6% per annum resulting in year on year productivity increases.

Table 5: Growth Rates for Exporting and Non-Exporting Firms 1998-2001

	Turnover (m)[1]		Employment	
	Exporters	**Non-exporters**	**Exporters**	**Non-exporters**
1998	£4,737.2	£360.4	49,771	7,229
1999	£5,135.9	£368.1	51,532	6,279
2000	£5,638.3	£420.6	50,528	6,233
2001	£5,537.9	£426.5	49,217	5,630
Annual Average Growth Rate	*5.3*	*5.8*	*-0.4*	*-8.0*

[1] In 2000 prices

Figures 3 and 4 display the distribution of export intensity values for the sample, and the skewness of the sample in terms of the share of exports for each year respectively. The boxplots in Fig. 3 indicate that although the spread of values is quite wide i.e. ranging form zero exports to a few outliers who export 100% of sales, the majority actually export less than 40% of their sales, with the median value located at approximately 15%. The distribution widens slightly between 1998 and 2001, but the median remains less than one fifth. There is some variation amongst the manufacturing subsectors, with for example, Electrical and Optical Equipment and the Chemicals sector having a much larger interquartile range and a median of 30-40%, and, at the other end, the Food sector with a median of 5% and the majority of firms exporting less than one fifth. However, the distribution of the export intensity values

corresponds with other similar studies in which it is noted that exporting firms tend to only export a small fraction of their output (Bernard et al., 2003).

Fig. 3: Boxplots of All Sectors 1998-2001

Boxplots of All Sectors 1998-2001
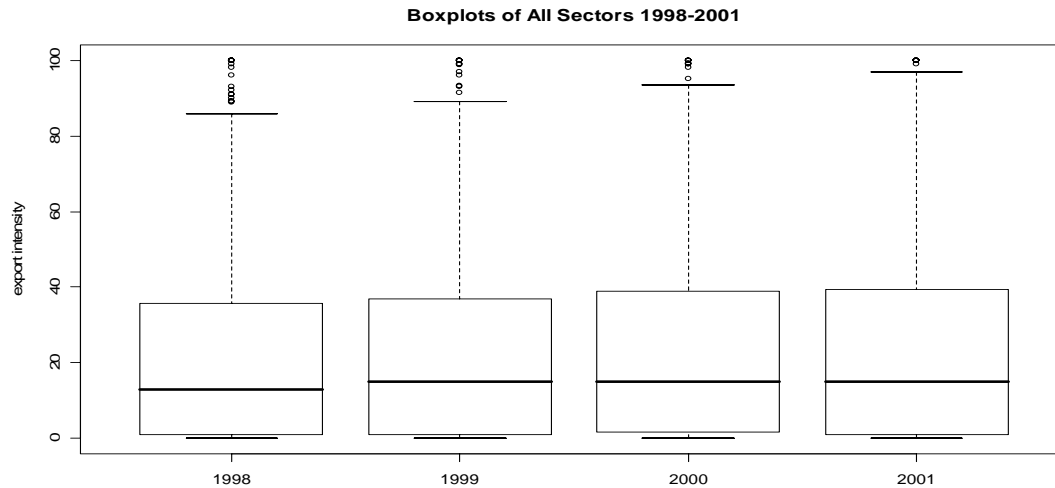
The share of the total value of exports amongst firms is displayed in Fig. 4 and as is immediately apparent a very small proportion of firms in the sample account for the majority of export sales, in fact just 10% of firms account for around four fifths of total exports. Although the skewness of the sample may appear a little extreme – 10% is just 40 firms – it is worth noting that Northern Ireland's top ten exporters account for around half of total exports.

Fig.4 Lorenz Curve for the Share of Exports by Firms 1998-2001

Lorenz Curve, Northern Ireland Exports 1998-2001, %share vs % of firms

5.1.3   The Explanatory Variables

The set of explanatory variables used for both stages of the modelling procedure include firm-level characteristics and sectoral dummies (Table 6). Ideally, a more complete dataset including characteristics of the owner-manager would have been preferred however such information was not available.   The selection of the firm characteristics as explanatory variables was based on a priori reasoning that certain firm attributes influence export performance, as discussed above in the literature (Bernard and Jensen, 2001a, 2001b; Bernard and Wagner, 1998; Lautanen, 2000; Roper and Love, 2001).

Given the widespread evidence for larger and more productive firms to be exporters, both are included as key firms in the analysis. Firm size is measured by employment size and is expected to be positively related to the likelihood of a firm being an

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exporter in that larger firms have greater resources and hence, greater capability to expand into foreign markets.

The productivity variable is defined as sales per employee and again is expected to be positive in both the export participation model and that for export intensity. More efficient firms are deemed the most likely to become exporters and are also more likely to compete effectively in a wider marketplace.

Labour costs are measured per employee and are included to act as a proxy for the quality of the workforce, in the way that the wage level is used as a proxy in the literature (Bleaney and Wakelin, 1999; Bernard and Jensen, 2001). The notion is that the higher the wage/labour costs the more sophisticated the product and therefore the more likely the firm is to be an exporter. The labour costs variable is also expected to be positively related to export intensity in that firms with a more sophisticated product are likely to sell across a wider marketplace.

The R&D variable is measured as the log of R&D expenditure per R&D employee for firms that reported R&D sales or employees in 1999 and/or 2001. The expected sign on the coefficient is positive in that firms who have a high R&D spend per R&D employee are obviously actively involved in the creation of more innovative products and/or processes and may be doing so in order to expand into new export markets. The continuing development of products may also influence the share of sales that are exported, thus a positive sign is also expected in relation to export intensity.

Firms' purchases are also included within both models, measured as purchases as a proportion of total sales. The expected sign on the variable could be either positive or negative, a higher share of purchases in total sales may suggest the lower the margins and thus the greater need to sell to as wide a market as possible, and hence be positively related to exporting. Alternatively, a lower share of purchases in total sales may reflect greater value added by the firm and hence a more sophisticated product being offered; therefore the variable would be inversely related to exporting.

Ownership is incorporated within the model, defined as a dummy, taking the value one if the firm's ownership lies outside the UK and zero otherwise. Ownership is likely to be positively related to whether a firm is an exporter or not, particularly in Northern Ireland, where there has historically been a strong tradition of inward investment. Such firms are typically part of a network, with headquarters located overseas, therefore we would also expect this variable to be positively related to the share of sales exported.

Sectoral dummies are included which distinguish eleven major groups of manufacturing activity. It is likely that the ability to export and the share exported will differ across sectors due to the nature of the product on offer, therefore we would anticipate a positive sign on the sectors which have a limited home market, such a heavy manufacturing, transport equipment etc. compared to the base case of other manufacturing.

Table 6: Variable Names and Description

Variable Type	Variable Name	Description
Dependent		
	Export (dummy)	1=firm is an exporter 0=firm is not an exporter
	Export Intensity	Export sales as a proportion of total sales
Firm Characteristics		
	Labiemp	Log of Employment
	Lprod	Log of productivity (turnover per employee)
	Purchprop	Purchases as a proportion of turnover
	Llabcstee	Log of labour costs per employee
	LRDee	Log of R&D spend per R&D employee
	External (dummy)	1=Firm ownership outside UK 0=Firm ownership within UK
Sector		
	Food (dummy)	1=firm in Food, Drink & Tobacco sector (SIC 15-16) 0=firm not in sector
	Text (dummy)	1=firm in Textiles, Clothing &Leather sector (SIC 17-19) 0=firm not in sector
	Wood (dummy)	1=Firm in Wood & Wood Products sector (SIC 20) 0=firm not in sector
	Paper (dummy)	1=firm in Paper & Printing sector (SIC 21-22) 0=firm not in sector
	Chem (dummy)	1=firm in Chemicals & Man-made Fibres sector (SIC 24) 0=firm not in sector
	Rubber (dummy)	1=firm in Rubber & Plastics sector (SIC 25) 0=firm not in sector
	Metal (dummy)	1=firm in Metal & Metallic Mineral sectors (SIC 26-28) 0=firm not in sector
	Machine (dummy)	1=firm in Machinery & Other Equipment sector (SIC 29) 0=firm not in sector
	Elec (dummy)	1=firm in Electrical & Optical Equipment sector (SIC 30-33) 0=firm not in sector
	Trans (dummy)	1=firm in Transport Equipment sector (SIC 30-33) 0=firm not in sector
	Manoth (dummy)	1=Firm in Other Manufacturing sectors (SIC 23, 36) 0= firm not in sector

5.2   *Republic of Ireland Data*

The data is sourced from a survey that is undertaken each year for Forfas's Annual

Business Report. In 2001 the sample for which data is available covers about 60% of

the firms, two thirds of output (sales) and 75% of employment in the manufacturing

industries in the Republic of Ireland. It also has good coverage of a number of internationally traded service sectors; these constitute only a minority of all services and they are not representative of services as a whole. The dataset contains information on output, material and labour costs, employees, research and development (R&D), and exports at the firm level from 2000 to 2004.

