

*Geography and Firm Exports:  
New Evidence on the Nature of Sunk Costs*

Martina Lawless<sup>\*</sup>

Central Bank and Financial Services Authority of Ireland

P.O. Box 559, Dame Street

Dublin 2

Ireland

<http://www.centralbank.ie>

Revised July 2010

---

<sup>\*</sup> I would like to thank Paul Walsh, Dermot McAleese, Frank Barry, Karl Whelan, Maurice McGuire and seminar participants in Trinity College Dublin and the CBFSAI for many useful suggestions. The anonymised data used in this paper was generously made available by Forfás. The views expressed in this paper are the personal responsibility of the author. They are not necessarily held by either the Central Bank and Financial Services Authority of Ireland or the ESCB. E-mail: [martina.lawless@centralbank.ie](mailto:martina.lawless@centralbank.ie)

# **Geography and Firm Exports: New Evidence on the Nature of Sunk Costs**

## **Abstract**

This paper presents an examination of the trading patterns of individual firms, looking at their coverage of export markets and movements into and out of destinations. This analysis is made possible by access to a new survey data set of Irish firms, which includes detailed information on firm characteristics and on the destinations of their exports over a two-year period. In line with Eaton, Kortum and Kramarz in their paper “Dissecting Trade: Firms, Industries and Export Destinations” (2004), we find that a large number of firms serve only the domestic market and many exporting firms export to a single foreign market. Although there is little movement of firms into and out of exporting, firms’ involvement in individual export markets is much more dynamic. Over one-third of firms change their market coverage, usually by entering or exiting one additional market. This is consistent with an interpretation where the bulk of any sunk cost encountered in exporting is incurred during the initial entry to the export market. Subsequent entry to additional markets may be made easier by prior export experience, which could help reduce the sunk cost of extending market coverage.

JEL: F19, D21

Keywords: Firm Exports, Market Coverage, Sunk Costs

## 1. Introduction

The aim of this paper is to analyse the geographic dimension of trade in terms of the trading patterns of individual firms. Increasing availability of firm-level data has resulted in a number of papers examining firm export decisions, primarily in terms of sunk costs to entry (Wagner, 2007, Roberts and Tybout, 1997, Bernard and Jensen, 2004b, Bernard and Wagner, 2001) and spillovers from other exporters (Aitken *et al.* 1997). Throughout this literature, the export market has generally been treated as a single entity, with little consideration given to the fact that firms can export to multiple geographic markets at the same time. This gap in the literature has been primarily due to an absence of firm-level data containing detailed information of export destinations. This paper utilises a new survey of Irish firms that contains information on both export participation and the geographic coverage of exports. The data cover two years, which allows us to examine both the export coverage of firms and the extent of entry and exit to and from new destination markets.

The paper makes three contributions to the recent literature on firm exporting. The first is a confirmation of some stylised facts identified by Eaton *et al.* (2004) and Bernard *et al.* (2009). A consistent finding to emerge from this firm-level analysis of exporting is the large number of firms serving only the domestic market and that even amongst exporting firms, many export only to a single foreign market.

The second contribution is to provide some evidence on the firm characteristics associated with the number of markets exported to. A number of characteristics of the

firm prove to be important. In particular, larger firms are more likely to export and also export to more markets, as are firms in high technology sectors. Firm age is found to have opposite effects on market participation compared to coverage: Older firms are more likely to export, but once export status was controlled for, younger firms were more diversified across markets.

The third contribution of this paper exploits the availability of two years of data to shed some light on the nature of the sunk costs associated with becoming an exporter. If there are significant sunk costs associated with entry into each new export market, we would expect to see a high level of persistence in the firms' portfolio of destination markets. On the other hand, if the main sunk cost involved in exporting is captured by the initial effort involved in becoming outward orientated; we might expect to find that firms experience less persistence in their market coverage than they do in their export status.

Our analysis shows that although there is little movement of firms into and out of exporting, firms' involvement in individual export markets is much more dynamic. Approximately one-third of firms change their market coverage over the two years of data, usually by entering or exiting one additional market. These patterns seem consistent with the hypothesis that the experience of exporting to one market significantly reduces the costs associated with entering a second market.

The paper is organised as follows. Section 2 reviews some literature on the destination of trade. Section 3 introduces the data sources. Section 4 describes firm-level export

market coverage and reports the results of a regression analysis of its determinants. Section 5 exploits the two-year span of the data by analysing the entry and exit of exporting firms to and from individual markets. Section 6 concludes.

## **2. Sunk Costs and Trade Patterns: Previous Work**

Sunk costs, whether they are encountered in setting up a new firm or entering a new market, create “an asymmetry between incumbents and potential new entrants”, which can lower firm turnover and potentially results in a stasis where new firms are not attracted to entry and existing firms are less likely to exit (Hölzl, 2005). The theoretical basis of sunk cost models was developed by Dixit (1989) and Krugman (1989), and applied empirically to the decision to enter the export market by Roberts and Tybout (1997) and Bernard and Jensen (2004b). If sunk costs exist in the export market, they could result in transitory changes (perhaps in the exchange rate or in trade policy) having permanent effects on export patterns. Examples of sunk costs in exporting are thought to be mainly those of information gathering on the new market, setting up new distribution networks, marketing and possibly repackaging of the product to appeal to new consumers. The effect of these costs on export participation, and their relationship to firm productivity, are reviewed by Wagner (2007).

The initial decision of the firm to enter the export market has been the topic of a number of papers, e.g. Roberts and Tybout (1997) for Columbian firms, Bernard and Jensen (2004b) on exporting activity in the United States. The question of whether sunk entry costs are relevant to the decision to become an exporter seems to be answered positively

by Bernard and Jensen (2004b), who found that exporting in the previous period substantially increases the probability of being an exporter in the next period, although some firms do transfer in or out of the export market. Relating exporting activity to firm characteristics finds that exporters tend to be larger, pay higher wages and have higher productivity (Bernard and Jensen, 2004b). Greenaway and Kneller (2007) review the evidence on links between productivity and international activity, distinguishing between features that induce firms to export and those which result in firms moving production abroad instead.

While the literature on sunk costs for exporting in general is now a relatively large one, there has been very little research on the question of how many export markets are supplied. There is therefore limited evidence on whether such sunk costs are encountered in entering each new market or if they may be reduced if the firm has experience of already supplying a similar market. Decomposing the growth of exports of twenty-four developing countries comparing export products and destination markets, Evenett and Venables (2001) found that the extension of an existing product line to a new geographic market accounts for around one-third of export growth, with the contribution being made by the introduction of new products averaging ten percent of growth.

Analysis relating to the geographic coverage of a firm's exports has been carried out by Eaton *et al.* (2004), using French data for 1986. They find great heterogeneity in firms' export participation. Most firms sell only in the domestic market, and for the exporters they find that the modal firm exports to a single market, and only a small fraction of firms

exports to a large number of markets. This pattern holds across all sixteen industries in the data.

Ruane and Sutherland (2004), analysing the export decisions of Irish-owned firms, also found significant sunk costs exist in entering the export market. Dividing exporters into those exporting only to the United Kingdom compared to exporters to the rest of the world revealed entry costs for Irish firms to the UK market to be significantly lower than the average sunk cost of exporting (i.e. the coefficient on lagged export status was lower for exporting to the United Kingdom compared to exporting in general).

### **3. Data – Enterprise Ireland Firm Survey**

The firm-level data come from a survey of Irish-owned manufacturing firms carried out by Enterprise Ireland and Forfás in 2001.<sup>1</sup> The firms surveyed are Irish-owned and the sample consists of 1,087 firms, of whom 773 are exporters. The data thus contains a much higher proportion of exporters than the population of firms, amounting to just over 70% compared to fewer than 59% of all Irish-owned manufacturing firms (Central Statistics Office, 2003). This is due primarily to the survey focusing on firms with over twenty employees, whereas the Census of Industrial Production collects information of firms with three or more employees. The International Study Group on Exports and Productivity (2008) reports export participation rates of 38 percent for Irish firms with

---

<sup>1</sup> Enterprise Ireland is an Irish state agency set up to promote the development of indigenous industry and, in particular, to assist Irish companies in exporting, and Forfás is the Irish national policy advisory board for enterprise and trade. The higher incidence of exporting firms in the data is also potentially due to the sampling frame being drawn predominantly from firms that have been clients of these agencies.

between 10 and 20 employees, compared to export participation by over 90 percent of firms with more than 250 employees. Ruane and Gleeson (2006) find that firms with fewer than twenty employees accounted for slightly less than eight percent of indigenous Irish exports in 2003. The restriction in this paper to firms employing more than this number will exclude some exporting activity but only of the group with the lowest participation rates and lowest export values and as such should not restrict the analysis to any great extent.

The survey includes information on various firm characteristics such as employment, inputs, wage costs, R&D spending, as well as export sales and the breakdown of countries to which the firm exports. It is the only data set of its kind that questions firms on the destination of their exports and the amount exported to each destination, and also contains information about the features of the firm. This paper uses survey data from 1999, 2000 and 2001 for firm characteristics and for 2000 and 2001 includes the destination of exports question.<sup>2</sup> Comparing the survey totals to the totals from the annual Census of Industrial Production (Central Statistics Office, 2003), the survey covers 62 per cent of exports from Irish-owned firms, with a slightly higher than average export intensity – in the survey data 54 per cent of an exporting firm's output is sold abroad compared to 47 per cent in the census data. In addition to higher export intensity, the value of the average exports of a firm in the survey is considerably higher than in the population (€5.2m compared to €2.6m), again this is due to the survey design being to cover larger firms.

---

<sup>2</sup> The information on firm characteristics available for 1999 allows us to lag these explanatory variables without losing any of the export data we are particularly interested in.

Turning to employment, once again the sample is more likely to include exporters than non-exporters, covering just under 70 per cent of employment in Irish-owned exporters, and approximately half of total employment by Irish-owned firms. Average employment of firms in the sample is 69, compared to an average size of 30 in the Irish-owned firms recorded in the Census of Industrial Production. Average R&D intensity of the firms is 5% in both years, which compares to a manufacturing aggregate of slightly less than 1% (Forfás 2001).

That the firms are Irish-owned is an aspect of the sample selection that must be emphasised, as foreign-owned firms dominate aggregate Irish exports; this is primarily due to a history of economic policy focussed on encouraging export platform foreign direct investment (FDI) to the country. Although having similar data on foreign-owned exporters would extend the scope of the analysis, the Irish experience of FDI-dominated exports is far from being a common occurrence. Understanding the export decisions and patterns of indigenous Irish firms is therefore more likely to yield conclusions that apply more broadly across countries. The extent to which the generalisation of the results can be made will of course depend on the degree of similarity of economic structure to that of the Irish indigenous firms.

#### **4. Evidence on Geographic Destinations for Exports**

##### ***4.1 Basic Patterns***

The distribution of firms according to the number of markets they serve is graphed in Figure 1. As was found by Eaton *et al.* (2004), a large number of firms serve only the

domestic market (market coverage = 1), and many exporting firms export to a single foreign market. In the French data, this single destination was usually Belgium, for Irish firms it is usually the United Kingdom. The number of markets covered declines quite steeply, with only a small number of firms exporting to many markets. The distribution is strongly skewed to the left with 312 firms (29 percent) serving only the domestic market, and 183 firms exporting to one foreign market (16.8 percent of the total sample or 23.7 percent of the exporting firms). The average number of export markets for the exporting firms in the data is 5.8, with the median being two markets. This average market coverage is higher than the 3.5 markets found by Bernard *et al.* (2009) for US exporters. The difference is likely due to the greater openness to trade of the Irish economy coupled with the small size of the domestic market. It may also be due to the Irish data containing information on firms over twenty employees rather than a census of all establishments as used in the US analysis.

Average market coverage varies considerably across sectors. Table 1 shows average firm export coverage across sectors using three different ways of measuring export spread. We first use a count of the markets to which the firm exports (Count measure). This ranges from 2.8 markets for firms in the wood products sector to an average of 9.6 for firms in chemicals. Secondly, the percentage of a firm's exports that go to its largest market is used as a measure of dependence on a single destination (C1 measure). Office machinery is one of the most diversified according to this measure as it has the lowest dependence on its largest market with an average of 40% of exports going to the main destination. A weakness of these first two measures is that they do not tell us if the firm

has one main market and a number of smaller markets or if it exports equally to all its identified destinations. To adjust for this a third measure that is a weighted measure of geographic market concentration is used, equivalent to a Herfindahl (HH) index of industrial concentration.

$$HH = \sum_{d=1}^n (s_d^2) \quad (1)$$

In this instance, it measures the squared shares,  $s$ , of each destination market,  $d$ , in the exports of a given firm, summed over all its destinations. Therefore, a HH of 1 would indicate that the firm exports to only one country, in other words that it is completely specialised geographically. HH measures close to zero indicate a great deal of diversification by the firm, with no destination being dominant. As the measures are correlated, it is unsurprising to once again see that office machinery is one of the most diversified sectors on average, whereas transport equipment exports are considerably more concentrated towards a small number of markets.