All firms in agriculture/fishing/mining and all plants in the construction sector are excluded from the analysis, as the survey is not representative of those sectors. All monetary variables in the manufacturing sectors are deflated using the annual average of the industrial price index by NACE category from the Central Statistics Office (CSO). The monetary values in the software development sector are deflated using the gross domestic physical capital formation for software from the National Accounts, also published by the CSO. Finally, monetary values for firms in the 'other computer related' and 'all other services' sectors are deflated using the gross value added of other services (including rent) at constant factor cost also published by the CSO in the National Accounts. The base year is 2000 in all cases. Outliers are defined as those observations that record inputs - that is the sum of total material cost, total services cost and other expenses - larger than two times sales. Outliers are further defined as observations that are in the top and the bottom percentile of the share of payroll in sales.

The regression analysis uses two different datasets: in one case all available data are pooled; in the other case only those plants that are observed over the entire sample period are used in order to control for idiosyncratic firm components. Summary statistics for the two samples, which are further divided into exporters and non-

exporters and the manufacturing and services sectors are presented in Table 8. The manufacturing sectors include firms with NACE codes 15-36, roughly at the 2-digit level. In the case of the services sectors, 'software development' contains firms with NACE code 72, where those with code 722 are categorised separately as 'other computer related', and all other services contain firms with NACE codes 37, 39, 40, 41, 47, 50-52, 55, 60-67, 70-75, 80, 85, 90-93. Variable definitions can be found in Table 7.

As can be seen in Table 8, in the pooled dataset there are close to 11,000 observations from 3,058 firms over the period 2000-2004. The average size firm has 101.5 employees, where exporters are larger and non-exporters less than half as big. Firms in the services sectors are also slightly smaller, with about 86 employees on average. The comparison for the other variables goes in very similar directions; noteworthy is perhaps that on average sales of non-exporters are just at about 15% of the average of all firms. They have virtually the same degree of foreign ownership as the manufacturing firms and a similar share of them has employees in R&D.

Comparing the manufacturing and services sectors in terms of their export characteristics, in both sectors just over 80% percent of the firms are exporters. In the services sectors firms export on average a slightly higher share of their sales than in manufacturing. In the balanced panel those characteristics that are said to be favourable to firm survival are enhanced[7] i.e. size, productivity, research and development, foreign ownership and exports. The relationship between the different

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[7] This said, one has to bear in mind that for the firms in this sample we do not know whether they went out of business or were not sampled when information is missing for a year.

groups (exporters/non-exporters, manufacturing/services) is very similar to those in the full sample.

Table 7: Variable Definitions

Variable	Description
Dex	Export dummy = 1 if firm is an exporter, = 0 otherwise
exprop	Export propensity = Value of total exports / Sales
l	log of employment
l2	log of employment squared
lp	log labour productivity = log (sales / employee)
purchprop	Purchasing Propensity = (total material cost + total services cost + other expenses) / sales
labcostee	labour cost per employee
RD	R&D dummy = 1 if firm has employees in R&D, = 0 otherwise
for	Dummy for foreign ownership = 1 if firm is foreign-owned, = 0 otherwise

Table 8: Summary Statistics

	All firms		Exporters		Non-Exporters		Manufacturing		Services	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Full Sample										
Observations	10,806		8,856		1,950		8,034		2,772	
Firms	3,058		2,564		758		2,196		862	
Employees	101.55	252.99	114.38	275.17	43.25	81.66	107.03	268.13	85.66	202.02
Sales*	36,251.61	275,433.36	43,005.12	303,745.24	5,580.26	15,928.18	38,065.40	286,340.30	30,994.75	241,021.11
labcostee*	32.38	23.15	33.23	24.00	28.50	18.32	30.15	22.38	38.83	24.14
purchprop	0.65	0.28	0.66	0.28	0.62	0.28	0.69	0.24	0.54	0.35
Log labour productivity (lp)	4.72	0.88	4.78	0.89	4.43	0.77	4.79	0.81	4.51	1.05
RD	0.47	0.50	0.52	0.50	0.27	0.44	0.48	0.50	0.46	0.50
For	0.28	0.45	0.33	0.47	0.07	0.26	0.27	0.45	0.30	0.46
Dex	0.82	0.38	-	-	-	-	0.82	0.39	0.82	0.38
exprop	0.46	0.41	0.56	0.38	-	-	0.43	0.40	0.53	0.42
Balanced Panel										
Observations	5,693		4,934		759		4,524		1,169	
Firms	1,157		1,052		220		916		241	
Employees	122.03	306.09	134.11	325.36	43.45	86.60	125.32	320.91	109.28	239.93
Sales*	46,821.01	310,815.47	53,195.34	333,378.04	5,383.67	12,631.09	45,304.38	295,295.22	52,690.30	364,792.43
labcostee*	32.07	24.02	32.59	24.90	28.68	16.85	30.50	24.69	38.15	20.09
purchprop	0.64	0.26	0.65	0.26	0.60	0.24	0.68	0.23	0.51	0.30
Log labour productivity (lp)	4.77	0.84	4.81	0.84	4.48	0.77	4.83	0.78	4.53	1.01
RD	0.53	0.50	0.57	0.50	0.29	0.46	0.55	0.50	0.47	0.50
For	0.30	0.46	0.34	0.47	0.09	0.29	0.30	0.46	0.33	0.47
Dex	0.87	0.34	-	-	-	-	0.86	0.35	0.89	0.31
exprop	0.50	0.40	0.58	0.38	-	-	0.48	0.40	0.59	0.40

* In 1,000€ (constant 2001 values).

6. Results

6.1 Northern Ireland Results

6.1.1 Export Participation Models

The first stage in the analysis is to estimate the determinants of being an exporter, using Logit estimation. The first model is run on a cross-section of those plants that are in operation in 2001, and then on the panel dataset; the variables incorporated within these preliminary models include firm-level characteristics and the sectoral variables. The results from the cross-section analysis are presented in Table 9, which includes the logit coefficients alongside the odds ratios. The odds ratio is calculated as the exponential of the logit coefficient; an odds ratio above 1.0 means that the odds of getting "1" on the dependent variable (i.e. being an exporter) increase with an increase in the continuous independent variable, conversely an odds ratio of less than 1.0 means that the odds of being an exporter decrease with an increase in the independent variable. Where the independent variable is also dichotomous (e.g. externally owned) an odds ratio above 1.0 means that the odds of being an exporter are greater for the given category (e.g. being externally owned) than for the base case (e.g. not being externally owned).

The results in Table 9 indicate that both plant-level and sectoral variables have a significant impact on the likelihood of a firm being an exporter. Amongst the plant level characteristics the strongest effect is found for the purchases variable; this is significant at the 1% level, and with an odds ratio greater than one, implies that the

higher the purchases as a share of sales the more likely the firm is to be an exporter. This finding may be explained by the fact that firms, whose intermediary purchases account for a high share of sales, have a relatively low profit margin and therefore must sell to as wide a marketplace as possible to remain profitable. Alternatively the finding may be an indication that firms with a high share of purchases are branch plants and therefore more likely to export to other firms within the branch structure or back to headquarters.