#### ***4.2 Export Concentration***

To estimate the determinants of export concentration using the Herfindahl index, we use a Heckman selection model which controls for the firm's endogenous selection into being an exporter. The first stage of the estimation is the export decision of the firm. The profit-maximising firm makes this decision based on expected profits from exporting, taking into account the fixed costs of entering the new market. If the expected profits are positive, then the firm will become an exporter. The export status of the firm  $i$  is denoted by  $Y_i$  where

$$Y_i = 1 \quad \text{if } \beta \mathbf{Z}_i + \varepsilon_i > 0 \quad (2)$$

$$= 0 \quad \text{otherwise} \quad (3)$$

The profits from exporting depend on firm specific factors denoted by  $\mathbf{Z}_i$  while the residual term  $\varepsilon_i$  captures any other non-firm-specific effects. The  $\mathbf{Z}$  vector is made up of firm employment, age, R&D expenditures, spending on training, average wage (total wage bill/employment), a technology indicator discussed in detail below, domestic sales and year and sector dummy variables. A full description of the variables is contained in the Appendix. Once the firm has made the decision to participate in the export market, the second step of deciding market coverage is made. The market coverage equation is estimated as

$$M^*_i = \beta \mathbf{X}_i + v_i \quad (4)$$

With:

$$M_i = M^*_i \quad \text{if} \quad Y_i = 1 \quad (5)$$

$$M_i = 0 \quad \text{if} \quad Y_i = 0 \quad (6)$$

The observed market coverage is zero if the firm is not an exporter. If the firm is an exporter, its market coverage will be determined by a vector of firm characteristics,  $\mathbf{X}_i$ , and by other effects captured by the error term  $v_i$ .<sup>3</sup> The  $\mathbf{X}$  vector of firm characteristics contains the same variables as in the  $\mathbf{Z}$  vector above, excluding the domestic sales variable (as domestic scale may affect the decision to enter exporting but is unlikely to affect the number of markets). The correlation between the error terms ( $\varepsilon_i, v_i$ ) is given by

---

<sup>3</sup> The vector of firm characteristics included in the market coverage equation,  $\mathbf{X}_i$ , can include the same variables as  $\mathbf{Z}_i$  in the selection equation, but ideally they should not overlap completely as this makes identification more difficult. Domestic sales are included as a determinant of scale that might be correlated with the firm entering exporting (when local opportunities have been exhausted perhaps) but given the small size of the home market, these sales are unlikely to determine the extent of foreign coverage.

$\rho$ , and the two decisions (i.e. to export and how many markets to export to) are related if  $\rho$  is not equal to zero. In such a case, estimating only the market coverage equation would induce a sample selection bias, which is avoided by estimating both equations as proposed by Heckman (1979).

In addition to information on the firm's R&D, we use a sector technology dummy based on the Davies and Lyons (1996) classification of European sectors, which groups industries according to the intensity of intangible, and largely sunk, investment in R&D and advertising. The dummy is defined as 0 for a firm in a high technology sector and 1 for a firm in a traditional or low technology sector. Two caveats to the interpretation of this variable should be noted. First, as it is defined at the sector level, there may be firms within sectors that have a technology level different to that of the sector's overall designation. Second, it combines effects of R&D and advertising, which it is possible have differential effects on exporting. The additional inclusion of the firm-level R&D measure should mitigate this issue somewhat.

The first specification uses the Herfindahl index of market concentration and the results are presented in Table 2. The selection into exporting column is the first stage of the regression. We find that larger, older firms that spend more on R&D and on average wages are those most likely to export. Domestic sales, which are included only in the selection equation, have a negative effect. The Herfindahl results show larger firms are also more diversified in their exporting, while older firms and those in low technology sectors are more specialised. R&D expenditures have no effect on the market

diversification in this specification, although it was still significant and positive for entry to the export market.<sup>4</sup>

Testing the determinants of market coverage using the count variable (i.e. number of markets supplied) also uses a two-stage procedure very similar to the Heckman methodology. However, as we are now using a count it is more appropriate to use a Poisson distribution in the second stage of the estimation. The two-stage procedure used here is a zero-inflated Poisson, which means that a first stage correction for the large number of zeros (i.e. non-exporters) is included<sup>5</sup>. The results are shown in Table 3. The results of the first stage have the opposite signs to those in the Heckman procedure because the zero inflation tests for non-exporters rather than for export participation but qualitatively all of the results are the same with larger, older firms that spend more on R&D and on average wages are those most likely to export.

The second stage results of the Poisson regression show that larger firms tend to have a higher number of export markets, as do firms with higher average wages and more spending on R&D. Age however has a different effect in the market coverage equation with younger firms exporting to more markets. It is likely that this effect is due to many older traditional firms being reliant on the United Kingdom as an export market. Firms in high technology sectors are also more likely to export to a greater number of markets, although technology level did not have any statistically significant effect in the first stage.

---

<sup>4</sup> To check the robustness of this result, we ran a similar specification using an alternative measure of concentration (the Theil index), and the essential pattern of results remained very similar

<sup>5</sup> Greene, 1994 and Park, 2005 provide a full discussion of this method.

Finally, Table 3 presents the Vuong (1989) test statistic, with the large positive value indicating that the zero-inflated model is to be preferred over a standard Poisson.

### ***4.3 Destination Characteristics***

Having looked at *how many* markets the firm exports to in the preceding analysis, this section adds some features of the destination markets to establish what can be said about *where* the firm exports. The percentage of firms exporting to any individual market appears to decline in line with the distance of the market from Ireland. This is as would be expected from standard gravity model predictions of trade, where distance is a commonly used proxy for transportation costs. Figure 2 shows that over three-quarters of Irish exporting firms sell to England, 60 percent export to Northern Ireland and almost a third export to France and/or Germany. In contrast, less than five percent of exporters sell to markets such as Brazil or Malaysia. The exception to this geographic distance rule is the United States, with slightly more than 30 percent of Irish exporters selling to this market. Sharing a common language may go some way to explaining this exception, as we will see in the gravity specification below. The numbers of firms currently exporting to the United States may also be due to the long history of economic interaction, as epitomised by the high proportion of Irish emigrants living there and the importance of US multinational activity located in Ireland.

Distance also plays a role in the dependence of firms on an individual market. Firms that export to only one market usually export to closer destinations. These are typically part of the United Kingdom or European Union. Table 4 shows the level of reliance firms

have on the main European markets. Taking England as an example, 10% of exporters to this market sell all of their exports there and a further 36% rely on this single market for more than half their total exports. This could indicate that firms do not extend exporting activity to more distant markets without some initial export experience, although this is difficult to test without a longer time dimension to the data.

Table 5 brings these market characteristics into a gravity model where the dependent variable is the log of firm exports to each market. The first column contains market characteristics and sector dummies only, and the second column then adds some characteristics of the firms. As expected from the descriptive evidence above, distance has a significant negative effect on exports and GDP per capita and population both have positive effects. GDP per capita and population are included to capture the demand in the destination market and, as such, are expected to attract firms to export to that market (particularly in the case of firms exporting final products).

We also include a dummy variable for common language in line with most empirical gravity models at the aggregate level (e.g. Melitz, 2007) and find that it has a positive and significant effect. As a common language would facilitate research on the market, reduce repackaging and advertising costs and generally ease the difficulties of operating in a foreign market, it would be expected to have a clear effect in reducing both initial sunk costs of entering the market as well as ongoing costs of operating abroad.

Adding in some firm characteristics increase the explanatory power of the model considerably (from a  $R^2$  of 0.23 to 0.42) and are in line with the earlier results relating to market coverage. Larger, higher wage, higher R&D firms are more likely to export to many markets, therefore it is not surprising that they are found to be more likely to export to any individual market in this specification. However, there is still a considerable amount of unexplained heterogeneity in firm export patterns.

## **5. Entry and Exit**

The literature on firm export decisions has found considerable persistence in export status over time. For example, Roberts and Tybout (1997) find average entry and exit rates of firms to exporting in the region of 2.7 percent and 11 percent respectively, while Bernard and Wagner (2001) find entry and exit among their German sample of 2.4 percent and 2.3 percent. Transitions to and from exporting occur more frequently amongst US firms, with entry and exit rates of 13.9 percent and 12.6 percent respectively (Bernard and Jensen, 2004b). The level of persistence in the sample of Irish firms is extremely high with only two firms changing export status (becoming exporters in both cases). This is a very low transition rate but may be due in part to the data set following only existing firms and the short time period.

Despite the persistence in exporting status, there is a much more dynamic picture when it comes to the market coverage of current exporters. Quite a large number of exporters increase or decrease their market coverage over these two years. Approximately 14 percent of exporters increased their number of export destinations, while slightly fewer,

12.5 percent, decreased market coverage. In addition some 61 firms (8 percent of exporters) both entered and exited markets. This gives a total of 34.5 percent of firms changing markets over the course of a year. Of the 61 firms which simultaneously entered and exited markets, 14 (23 percent) had a net increase in the number of markets, and 20 (33 percent) had a net decrease. The remainder had no net change in their market coverage, entering and exiting the same number of markets. Relating this to the existence of sunk costs to exporting, these patterns are suggestive of high initial sunk cost to becoming an international player and then relatively smaller costs to changing markets.

The numbers of firms entering and exiting exporting to individual destinations are shown in Figure 3, which shows simultaneous entry and exit of firms to most destinations. There is little pattern of systematic entry to a newly attractive market or of exit from a declining one. On the contrary, the picture is one of heterogeneity amongst firms, with movement into and out of all observed markets. However, one consistent result is found; levels of entry and exit are both positively associated with the stock of Irish firms already exporting to the market. The (unweighted) correlation coefficient between numbers of entrants and the number of incumbent exporters is 0.75, while the correlation between existing exporters and number of exits is slightly lower at 0.63.

The most common change in market coverage was to increase or decrease the number of destinations by one, as shown in the distributions of entry and exit in Table 6. Only a very small number of firms changed their market coverage by more than five destinations. The average number of markets entered was 1.78 and exited was 2.2.

Table 7 looks at some of the firm characteristics associated with entering and exiting export markets. Using a Poisson specification for the count of increases and decreases in export markets, we find that firms with a higher number of existing markets are more likely to both enter and exit markets. The coefficient on existing market coverage is substantially higher for exit (1.356) than for entry (0.370). Firm size has no statistically significant effect on either entry or exit. Firm age has opposite effects, with older firms more likely to reduce their market coverage and younger firms more likely to be expanding their number of export markets. Firms paying higher wages and firms in low technology sectors are more likely to add markets but neither of these variables has any effect on exits.

These results can be interpreted as giving an indication of the nature of the sunk costs associated with becoming an exporter. The literature has established that considerable persistence exists in firm export status, which can be explained as resulting from costs associated with becoming an exporter. If the same level of sunk costs were associated with entry into each new export market, we would also expect to see a high level of persistence in the firm's portfolio of destination markets. This is not found to be the case. Instead, amongst the sample of continuing exporters, substantial levels of entry and exit of markets are found when compared to the persistence in exporting status. Although we cannot estimate the sunk costs directly, this pattern is consistent with the alternative hypothesis that the experience of exporting to one market significantly reduces the costs associated with entering additional markets. The bulk of the sunk costs involved in

exporting therefore appear to be associated with the initial movement to outward orientation of the firm.

That sunk costs of entry to additional markets might be lower than the initial entry to exporting could also be of influence if there are benefits to familiarity with a particular region. Firms may find that the costs involved in expanding into new markets are lower if they already export to a similar or neighbouring market. This reasoning appears to be borne out if we look at the regional pattern of market entry – dividing the countries in the data into nine regions<sup>6</sup>, we find that almost 90% of new markets entered are by firms already exporting to another market in the same region. This regional experience channel for reducing sunk costs could be an interesting area for future research.