The firm size variable is also highly significant, and with an odds ratio of 1.641, indicates that each additional employee increases the odds of the firm exporting by 64%, controlling for other variables in the model, or in other words the larger the firm the more likely it is to be an exporter. This result is consistent with the literature and is to be expected, as larger firms have greater resources to expand into foreign markets and to overcome the sunk costs associated with exporting, they also can engage in economies of scale in the production process and may be better able to absorb the risks associated with venturing into new markets. The R&D variable, which measures R&D expenditure per R&D employee, is significant at the 5% level and indicates that the higher the R&D spend per R&D employee the more likely the firm is to be an exporter. Although this variable is not typically used in the literature, it is consistent with those studies in which an R&D dummy is included and found to have a strong positive effect (Bernard and Jensen, 2001a, 2001b; Bernard and Wagner, 1998; Delgado, 2002) indicating that firms undertaking R&D are producing more sophisticated products and are able to compete in a wider marketplace on a product-quality basis. The labour cost variable also confirms this; it is highly significant in the model and positive, indicating that the higher the labour costs the

more likely the firm is to be an exporter. Again this intuitively suggests that such firms have more highly qualified staff and are manufacturing a more sophisticated product which there are selling in a wider marketplace.

The sectoral variables that prove significant in this model are that for the Food, Drink and Tobacco sector and Electrical & Optical Equipment. The former has an odds ratio less than one (0.497) indicating that the likelihood of being an exporter is reduced by half for firms located in this sector, compared to those engaged in other manufacturing (the base case). This finding may suggest that the production of food and drink in Northern Ireland is geared largely towards the home and UK markets, and, in fact, this is backed up by results from the MSES which states that in 2001/02 external sales (sales outside Northern Ireland) as a proportion of total sales for firms in the Food, Drink and Tobacco sector was 64%, whilst export sales as a proportion of total sales was just 20%, indicating a reliance on the GB market. Conversely, the odds ratio on the Electrical and Optical Equipment variable of 3.930 suggests that firms undertaking the manufacturing of Electrical Equipment are more likely to be exporters, than those engaged in other manufacturing, by a factor of 4. This is most likely due to the fact that such companies are producing high specification products which have a worldwide demand and/or a limited UK market, and again is reinforced by the findings from the MSES (DETI, 2003).

Table 9: Logit Model for Export Participation 2001

	Coefficient	Odds Ratio
Constant	-4.178 (0.916)***	-
Food	-0.700 (0.434)*	0.497 (0.215)*
Text	0.359 (0.498)	1.431 (0.713)
Wood	0.577 (0.625)	1.780 (1.112)
Paper	0.293 (0.495)	1.340 (0.664)
Chem	0.282 (0.767)	1.326 (1.017)
Rubber	0.582 (0.592)	1.790 (1.061)
Metal	0.173 (0.446)	1.189 (0.530)
Machine	0.583 (0.586)	1.791 (1.050)
Elec	1.369 (0.612)**	3.930 (2.407)**
Trans	0.470 (0.640)	1.600 (1.025)
Labiemp01	0.495 (0.129)***	1.641 (0.212)***
Lprod01	0.155 (0.202)	1.168 (0.236)
Purchprop01	2.771 (0.569)***	15..968 (9.092)***
Llabcstee01	0.487 (0.299)*	1.627 (0.487)*
LRDee	0.392 (0.156)**	1.480 (0.231)**
External	-0.066 (0.353)	0.936 (0.331)
No. Obs	727	
Pseudo R^2	0.185	
Chi^2	131.4***	
LogL	-289.056	

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

The same Logit methodology is applied to the panel dataset, in order to obtain more efficient estimates for the export participation model. Table 10 presents the results of the cross-sectional time-series Logit, estimated with random effects. The resulting model is broadly similar to that estimated on the cross-section; with a small number of additional significant variables. The productivity variable comes through as highly significant, whereas previously this had no effect, and suggests that the odds of being an exporter increase with an increase in the firm's productivity. The finding that the most productive firms are more likely to be exporters, is consistent with the literature (Bernard and Wagner, 1998; Bernard and Jensen, 1999, 2001; Bleaney and Wakelin, 1999, Roper and Love, 2001) suggesting that more efficient firms self-select into export markets as they are best able to compete in a wider-marketplace.

An additional significant variable is that for firms operating in the Rubber and Plastics sector, and with an odds ratio of 8.390 suggests that firms in this sector are more likely to export compared to those in the other manufacturing sector, by a factor of 8; conversely the variable for the Electrical and Optical Equipment sector is no longer significant in this model. The remaining significant variables are those which were found to be significant in the cross-section analysis, namely firm size, purchases, labour costs, R&D and that representing the Food sector, all with the same signs as before.

Overall the results suggest that firms in Northern Ireland are more likely to be exporters if they are larger, more productive and actively engage in R&D, factors which are commonly found in similar analyses across countries. In addition, with respect to Northern Ireland firms, a high share of purchases in total sales and higher labour costs per employee also significantly contributes to the likelihood of being an exporter. In terms of sectors, those in the Electrical and Optical, and Rubber and Plastics sectors are more likely to be exporters whilst those in the Food, Drink and Tobacco sector are less likely.

Although the results from the cross-section and panel models are broadly similar, the differences found can be attributed to the fact that the panel model allows for firm heterogeneity and also reflects changes in the firms over time. In the panel model estimated for export participation 69% of the total variance is explained by the difference between firms (the panel variance component), suggesting that the time element is also relatively important in the model.

Table 10: Cross-Sectional Time-Series Logit Model for Export Participation

	Coefficient	Odds Ratio
Constant	-8.540 (1.368)***	-
Food	-2.389 (0.724)***	0.092***
Text	-0.197 (0.797)	0.821
Wood	0.572 (0.931)	1.772
Paper	-0.263 (0.811)	0.769
Chem	-1.184 (1.099)	0.306
Rubber	2.127 (1.028)**	8.390**
Metal	0.153 (0.735)	1.165
Machine	0.170 (0.914)	1.185
Elec	0.492 (0.968)	1.636
Trans	-1.351 (0.991)	0.259
Labiemp	1.518 (0.195)***	4.563***
Lprod	0.808 (0.242)***	2.243***
Purchprop	2.070 (0.506)***	7.925***
Llabcstee	0.474 (0.289)*	1.606*
LRDee	0.468 (0.184)**	1.597**
External	-0.453 (0.523)	0.636
Sigma_u	2.677 (0.131)	
Rho	0.685 (0.021)	
No. Obs	1916	
No. Groups	479	
Wald Chi^2	136.42***	
LogL	-499.502	

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

6.1.1.1 Results by Size

It has been suggested that there are different factors at play which influence the export participation decision between large and small firms (Reid, 1981; Lautenan, 2000). In order to determine whether firm size has any effect on the individual explanatory variables for our sample of firms, size interaction terms are generated for the sectoral and firm-level characteristics (large firms defined as those with employment of fifty or more).

Table 11 presents the results of the Logit model for the cross-section with the interaction terms included. The results initially indicate that for all firms being in the Electrical and Optical Equipment sector, having higher employment, having higher purchases as a proportion of sales and higher labour costs all positively impact on the likelihood of being an exporter. However the interaction terms further indicate that for large firms, only size and undertaking R&D are significantly different from zero. Thus large firms undertaking R&D are more likely to be exporters than large firms that do not. Additionally large firms are more likely than small firms to be exporters but amongst large firms themselves, it is the smaller large firms that are more likely to export (this may be due to the number of large textiles firms that are non-exporters).

These effects only provide an indication of the effects for large firms thus in order to determine whether the effects are significantly different between large and small firms the equation is differentiated with respect to each variable, and the overall effect obtained by summing the coefficient on the individual level effect with the relevant interaction term[8]. Table 12 presents the total firm level and sectoral effects for the export participation model.

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[8] Generally the overall effect is obtained by $\beta_1 + (\beta_2 * \chi_2)$ where β_1 is the coefficient on the level term, β_2 is the coefficient on the interaction term and χ_2 is the value of the interaction variable. However as χ_2 is a dummy variable this effect drops out.

Table 11: Logit for Export Participation: Size Interaction

	Coefficient	Odds Ratio
Constant	-4.908 (1.308)***	-
Food	-0.429 (0.509)	0.651
Text	0.835 (0.604)	2.305
Wood	0.709 (0.719)	2.032
Paper	0.285 (0.559)	1.330
Chem	0.462 (0.815)	1.587
Rubber	0.275 (0.700)	1.317
Metal	0.086 (0.505)	1.090
Machine	1.087 (0.681)	2.965
Elec	1.650 (0.697)**	5.207**
Trans	0.981 (0.783)	2.667
Labiemp01	0.522 (0.242)**	1.685**
Lprod	0.168 (0.251)	1.183
Purchprop	2.941 (0.692)***	18.935***
Llabcstee	0.598 (0.343)*	1.818*
LRDee	0.187 (0.191)	1.206
External	-0.135 (0.515)	0.874
Size Interaction Variables		
Food*Large	-1.241 (1.223)	0.289
Text*Large	-1.712 (1.316)	0.181
Wood*Large	-0.962 (1.645)	0.382
Paper*Large	0.383 (1.585)	1.467
Rubber*Large	0.430 (1.621)	1.537
Metal*Large	0.461 (1.376)	1.586
Machine*Large	-2.255 (1.536)	0.105
Elec*Large	-1.299 (1.655)	0.273
Trans*Large	-2.136 (1.550)	0.118
Labiemp01*Large	-0.724 (0.399)*	0.485*
Lprod*Large	0.111 (0.475)	1.117
Purchprop*Large	-1.055 (1.259)	0.348
Llabcstee*Large	-0.607 (0.786)	0.545
LRDee*Large	0.647 (0.377)*	1.910*
External*Large	0.578 (0.771)	1.782
Large	6.044 (2.457)**	-
No. Obs	717	
Pseudo R^2	0.215	
Chi^2	151.79***	
LogL	-276.708	

Notes: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level; standard errors in brackets; too few observations to estimate a coefficient for Chem*Large

Table 12 indicates that of the total firm level and sectoral effects just two are significantly different between large and small firms, that for R&D expenditure per R&D employee and purchases as a proportion of sales. The coefficients are both

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positive (although the latter is only weakly significant) suggesting that their effects on the probability of exporting are stronger in large firms.

Table 12: Total Sectoral and Firm-level Effects

	Coefficient	Odds Ratio
Food	-1.670 (1.113)	0.188
Text	-0.877 (1.169)	0.416
Wood	-0.253 (1.480)	0.776
Paper	0.668 (1.483)	1.950
Rubber	0.705 (1.462)	2.024
Metal	0.547 (1.280)	1.728
Machine	-1.168 (1.377)	0.311
Elec	0.351 (1.501)	1.420
Trans	-1.155 (1.338)	0.315
Labiemp01	-0.202 (0.317)	0.817
Lprod01	0.278 (0.403)	1.320
Purchprop01	1.886 (1.052)*	6.593
Llabcstee01	-0.010 (0.707)	0.990
LRDee	0.833 (0.325)**	2.300
External	0.443 (0.574)	1.557
Large	1.136 (2.080)	3.114

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

The most interesting implication here is, though, for a variable – employment - where the main effect and the interaction term are both significant but the sum of them is not. From the top half of Table 11 we see that the main effect of employment has a coefficient of 0.52, significant and with a positive sign; from the lower part of the table we see that the interaction effect has a coefficient of 0.72, significant and with a negative sign. So the effect of employment on the chance of being an exporter is generally positive but significantly smaller for large firms. Indeed, from Table 12 – we then see that the coefficient on employment for large firms *is not significantly different from zero*. In other words: for small firms (i.e. less than 50 employees) more employees means more likely to be an exporter; whilst, for large firms (i.e. 50 or more

employees) the chance of being an exporter is independent of the number of employees.

6.1.2   Export Intensity Models

The determinants of export intensity are modelled for the cross section, using fractional Logit, and for the panel, using Tobit estimation. The results are presented in Tables 13 and 14. The results from the Logit are quite similar to those found for the likelihood of being exporter. In this model the strongest effects are found on the productivity, purchases, R&D, ownership variables and previous exporter variables. The ownership variable is highly significant in the export intensity model, although had no effect on the export participation model, with the results suggesting that externally-owned firms export a higher share of output than those under local ownership. This finding is consistent with the literature (Roper and Love, 2001) and is to be expected as externally-owned firms in Northern Ireland are likely to be selling goods either to other plants within their branch structure, or back to headquarters, alternatively they may have been established as production posts to serve EU markets. The remaining significant variables include the sectoral variables of Food, Paper and Electrical Equipment, the former of which are negative. Interestingly, once the dummy for previous export experience is included within the model the size effect drops out, suggesting that size is perhaps a necessary condition for commencing exporting, and thereafter it has no effect. Overall the results suggest that those factors that influence the likelihood of a firm being an exporter are similar to those that determine the extent of firms' export intensity. They suggest that firms with

preferable characteristics are more likely to be competitive and hence export a greater share of output.

Table 13: Fractional Logit Model for Export Intensity 2001

	Coefficient	Odds Ratio
Constant	-4.751 (0.685)***	-
Food	-0.666 (0.284)**	0.514**
Text	-0.058 (0.293)	0.944
Wood	-0.200 (0.296)	0.819
Paper	-0.583 (0.279)**	0.558
Chem	0.275 (0.341)	1.317
Rubber	-0.210 (0.282)	0.811
Metal	-0.363 (0.268)	0.696
Machine	0.090 (0.289)	1.094
Elec	0.458 (0.297)*	1.581*
Trans	-0.242 (0.342)	0.785
Labiemp01	0.040 (0.057)	1.041
Lprod01	0.320 (0.095)***	1.377***
Purchprop01	0.365 (0.089)***	1.441***
Llabcstee01	-0.228 (0.195)	0.796
LRDee	0.147 (0.040)***	1.158***
External	0.738 (0.138)***	2.092***
Exporter00	2.724 (0.313)***	15.241***
No. Obs	727	
Deviance	1621.432	
Pearson	214.703	
Log Pseudolikelihood	-275.723	

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

The Tobit model, using the panel dataset, is not only a more efficient model but is also a better predictor of the determinants of export intensity. Several of the sectoral dummies are significant in this model, as well as the characteristic variables. The productivity variable is highly significant in that the more productive the firm the larger the share of exports as a proportion of sales. Similarly, the higher the purchases the larger the export sales, which as before, could be related to either profitability or the nature of firms i.e. branch plants. The ownership variable is also highly significant

suggesting that whilst external ownership does not impact on the likelihood of being an exporter it does influence the extent of export sales. Surprisingly the R&D variable has no impact in this model, nor is there is an effect on labour costs, although the sign is negative. A possible explanation is that once firms in Northern Ireland have begun the exporting process they compete in export markets on a cost-basis rather than product quality, thus the R&D and labour quality effects are necessary to begin exporting, but similar to size, lose their effect once exporting has developed.

Four of the sectoral variables come through as significant in the export intensity model, with just one, that for the Food, Drink and Tobacco sector having a negative sign, suggesting, as before, that this sector is more reliant on the local and GB markets.   Strong positive effects come through for the Electrical and Optical Equipment sector, Rubber and Plastics, and Machinery sectors. The finding that these sectors positively influence the share of sales exported is not surprising, given the type of products manufactured and the limited domestic markets for such goods.

As before, with the export participation models, the panel model is more efficient, allowing for differences both between firms and over time. Within the export intensity model 91% of the total variance is contributed by the cross-sectional element, i.e. the difference between firms, suggesting that the time component is relatively unimportant in this case. This contrasts somewhat with the previous model for export participation, in which just 69% of the variation was explained by the difference between firms, thus firm heterogeneity is more of a factor in explaining export intensity than it is for export participation.