## **6. Conclusions**

This paper looked at the geographic dimension of trade using detailed export destination information at the firm level and asks what affects the firm's decision about how many of markets it will export to. We find that a large number of firms serve only the domestic market and many exporting firms export to a single foreign market. Although there was virtually no entry and exit to exporting, a large number of exporters are found to change their market coverage over these two years. Approximately 14 percent of exporters increased their number of export destinations, 12.5 percent decreased market coverage

---

<sup>6</sup> The regions are United Kingdom, European Union-15, Other Europe, North America, South America, Africa, Middle East, Asia and Oceania.

and 8 percent simultaneously entered and exited markets. Of these, most increased or decreased market coverage by one market.

The paper also provides some evidence on the firm characteristics associated with the decision to export and the extent of coverage of different markets. A Heckman selection model was used to examine market coverage whilst controlling for the export status of the firm. The selection estimation for being an exporter found that larger, older firms that spend more on R&D and on average wages, are those most likely to export. The measures of market coverage used are the count of export destinations and a Herfindahl index to measure market specialisation. One of the main findings is that larger firms are more likely to export, and once in the export market they have greater levels of market coverage.

The high levels of entry and exit of markets relative to the export decision allows us to shed some light on the nature of the sunk costs associated with becoming an exporter. The high levels of persistence observed in the firm's export status are not found in the market coverage decision. Once the firm has made the decision to become an exporter, there is considerable turnover in the portfolio of export destinations. This is suggestive of a situation where the main sunk cost involved in exporting is captured by the initial effort involved in becoming outward orientated and that subsequently the experience of exporting to one market significantly reduces the costs associated with entering a second market.

## References:

- Aitken, Brian; Gordon H. Hanson and Ann E. Harrison (1997) “Spillovers, Foreign Investment and Export Behaviour” *Journal of International Economics*, Vol. 43(1-2), 103-132
- Bernard, Andrew B. and J. Bradford Jensen (2004a) “Entry, Expansion and Intensity in the US Export Boom, 1987-1992” *Review of International Economics*, Vol. 12(4), 662-675
- Bernard, Andrew B. and J. Bradford Jensen (2004b) “Why some firms export” *Review of Economics and Statistics*, Vol. 86(1), 413-417
- Bernard, Andrew B. and Joachim Wagner (2001) “Export Entry and Exit by German Firms” *Weltwirtschaftliches Archiv/Review of World Economics*, Vol. 137(1), 105-123.
- Bernard, Andrew, B., J. Bradford Jensen and Peter K. Schott (2009) “Importers, Exporters and Multinationals: A Portrait of Firms in the U.S. that Trade Goods”, in T. Dunne, J.B. Jensen and M.J. Roberts (Ed.s), *Producer dynamics: New Evidence from Micro Data*, University of Chicago Press
- Central Statistics Office (2003), *Census of Industrial Production 2000*, Stationery Office, Dublin
- Dixit, Avinash (1989) “Entry and Exit Decisions under Uncertainty” *Journal of Political Economy* Vol. 97(3), 620-638
- Davies, S. and B. Lyons (1996) *Industrial Organization in the European Union*, Oxford University Press: Oxford
- Eaton, Jonathan; Samuel Kortum and Francis Kramerz (2004) “Dissecting Trade: Firms, Industries and Export Destinations” *American Economic Review*, Vol. 94(2), 150-154
- Evenett, Simon J. and Anthony J. Venables (2001) “The Geographic Spread of Trade: Evidence from Twenty Four Developing Countries” mimeo, World Trade Institute
- Forfás (2001) *Research and Development in the Business Sector*. Available at [www.forfas.ie](http://www.forfas.ie)

- Greenaway, David and Richard Kneller (2007) "Firm Heterogeneity, Exporting and Foreign Direct Investment" *Economic Journal*, 117(517), F134-F161
- Greene, W. H. (1994) "Accounting for Excess Zeros and Sample Selection in Poisson and Negative Binomial Regression Models" Working paper, Stern School of Business, NYU EC-94-10.
- Heckman, J.J. (1979). "Sample Selection Bias as a Specification Error," *Econometrica*, Vol. 47(1), 153-61.
- Heston, Alan; Robert Summers and Bettina Aten (2002). Penn World Table Version 6.1, Centre for International Comparisons at the University of Pennsylvania (CICUP)
- Hölzl, Werner (2005) "Tangible and intangible sunk costs and the entry and exit of firms in a small open economy: the case of Austria" *Applied Economics*, Vol. 37(21), 2429-2443
- International Study Group on Exports and Productivity (2008). "Understanding Cross-Country differences in Exporter Premia: Comparable Evidence for 14 Countries" *Review of World Economics/Weltwirtschaftliches Archiv*, 2008, Vol. 144(4), p596-635
- Krugman, Paul (1989) *Exchange Rate Instability*, MIT Press, Cambridge MA
- Melitz, Jacques (2007) "North, South and distance in the gravity model" *European Economic Review*, Vol. 51(4), 971-991
- Park, Hun Myoung (2005) "Regression Models for Event Count Data", mimeo, Indiana University
- Roberts, Mark J. and James R. Tybout (1997) "The Decision to Export in Columbia: An Empirical Model of Entry with Sunk Costs" *American Economic Review*, Vol.87(4), 545-564
- Ruane, Frances and Ann Marie Gleeson (2006) "Export Dynamics in Small Open Economies", IIS Discussion Paper No. 140 (May 2006)
- Ruane, Frances and Julie Sutherland (2004) "Ownership and Export Characteristics of Irish Manufacturing Performance" IIS Discussion Paper No. 32 (Aug.04)
- Vuong, Q. H. (1989) "Likelihood ratio tests for model selection and non-nested hypotheses" *Econometrica*, Vol. 57(2), 307-333

Wagner, Joachim (2007) "Exports and Productivity: A Survey of the Evidence from Firm-level Data" *World Economy*, Vol.30(1), 60-82

**Table 1: Average Market Coverage and Concentration by Sector**

	Share of Firms	Export Markets	HH Index	C1 Concentration
Office Machinery	0.03	7.3	0.32	40
Electrical Goods	0.08	5.4	0.37	44
Chemicals	0.04	9.6	0.41	52
Food & Drink	0.22	6.0	0.41	48
Rubber Products	0.03	6.1	0.42	49
Metal Products	0.15	3.4	0.43	48
Paper & Printing	0.05	3.6	0.43	47
Machinery	0.09	4.8	0.44	52
Basic Metals & Minerals	0.08	4.3	0.45	51
Clothing & Textiles	0.07	6.1	0.46	56
Wood Products	0.05	2.8	0.47	52
Other Manufacturing	0.08	7.6	0.48	67
Transport Equipment	0.02	4.7	0.57	63

**Table 2: Heckman Selection Model for Market Concentration**

	Herfindahl	Export Selection
Employment	-0.03** (0.01)	0.48*** (0.09)
Age	0.03* (0.02)	0.21*** (0.07)
R&D	-0.01 (0.01)	0.05* (0.03)
Training	0.004 (0.01)	-0.02 (0.03)
Average Wage	-0.01 (0.02)	0.26** (0.12)
Low Tech Sector	0.10*** (0.03)	-0.04 (0.13)
Domestic Sales		-0.29*** (0.05)
Year Control	Yes	Yes
Industry Control	Yes	Yes
No. of obs.	841 (c=134, u=707)	
P	0.67 (0.13)	
$\Lambda$	0.20 (0.05)	
LR test of indep. eqns.	$\chi^2$ (1) = 12.95 Prob> $\chi^2$ = 0.000	
Wald Test	$\chi^2$ (8) = 27.07 Prob> $\chi^2$ = 0.001	

Standard Errors in parentheses.

\*\*\*Significant at 1%, \*\* significant at 5%, \* significant at 10%

Note: firm characteristics are in logarithms and are lagged one year

**Table 3: Zero-Inflated Poisson Regression for Market Count**

	Market Count	Non-Exporting Logit
Employment	0.26*** (0.01)	-0.85*** (0.15)
Age	-0.11*** (0.02)	-0.44*** (0.13)
R&D	0.09*** (0.01)	-0.11* (0.06)
Training	-0.05*** (0.02)	0.08 (0.06)
Average Wage	0.11*** (0.03)	-0.37* (0.22)
Low Tech Sector	-0.41*** (0.03)	0.07 (0.23)
Domestic Sales		0.50*** (0.11)
Year Control	Yes	Yes
Industry Control	Yes	Yes
No. of obs.	842	
LR test of indep. eqns. ( $\rho=0$ )	$\chi^2(8) = 815.7$	Prob > $\chi^2 = 0.000$
Vuong Test of ZIP versus standard Poisson	$z = 7.59$	Prob > $z = 0.000$

Standard Errors in parentheses.

\*\*\*Significant at 1%, \*\* significant at 5%, \* significant at 10%

Note: firm characteristics are in logarithms and are lagged one year

**Table 4: Share of Firms Reliant on One Main Market**

	Totally Reliant (100% of Exports)	Mainly Reliant (50-99% of Exports)	Somewhat Reliant (25-49% of Exports)
N. Ireland	0.21	0.16	0.11
England	0.10	0.36	0.20
Scotland	0.02	0.05	0.09
Netherlands	0.02	0.04	0.07
USA	0.02	0.22	0.18
Belgium	0.00	0.02	0.04
France	0.00	0.06	0.10
Switzerland	0.00	0.02	0.01
Denmark	0.00	0.00	0.03
Norway	0.01	0.02	0.02
Germany	0.01	0.05	0.11
Spain	0.02	0.02	0.03
Czech R.	0.00	0.00	0.00
Sweden	0.00	0.04	0.02
Portugal	0.02	0.01	0.04
Austria	0.00	0.02	0.02

**Table 5: Destination Gravity Model**  
*Dependent Variable: Ln Firm Exports*

	Market Characteristics	Firm & Market Characteristics
Distance	-0.30*** (0.03)	-0.40*** (0.02)
GDP per Capita	0.44*** (0.06)	0.68*** (0.05)
Population	0.38*** (0.02)	0.44*** (0.02)
Language Dummy	0.64*** (0.06)	0.68*** (0.05)
Firm Size (Employment)		0.83*** (0.02)
Average Wage		0.44*** (0.05)
R&D		0.02** (0.01)
Year Control	Yes	Yes
Industry Control	Yes	Yes
No. of obs.	5619	5619
R <sup>2</sup>	0.23	0.42
F-test	95.9 (Prob.>F = 0.000)	205 (Prob.>F = 0.000)

Standard Errors in parentheses.

\*\*\*Significant at 1%, \*\* significant at 5%, \* significant at 10%

Note: All variables are in logarithms.

**Table 6: Distribution of Entry and Exit**

Change in number of markets	Share of Firms Entering	Share of Firms Exiting
1	0.63	0.52
2	0.20	0.18
3	0.08	0.14
4	0.04	0.04
5	0.01	0.04
6	0.01	0.03
7	0.02	0.01
8	0.00	0.02
9	0.01	0.00
10+	0.01	0.01