Table 14: Cross-Sectional Time-Series Tobit Model for Export Intensity

	Coefficient
Constant	-0.372 (0.089)***
Food	-0.143 (0.035)***
Text	0.032 (0.045)
Wood	0.041 (0.033)
Paper	-0.033 (0.040)
Chem	0.071 (0.049)
Rubber	0.086 (0.039)**
Metal	-0.028 (0.030)
Machine	0.089 (0.041)**
Elec	0.096 (0.047)**
Trans	0.048 (0.043)
Labiemp	0.026 (0.029)
Labiempsq	0.004 (0.003)
Lprod	0.083 (0.011)***
Purchprop	0.084 (0.019)***
Llabcstee	-0.016 (0.010)
LRDee	0.003 (0.002)
External	0.101 (0.032)***
Sigma_u	0.266 (0.009)***
Sigma_e	0.084 (0.002)***
Rho	0.911 (0.006)
No. Obs	1916
No. Groups	479
Wald Chi^2	318.36***
LogL	684.656

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

6.1.2.1 Results by Firm Size

As before, the effect of firm size is taken into account by generating size interaction terms to take account of the effect size has on the determinants of export intensity. Table 15 presents the result of the model, with size interaction terms included. Overall the results suggest that higher productivity, higher purchases as a proportion of sales, undertaking R&D and being foreign owned, as well as being in the Electrical sector all positively impact on the likelihood of being an exporter. However, the only

significant interaction terms are those on the sectoral dummies for Food, Textiles, Paper and Transport, which are all negative, indicating that amongst large firms in these sectors those with lower employment are more likely to export a greater share of output. As before, this only tells us the effects for larger firms thus in order to determine the difference between large and small firms in terms of the influences on export intensity the total sectoral and firm level effects are again estimated, created by differentiating the equation with respect to each variable.

Table 16 indicates that a number of variables have a significant impact on export intensity. On the sectoral side, the Textiles, Paper and Transport sector variables are all significant, each with a negative sign, suggesting that smaller firms in these sectors are more likely, than larger firms, to export a greater share of output. This is quite a positive finding, perhaps indicating that small firms in these sectors have a particular niche product that they are able to sell to a wider marketplace and suggesting that size is not necessarily a hindrance in terms of selling abroad. The significant firm level characteristic variables include size, productivity, R&D and ownership indicating a stronger effect on export intensity for larger firms compared to small. Overall however the impact on the dummy for large firms is negative and significant implying that there are significantly different effects between large and small firms in terms of export intensity, with small firms more likely to be export intensive. The fact that this variable is significant runs contrary to the finding for the export participation model; whilst its negative sign is also counterintuitive, however we must remember that the dependent variable is export intensity, thus whilst small firms may export a greater share of output, in value terms this does not mean that they export a greater amount.

Additionally, it could be that larger firms rely more on the Great Britain market, reducing their export share of total sales.

Table 15: Fractional Logit for Export Performance: Size Interaction

	Coefficient	Odds Ratio
Constant	-3.850 (0.861)***	-
Food	-0.323 (0.381)	0.724
Text	0.578 (0.394)	1.782
Wood	0.180 (0.440)	1.197
Paper	-0.044 (0.373)	0.957
Chem	0.208 (0.509)	1.231
Rubber	-0.011 (0.433)	0.989
Metal	-0.079 (0.356)	0.924
Machine	0.560 (0.380)	1.751
Elec	0.875 (0.407)**	2.399**
Trans	0.522 (0.491)	1.685
Labiemp01	0.202 (0.168)	1.224
Lprod01	0.411 (0.142)***	1.508***
Purchprop01	0.616 (0.240)*	1.852*
Llabcstee01	-0.218 (0.266)	0.804
LRDee01	0.266 (0.079)***	1.305***
External	0.816 (0.246)***	2.261***
Size Interaction Variables		
Food*Large	-1.051 (0.560)*	0.350*
Text*Large	-1.276 (0.583)**	0.279**
Wood*Large	-0.457 (0.608)	0.633
Paper*Large	-0.919 (0.554)*	0.399*
Chem*Large	-0.060 (0.694)	0.942
Rubber*Large	-0.307 (0.586)	0.736
Metal*Large	-0.448 (0.532)	0.639
Machine*Large	-0.754 (0.582)	0.470
Elec*Large	-0.865 (0.604)	0.421
Trans*Large	-1.335 (0.684)*	0.263*
Labiemp01*Large	-0.003 (0.194)	0.997
Lprod01*Large	-0.061 (0.206)	0.941
Purchprop*Large	-0.371 (0.527)	0.690
Llabcstee*Large	0.041 (0.389)	1.042
LRDee*Large	-0.128 (0.092)	0.880
External*Large	-0.252 (0.299)	0.777
Large	1.153 (1.257)	3.167
No. Obs	727	
Deviance	1714.189	
Pearson	244.940	
Log pseudolikelihood	-295.727	

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

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Table 16: Total Sectoral and Firm-level Effects

	Coefficient	Odds Ratio
Food	-1.375 (0.410)***	0.253***
Text	-0.698 (0.429)*	0.498*
Wood	-0.293 (0.414)	0.746
Paper	-0.964 (0.410)**	0.381**
Chem	0.149 (0.472)	1.161
Rubber	-0.318 (0.395)	0.728
Metal	-0.528 (0.395)	0.590
Machine	-0.194 (0.441)	0.824
Elec	0.010 (0.446)	1.010
Trans	-0.814 (0.476)*	0.443*
Labiemp01	0.199 (0.096)**	1.220**
Lprod01	0.350 (0.149)**	1.419**
Purchprop01	0.245 (0.469)	1.278
Llabcstee01	-0.177 (0.284)	0.838
LRDee	0.138 (0.048)***	1.148***
External	0.564 (0.169)***	1.758***
Large	-2.697 (0.915)***	0.067***

Note: *significant at 0.10 level, ** significant at 0.05 level, *** significant at 0.01 level
Standard errors given in brackets

6.2   Republic of Ireland Results

6.2.1   Export Participation Models

This section explores which characteristics are more prominent in exporting firms.
Two models are used for this analysis, first a logit model where the data are pooled
for the full sample, and second a cross-sectional time-series logit model where only
those firms that are observed over the whole sample period are used. As possible
determinants of exporting, the firm-level variables introduced in the data section are
included in the models. In addition, all estimations include year and where appropriate
industry dummies.

Table 17 gives the results of the pooled logit model for the full sample, for firms with less than 25 employees, for firms with 25 and more employees as well as for the manufacturing and services sectors separately. The coefficients together with their standard errors (adjusted for clustering at the firm level) as well as the odds ratios are reported. An odds ratio larger than 1 implies that the probability of being an exporter (Dex=1) increases with a continuous variable or, in the case of a dichotomous variable, is larger than in the base category. Most of the firm-level variables are significant. A larger size enhances the probability of being an exporter. Higher productivity measured as labour productivity makes firms more likely to be exporters irrespective of their size group. The share of purchases in turnover (purchprop) has a positive impact on a firm being an exporter, supporting the hypothesis that firms with a higher purchasing propensity earn lower margins and therefore have a greater need to sell to a larger market. Firms that are foreign owned as well as firms that have employees in research and development (R&D) are more likely to be exporters than firms with domestic owners and firms not engaged in R&D, respectively. There is no significant effect from labour costs per employee.

There are few differences between the two size groups when it comes to the firm-level variables, however the industries in which firms are (less) likely to be exporters do differ: In the full sample firms in the food, wood and basic fabricated metals sectors are less likely to be exporters compared to firms in other manufacturing (the base category), while firms in the textiles, chemicals, rubber & plastics, and transport equipment industries, manufacturers of medical, optical and precision instruments, software developers and firms in other computer related industries are more likely to be exporters than firms in the base category. For the firms with less than 25

employees being in the fabricated metals industry makes it less likely for a firm to be an exporter compared to other manufacturing. In turn, firms in the textiles and transport equipment industries, manufacturers of medical, optical and precision instruments, as well as software developers and firms in other computer related industries are more likely to be exporters. For the firms with 25 or more employees that are in the food, wood or fabricated metals industry and in other services the odds of being an exporter is smaller than one, only for firms in the textiles and medical, optical and precision instruments sectors the odds are significantly larger than one.

Looking at the manufacturing and services sectors separately, the results for the manufacturing sector very much resemble those of the full sample. Even firms in the same industries as mentioned above are more or less likely to be exporters, except being in the rubber & plastics industry does not have a significant impact in this sample. In the services industry only labour productivity, R&D and foreign ownership make it more likely for firms to be exporters and firms in software development and other computer related sectors are more likely to be exporters compared to firms in other services sectors.

Table 17: Pooled Logit Model for Export Participation

	full sample			< 25 empl			>= 25 empl			manufacturing			services		
	coeff		odds	Coeff		odds	coeff		odds	coeff		odds	coeff		odds
l	0.307	**	1.359	0.216	*	1.241	0.185	*	1.203	0.420	**	1.522	0.118		1.125
	0.048			*0.103*			*0.091*			*0.063*			*0.076*		
lp	0.400	**	1.491	0.358	**	1.431	0.376	**	1.456	0.364	**	1.439	0.336	**	1.399
	0.066			*0.089*			*0.101*			*0.089*			*0.100*		
purchprop	0.740	**	2.095	0.660	**	1.934	0.804	**	2.233	1.013	**	2.754	0.310		1.364
	0.156			*0.181*			*0.277*			*0.213*			*0.221*		
labcostee	-0.001		0.999	0.001		1.001	-0.003		0.997	-0.001		0.999	0.001		1.001
	0.001			*0.002*			*0.003*			*0.001*			*0.004*		
RDemp	1.114	**	3.047	0.902	**	2.464	1.310	**	3.706	1.169	**	3.219	0.800	**	2.225
	0.097			*0.122*			*0.154*			*0.116*			*0.183*		
for	1.413	**	4.109	1.390	**	4.013	1.542	**	4.674	1.549	**	4.707	1.252	**	3.499
	0.178			*0.297*			*0.222*			*0.237*			*0.284*		
cons	-2.604	**		-2.488	**		-1.633	**		-3.023	**		-1.371	*	
	0.399			*0.596*			*0.614*			*0.466*			*0.576*		
N	10806			4166			6640			8034			2772		
Plants	3058			1517			1913			2196			862		
Pseudo R2	0.17			0.12			0.18			0.21			0.09		
LogL	-4216.36			-2135.98			-2026.64			-3017.58			-1171.43		
Chi2	492.65			213.04			274.69			394.74			87.97		

**,*,(*) indicate significance at 1,5, and 10% respectively. Standard errors in italics.

Industry and Year dummies included in all regressions. Standard errors adjusted for clustering at the plant level.

In a second step use is made of the time dimension of the data and the logit model is applied to only those firms that are observed over the full sample period. Table 18 presents the results of this cross-sectional time-series model estimated with random effects. The results are remarkably similar. For firms with less than 25 employees some of the variables that had significant coefficients in Table 17 are significant at a lower level only or not significant at all in this case. In the services sectors now size, labour productivity, the share of purchases in sales and labour costs per employee are important, while R&D and foreign ownership do not matter anymore. In fact, a firm's propensity of being an exporter decreases with labour cost per employee. This might suggest that having high labour costs in the service sector is not necessarily a sign of a more sophisticated product, but rather of inefficiency. Apart from the wood industry, which does not get a significant coefficient in any of the models, firms in roughly the same industries as mentioned above are more or less likely to be exporters than in other manufacturing or in other service sectors, in the case of services.

Overall we find that the determinants for firms to be exporters in the Republic of Ireland are firm size, productivity, R&D, foreign ownership and the share of purchases in turnover. This is similar to previous evidence in the field. Productivity appears to be a crucial determinant in the services sectors for firms to be exporters.

Previous research suggests that entering the export market is associated with a high sunk cost. This implies that having taken the decision to become an exporter once, firms are likely to persist in exporting. To model the sunk cost a dummy for export status in the previous year is included. When re-estimating the models in Tables 18 and 19 with such an indicator included, the sunk cost hypothesis is confirmed in our

dataset. Moreover, in these models firm size loses its significance. This suggests that size may only matter at entry into the export market but not any more once the sunk cost has been incurred.

Table 18: Cross-Sectional Time-Series Logit Model for Export Participation

	full sample			< 25 empl			≥25 empl			manufacturing			services		
	coeff		odds	Coeff		odds	coeff		odds	coeff		odds	coeff		odds
l	0.808	**	2.244	0.209		1.232	0.692	**	1.997	1.000	**	2.719	0.368	(*)	1.445
	0.109			*0.306*			*0.181*			*0.151*			*0.205*		
lp	0.909	**	2.483	0.432	(*)	1.540	0.863	**	2.371	0.792	**	2.207	0.954	**	2.596
	0.137			*0.236*			*0.184*			*0.184*			*0.250*		
purchp~p	1.493	**	4.452	1.115	*	3.051	1.908	**	6.738	1.490	**	4.437	1.288	*	3.627
	0.355			*0.513*			*0.512*			*0.448*			*0.627*		
labcos~e	-0.003		0.997	0.000		1.000	-0.005		0.995	-0.001		0.999	-0.021	*	0.979
	0.003			*0.004*			*0.004*			*0.003*			*0.011*		
RDemp	1.038	**	2.824	0.437		1.548	1.554	**	4.729	1.180	**	3.255	0.285		1.330
	0.187			*0.286*			*0.253*			*0.219*			*0.412*		
for	1.568	**	4.796	1.998	**	7.371	1.550	**	4.713	1.938	**	6.946	0.920		2.508
	0.326			*0.588*			*0.395*			*0.490*			*0.586*		
cons	-5.468	**		-2.616	(*)		-4.439			-5.672	**		-3.039	(*)	
	0.889			*1.586*			*1.271*			*1.038*			*1.574*		
N	5693			1690			4003			4524			1169		
Plants	1157			448			892			916			241		
rho	0.67			0.68			0.65			0.68			0.66		
sigma_u	2.61			2.65			2.46			2.62			2.54		
LogL	-1117.13			-524.43			-612.35			-864.76			-241.9		
Chi2	293.79			116.26			156.25			218.84			40.97		
**,*,(*) indicate significance at 1,5, and 10% respectively. Standard errors in italics.															
Industry and Year dummies included in all regressions. Standard errors adjusted for clustering at the plant level.															

6.2.2   Export Intensity Models

In this section the determinants of export intensity are examined, that is the share of their output the firms in the sample export. First, a fractional logit model is fitted for the full sample and the results are presented in Table 19. Only for the sample of firms with 25 or more employees does firm size have a significant impact on the share of output that firms export. For these firms there is also some evidence of the inverted u-shape relationship between exporting propensity and firm size (Wagner 1991). Although the square term of size (l2) is not significant it has a negative sign, suggesting that larger firms export more of their output, but at a decreasing rate. Labour productivity and foreign ownership are the only variables that are significant for all of the samples. In particular, for a foreign-owned firm the odds of having a high export-propensity is 5-6 times larger than for a firm with a local owner. In manufacturing those firms with employees in R&D have a higher export propensity than firms without. The share of purchases in turnover is positively related to the export propensity for the manufacturing firms but not for the large firms.

In the full sample firms in the wood, printing and publishing, non-metallic minerals and basic/fabricated metal goods industries have a lower export propensity than firms in other manufacturing. It is higher for firms in the textiles, chemicals, rubber & plastic, electronics, medical, optical and precision instruments, transport equipment, software development and other computer related sectors. The printing and publishing and non-metallic minerals sectors do not come up significant for the firms with less than 25 employees. For manufacturing only, all of the aforementioned manufacturing industries come up significant and with the comparison going in the same direction. In

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the services sectors, firms in software development and firms in other computer related sectors have a higher export propensity than firms in other services.