**Table 7: Market Entry and Exit – Poisson Regressions**

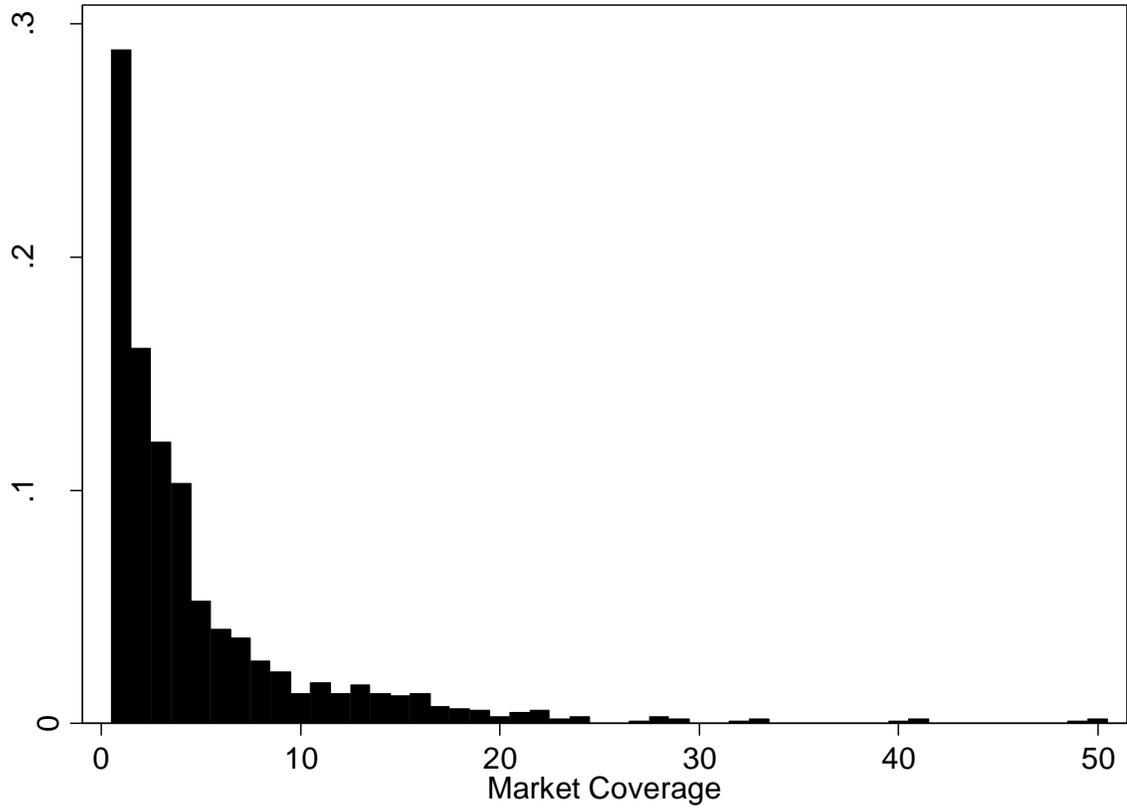
	Count New Markets	Count Exit Markets
Existing Market Count	0.37*** (0.11)	1.36*** (0.13)
Employment	-0.06 (0.13)	0.02 (0.11)
Age	-0.43*** (0.13)	0.38*** (0.14)
R&D	0.03 (0.05)	0.11* (0.06)
Training	-0.09 (0.06)	-0.13** (0.06)
Average Wage	0.51*** (0.19)	-0.01 (0.20)
Low Tech Sector	1.25* (0.64)	-13.2 (538.4)
Domestic Sales	0.01 (0.08)	0.03 (0.07)
Industry Control	Yes	Yes
No. of obs.	404	404
Pseudo R <sup>2</sup>	0.18	0.33
$\chi^2$	126.8 (Prob> $\chi^2$ = 0.000)	274.3 (Prob> $\chi^2$ = 0.000)

Standard Errors in parentheses.

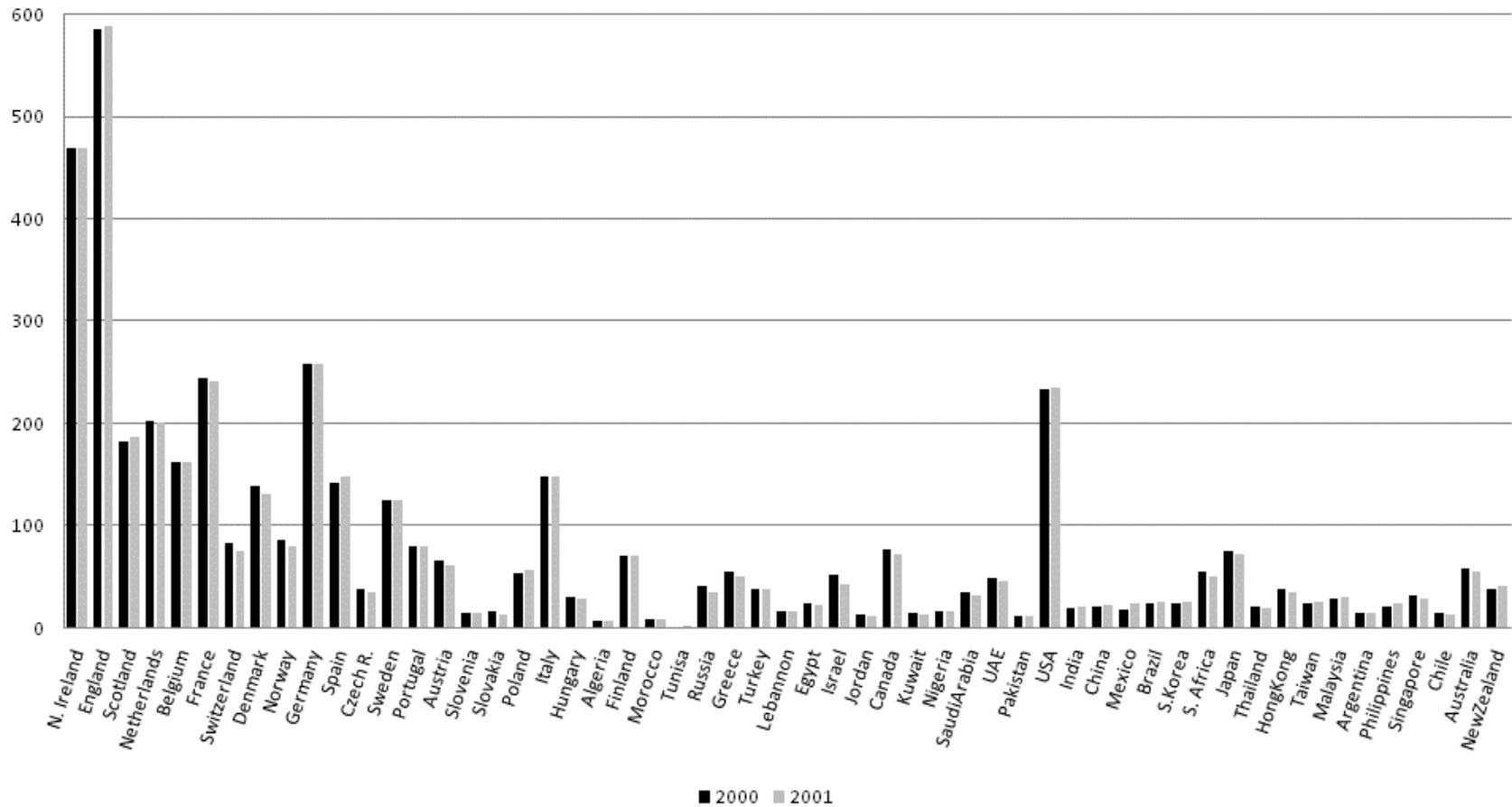
\*\*\*Significant at 1%, \*\* significant at 5%, \* significant at 10%