In the second step an unconditional fixed effects model is applied to the sample of those firms that are observed in all years. The fixed effects take care of the unobserved heterogeneity in the sample, namely firm and industry characteristics that are time invariant. The results for this model are reported in Table 20. Note that foreign ownership drops out of this model as it is only recorded for the last year of the data set and, hence, does not vary over time. This model suggests that a large portion of the variance is due to within-panel variation (rho > .90), i.e. it is firm- and industry-level unobservable effects driving the earlier results. In the full panel, productivity and the share of purchases in sales continue to be significant determinants of export propensity with a positive effect. Also labour costs per employee have a slightly positive effect on the export propensity of firms. The reason that the R&D variable is not significant in this specification could well be that there is a similar entry cost into doing R&D as there is into exporting, and hence, there is very little variation over time in the R&D variable. In the manufacturing only sample, again purchasing propensity is confirmed as a determinant that enhances export propensity and in the services sample productivity retains its earlier significance and positive effect.

Overall the determinants of being an exporter and of the amount of turnover a firm exports are rather similar. In particular, higher productivity, a larger share of purchases in output, doing R&D and being foreign owned make it more likely that a) a firm enters the export market and b) that it exports a larger share of its output. To become an exporter firm size is another important determinant; however this applies

only as long as the sunk cost of entering the export market has not been incurred. When it comes to export intensity unobservable firm characteristics explain a large share of the variance in the model, this suggests that, for example, management characteristics or a product that is unique to a firm are other important factors in the decision to sell abroad. By and large, the results confirm the earlier evidence from the Republic of Ireland as well as other countries.

Table 19: Pooled Fractional Logit Model for Export Propensity

	full sample			< 25 empl			≥25 empl			manufacturing			services		
	coeff		odds	Coeff		odds	coeff		odds	coeff		odds	coeff		odds
l	0.104		1.109	-0.195		0.823	0.566	*	1.762	0.188		1.207	0.124		1.132
	0.107			*0.318*			*0.287*			*0.153*			*0.154*		
l2	0.004		1.004	0.039		1.039	-0.044		0.957	-0.002		0.998	-0.011		0.989
	0.013			*0.075*			*0.029*			*0.019*			*0.020*		
lp	0.224	**	1.251	0.300	**	1.350	0.181	**	1.198	0.192	**	1.212	0.222	**	1.248
	0.042			*0.068*			*0.057*			*0.056*			*0.066*		
purchprop	0.276	**	1.317	0.350	**	1.419	0.222		1.249	0.383	**	1.467	0.143		1.154
	0.096			*0.126*			*0.141*			*0.131*			*0.140*		
labcostee	-0.001		0.999	0.001		1.001	-0.009	**	0.991	-0.002		0.998	0.001		1.001
	0.001			*0.002*			*0.003*			*0.002*			*0.002*		
RDemp	0.498	**	1.645	0.540	**	1.716	0.478	**	1.613	0.575	**	1.777	0.184		1.202
	0.061			*0.092*			*0.079*			*0.072*			*0.122*		
for	1.701	**	5.479	1.789	**	5.984	1.698	**	5.460	1.777	**	5.910	1.557	**	4.745
	0.092			*0.181*			*0.106*			*0.111*			*0.169*		
cons	-2.885	**		-3.095	**		-3.360	**		-3.049	**		-2.157	**	
	0.320			*0.537*			*0.741*			*0.420*			*0.436*		
N	10806			4166			6640			8034			2772		
Plants	3058			1517			1913			2196			862		
Deviance	16418.83			7329.67			9141.28			12886.23			3551.30		
Pearson	6078.52			2398.47			3805.04			4216.96			1843.59		
Log PseudoL	-5198.49			-2007.89			-3134.80			-3663.84			-1518.65		
Chi2	1008.85			348.22			690.60			814.92			147.53		

**,*,(*) indicate significance at 1,5, and 10% respectively. Standard errors in italics.

Industry and Year dummies included in all regressions. Standard errors adjusted for clustering at the plant level.

Table 20: Unconditional Fixed-Effects Model for Export Propensity

	full sample			< 25 empl			>= 25 empl			manufacturing			Services		
	coeff		odds	Coeff		odds	coeff		odds	coeff		odds	coeff		Odds
l	0.018		1.018	-0.122		0.885	0.103		1.109	-0.006		0.994	0.069		1.071
	0.035			*0.102*			*0.101*			*0.046*			*0.055*		
l2	-0.003		1.007	0.025		1.002	-0.010		1.003	0.001		1.001	-0.010		0.990
	0.005			*0.021*			*0.011*			*0.006*			*0.008*		
lp	0.034	*	0.997	0.000		1.025	0.033		0.990	0.028		1.029	0.046	(*)	1.047
	0.017			*0.024*			*0.022*			*0.023*			*0.024*		
purchprop	0.036	(*)	1.035	0.017		1.000	0.045		1.034	0.037	*	1.038	0.041		1.042
	0.020			*0.024*			*0.031*			*0.016*			*0.048*		
labcostee	0.000	(*)	1.037	0.000		1.017	0.000		1.046	0.000		1.000	-0.001		0.999
	0.000			*0.000*			*0.000*			*0.000*			*0.001*		
RDemp	0.007		1.000	0.002		1.000	0.003		1.000	0.003		1.003	0.022		1.022
	0.009			*0.014*			*0.011*			*0.009*			*0.021*		
cons	0.279	*		0.500	*		0.099			0.310	(*)		0.273	(*)	
	0.122			*0.199*			*0.245*			*0.174*			*0.155*		
N	5693			1690			4003			4524			1169		
Plants	1157			448			892			916			241		
rho	0.95			0.95			0.95			0.96			0.90		
sigma_u	0.39			0.39			0.38			0.39			0.39		
LogL	6092.59			2031.4			4389.8			5481.2			867.43		
R2 adj	0.02			0.01			0.02			0.01			0.03		

**,*,(*) indicate significance at 1,5, and 10% respectively. Standard errors in italics.

Year dummies included. Standard errors are adjusted for clustering at the plant level.

7 Conclusion

7.1 Summary

Governments worldwide pursue export-promotion policies, in the belief that sustainable GDP growth can be attained through policies aimed at increasing the growth rate of exports. Within Northern Ireland and the Republic of Ireland export promotion policies have been central to industrial policy, particularly from the early 1990s when the key aim of policy, in both areas, was achieving growth through measures to improve the competitiveness of the economy.

The policies used to promote exports typically involve enabling non-exporters to enter foreign markets, as well as expanding the export potential of those already engaged in exporting; therefore it is essential that the relationship between exporting and the firm is well understood. However, despite the emphasis placed on improving export performance within industrial policy in Ireland (both North and South) relatively little has actually been documented about the relationship between exports and the firm, which is surprising given that the firm is the instrument through which the policy is operated. Given this gap in knowledge the objective of this study has been to examine the characteristics of exporters in both Northern Ireland and the Republic of Ireland and to analyse the determinants of export performance, as only when these factors are known can policies be effectively implemented and can non-exporters be successfully targeted to enter global markets.

The analysis for the Northern Ireland firms was performed on both cross-sectional and panel data for the 1998-2001 period, and employed Logit, fractional Logit and Tobit estimation procedures in order to identify the characteristics that distinguish exporters from non-exporters, and to examine the determinants of export intensity. The results suggest that firms in Northern Ireland are more likely to be exporters if they are larger, more productive and engage in R&D, factors which are commonly found in similar analyses across other countries and which confirms the notion that successful firms become exporters, due to the associated costs and risks involved with entering new markets. In addition, a high share of purchases in total sales, also significantly contributes to the likelihood of being an exporter, which suggests that firms with high intermediary purchase costs must sell to a wider market place in order to remain profitable. Several sectoral influences also play a part, with those in the Food, Drink and Tobacco sector, in particular, less likely to be exporters. Splitting the sample into larger and smaller firms, in keeping with the literature, reveals a different set of determinants depending on firm size. The large firm export decision appears to be strongly related to the ability to produce innovative products whilst for smaller firms, more resources in terms of firm size appears to drive the export decision.