Note: firm characteristics are in logarithms and are lagged one year

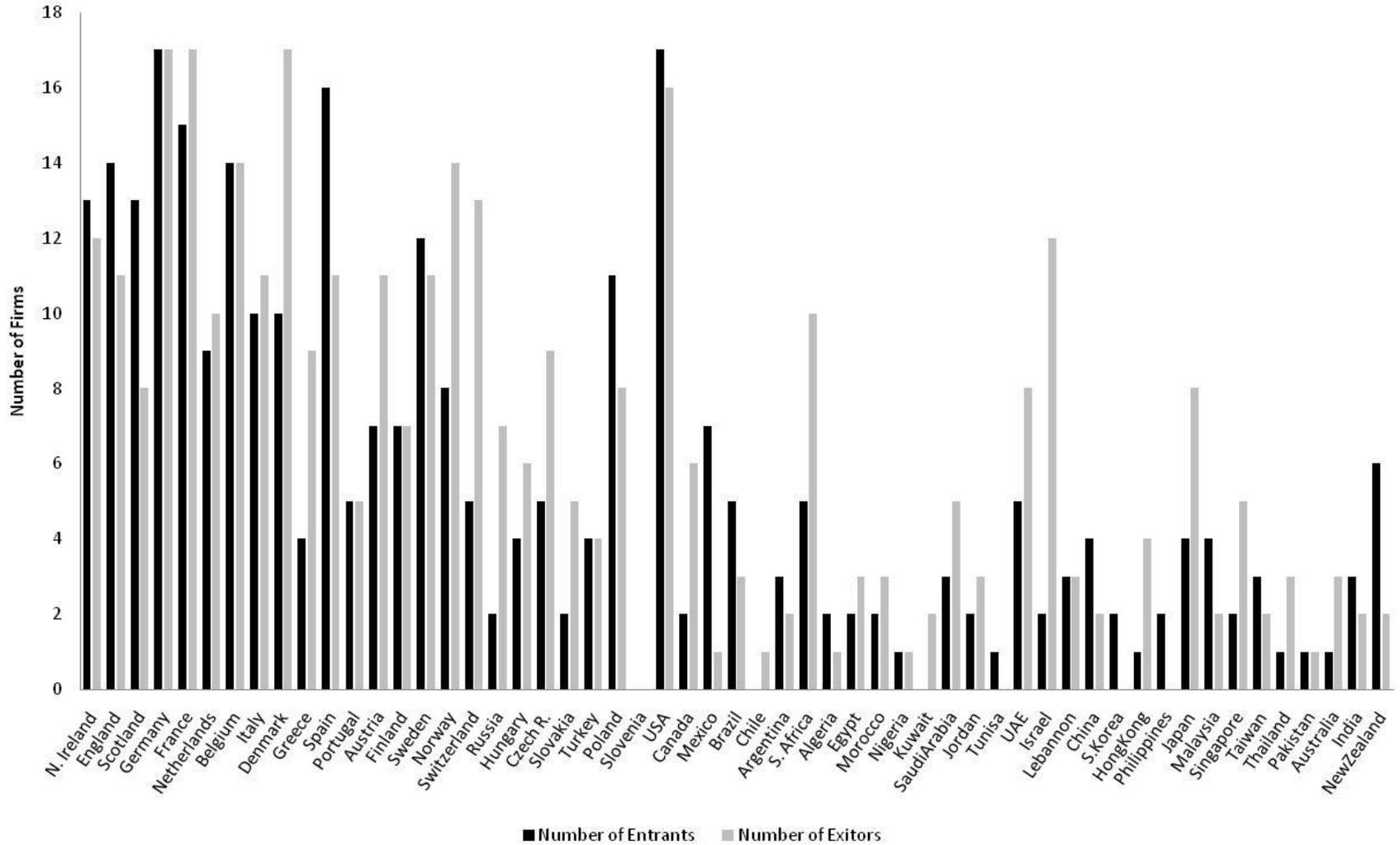
**Figure 1: Distribution of Firms by Market Coverage**



**Figure 2: Number of Exporters by Destination  
(Sorted by Distance From Ireland)**



**Figure 3: Market Entry and Exit  
(Sorted by Distance from Ireland)**



## **Appendix: Variable Definitions**

Export status: Dummy variable equal to 1 if firm reports positive export sales and 0 otherwise.

Market coverage: Count variable for how many of the 55 countries named in the survey the firm reports exports.

Export market Herfindahl / HH Index: Concentration measure consisting of the squared shares,  $s$ , of each destination market,  $d$ , in the exports of a given firm, summed over all its destinations. HH of 1 indicates that the firm exports to only one country and HH measures close to zero indicate a great deal of diversification, with no destination being dominant.

C1 concentration: Percentage of its exports that the firm sells to its main market.

Employment: Number of full-time employees in the Republic of Ireland at year end.

Age: Years since firm was established.

R&D: Total expenditure on in-house R&D.

Training: Direct cost of all formal structured training, in-house and external (excluding salary of those being trained)

Average wage: Total of wages, salaries, pensions and other payroll costs for employees divided by number of employees.

Sector technology dummy: Based on the Davies and Lyons (1996) classification of European sectors, grouping industries according to the intensity of investment in R&D and advertising. The dummy is defined as 0 for a firm in a high technology sector and 1 for a firm in a traditional or low technology sector.

Industry dummies: 3-digit Nace Clio industry classification.

Domestic sales: Sales of manufactured goods and services produced by firm for the domestic market.

Distance: Kilometres from Dublin to capital city of each destination (source: Jon Haveman's gravity data website: <http://www.maclester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#Gravity>).

GDP per capita: Gross Domestic Product in constant prices divided by population from Penn World Tables (Heston, Summers and Aten, 2002).

Population: Population (millions) from Penn World Tables (Heston, Summers and Aten, 2002).

Language dummy: Dummy variable equal to 1 if English is an official language of the destination market. (Source: Jon Haveman's gravity data website: <http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html#Gravity>).

Market entry: Number of markets the firm exported to in 2001 that had not been exported to in 2000.

Market exit: Number of markets the firm exported to in 2000 that are no longer exported to in 2001.