The factors that determine export performance in Northern Ireland, measured as export intensity, are found to be similar, but not identical, to those influencing export participation. The ownership variable, which previously had no effect, is now highly significant. This finding is perhaps not surprising, however it would be interesting to determine how much of this was inter-company sales as opposed to exports to customers in other or new markets. Within the panel model, the labour costs variable is also significant, but negative, whilst the R&D variable is no longer significant, thus

the suggestion is that although firms may need to be innovative to enter export markets, once they become exporters they begin to compete largely on a low cost-basis, with those with lower labour costs exporting a greater proportion of sales. In terms of the remaining characteristics, firm size and productivity are again key determinants, suggesting that firms with preferable characteristics are more likely to be competitive and hence are able to export a greater share of output. The results for firm size are based on the cross-sectional data only, and do indicate differential impacts according to size. In particular the findings suggest that small firms in certain sectors are likely to export a greater proportion of sales than larger firms perhaps due to a particular niche product that they are able to sell to a wider marketplace, whereas larger firms are perhaps producing a larger mass of goods but selling a higher proportion within the UK. These findings may not be surprising however they do suggest small firms within certain sectors can overcome their size limitations if they have a product which is unique.

The analysis for the Republic of Ireland was carried out in a similar manner, employing Logit, Fractional Logit and Unconditional fixed effects models to pooled data for the 2000-2004 period to estimate the determinants of being an exporter, and the influences on export performance. Despite the slight difference in time period and the differences in sampling, the results are strikingly similar to those found for Northern Ireland. In the overall model (which includes some service sector firms not present in the Northern Ireland sample) most of the firm level characteristic variables are significant, suggesting that larger and more productive firms are more likely to be exporters. Firms with a high share of purchases in turnover, those engaged in R&D and foreign owned firms are also all more likely to be exporters. The results differ

from Northern Ireland in that foreign ownership was only an influence on export performance in Northern Ireland and not an influence on the likelihood of a firm being an exporter, however that result may have been related to the definition of foreign owned (which was defined as outside the UK rather than outside Northern Ireland) and therefore the results from the Republic of Ireland are more in line with expectations. The labour costs variable, which was significant and positive for Northern Ireland, is however insignificant (and negative) in the Republic of Ireland models for the determinants of being an exporter, which could either be the result of the data/sampling, or it may indicate that the link between the ability to export and labour costs is particular to Northern Ireland firms only.

Splitting the sample into large and small firms revealed a similar set of determinants for both sets of firms however, as with the Northern Ireland data, the main differences lay in the sectoral influences. A similar picture arose when the sample was spilt into manufacturing and service sector firms, the manufacturing model closely resembled that for the entire sample, whilst in the service sector model the firm size and purchase variables were the only firm level characteristics which were no longer significant. As was the case with the Northern Ireland data, when the time dimension is included within the models the results are broadly similar, with the main differences occurring in the model for small firms and for service sector firms.

The results from the export intensity models for the Republic of Ireland indicate many of the same significant determinants as was found for the previous export participation model, and indeed share many of the same influences as that found for Northern Ireland. In the pooled model the main difference is that firm size is no

longer significant, except for the large firm model, although a negative (but insignificant) relationship is found, suggesting an inverted u-shape relationship between export performance and firm size. The insignificance of firm size in this model, despite its significance in the determinants of being an exporter, is believed to suggest that size is only important to get over the sunk costs of entering export markets, and thereafter it no longer matters. Indeed a similar finding was made by Mittelstaedt et al. (2003) who found firm size to be a necessary and sufficient condition for export success amongst small firms. The presence of sunk costs was tested for in the Republic of Ireland and confirmed, thus further adding weight to this theory. Interestingly, the R&D variable is no longer significant in the fixed effects model, despite being so in the pooled regression, which is identical to that found for the Northern Ireland data, whereby R&D was found to significantly impact export intensity in the cross-section model but not in the panel. A possible suggestion for this is that entry costs into R&D are similar to the entry costs into exporting and therefore there is little variation in undertaking R&D over time.

Overall however, the models suggest that firms with a higher productivity, a larger share of purchases in output, undertaking R&D and being foreign owned are more likely to export a larger share of their output. However, as was found for Northern Ireland, the results also indicate that a large part of export performance is explained by unobservable firm characteristics, such as the characteristics of the owner-manager and/or the type of product produced. However, the similarities between the two sets of results, and their conformance to other empirical work of the same nature implies that being an exporter or having a good export performance is not a random event but can actually be characterised by a certain type of firm, and therefore policies tailored to

specific firms can help in making the first step towards exporting and improving performance once that initial hurdle has been overcome.

7.2 Policy Recommendations and Further Research

The results presented in this study provide a useful model of the determinants of export participation and performance amongst manufacturing firms located in Northern Ireland and the Republic of Ireland and, as a result, have some important policy implications. One of the main findings is that the characteristics that influence the type of firms that export are not exactly identical to those which influence export intensity, therefore it might be helpful if export promotion policies distinguished between those designed to promote non-exporters to participate in export markets and those aimed at increasing the export share of current exporters.

Firm size, productivity and undertaking R&D are all deemed influences on the decision to export, suggesting that the firms that are already successful in their domestic markets are those which will be more able to enter export markets. The results also provide evidence for sunk costs into exporting, thus from a policy perspective the suggestion then appears that support should be geared towards improving the position of firms within the home market first, in terms of employment and productivity growth, as that then paves the way for a more successful transition into exporting, in terms of the resources available and the efficiency required to firstly enter export markets and then compete globally. The importance of R&D also suggests that support be targeted at helping firms become more innovative, the idea being that product quality will improve and allow firms to compete on the basis of a

unique or more sophisticated product, rather than on costs alone. This is particularly topical at the moment, whereby firms in the UK are finding it more and more difficult to compete against low cost imports from the wave of low income countries specialising in manufacturing.

The determinants of export performance, in this case export intensity, are shown to also be linked to superior firm characteristics, however there appears to be a greater sectoral influence, suggesting that policy to increase exports be tailored more specifically towards individual sectors rather than a broad brush approach. The significance of ownership of the firm implies that export intensity is higher amongst the externally-owned group of firms however policy may wish to put more resources into the locally-owned sector as it is less likely to be able to influence the export strategies of foreign owned firms, if such decisions are made in the country of ownership. The unexpected finding that firms with high labour costs export lower shares of total sales is also important and suggests that firms are using their low cost basis as a means of being competitive, however as shown above, this is a concern for policy given the increase in low-wage countries now entering the market place. Again this may suggest that putting resources into product development may be a more useful first step into exporting, whereby the product becomes the key feature and the exporting of it becomes a longer term goal.

For both models the results were shown to differ according to firm size which, as for the sectoral results, reinforces the fact that business support should be targeted more specifically according to firm size. However a key weakness of the study, in terms of the literature, is the lack of information on the owner-manager or decision maker of

the firm, factors which are deemed to be crucial in the export decision of small firms. Ideally any further analysis would incorporate such measures, particularly given the contribution small firms make to the Northern Ireland economy. Similarly, there is no data at present indicating whether firms received assistance for export purposes, or indeed quantifying the extent of any assistance, factors which may have a significant impact on their export performance. Such assistance variables could also be used to determine the impact of export promotion policies, which as previously stated, were key to industrial policy from the 1990s onwards.

A final comment on the analysis is that although it provides information on the type of firms that currently export, and hence allows for policy to be targeted more specifically, the study says nothing about causality, or the benefits to firms from exporting. The literature tends to suggest that good firms become exporters rather than the other way round, however if policy is concerned with increasing the number of exporters, then it must provide a rationale to the firms for doing so, without this there is no particular incentive to the firm to undergo the costs involved with selling overseas, particularly in a small firm economy where the costs of doing so are prohibitive. A further study looking at this aspect of the relationship between exporting and the firm would therefore provide a more complete picture and potentially provide policymakers with a justification for promoting firms to enter export markets as well as providing firms with the motivation for doing so. It may be well understood that exports are good for the economy as a whole but for the individual decision maker at the firm level, without any evidence of direct benefits to the firm, the costs, uncertainty and risks involved with exporting may far outweigh any potential advantages to the economy.

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