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## Research Technical Paper

### *Firm Export Dynamics and the Geography of Trade*

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### **Abstract**

Two recent trends in international economics have been an increased focus on the geography of trade (e.g. what factors determine where a country exports to) and the emergence of empirical work examining firm-level data on exporting activity. However, data limitations have prevented there being much progress in combining these two areas, because very few countries provide firm-level data breaking down firm exports by their destination. Eaton, Kortum and Kramarz (2004) have analysed such data for French firms but their study only uses a single cross-section of data. This paper uses a unique survey of Irish exporting firms over a five year period to fill some of the gaps in this empirical literature. With information on over fifty destinations, firm-level changes in market coverage and their contribution to net export growth are investigated. Firm involvement in individual export markets is found to be much more dynamic than export status. Entry and exit to markets is shown to be a quantifiably important component of overall export flows, with this factor becoming more important for less popular markets. The paper also shows how the patterns of entry and exit into export markets combine to determine the overall firm-level distribution of number of markets entered.

# 1 Introduction

Recent years have seen an important development in empirical research in international economics towards the analysis of firm-level data to gain a better understanding of the processes underlying international trade, with classic contributions including the work of Roberts and Tybout (1997) and Bernard and Jensen (1995, 2004). This literature has provided substantial insights into the exporting firms. For instance, exporting firms tend to be more productive than non-exporting firms and the exporting process is very persistent, so that firms rarely change their status as either exporters or non-exporters. This evidence has suggested a process in which individual firms face substantial barriers to engaging in trading activity, so that only the most productive can afford to do so. In addition, the persistence of exporting activity is commonly interpreted as implying that substantial “sunk costs” are encountered in becoming an exporter. Common examples of sunk costs in exporting relate to information gathering on new markets, setting up new distribution networks, marketing and possibly repackaging of products to appeal to new consumers.

An important limitation of this empirical literature is that most of the existing datasets report information on whether a firm exports and, if so, how much it exports. However, information on the destination of exports has generally been missing from these studies. This is important because geography is clearly a crucial element in international trade. While traditional trade theory generally stresses differences in factor content as an explanation for which countries trade with each other, in reality geographic distance tends to exert a huge influence on the direction of trade, as illustrated by popular “gravity” regressions. In addition, languages, cultures and other elements unrelated to factor content tend to influence the direction of trade. Understanding how these geographic factors affect the exporting process requires data on the destination of firm exports, and such evidence has generally been missing.

One important exception to this rule has been the work of Eaton, Kortum and Kramarz (2004) on the export destinations of French exporters. Using a cross-section of data from

1986, they find great heterogeneity in firms' involvement in exporting. Most firms sell only in the domestic market. Amongst exporters, the modal firm exports to only a single foreign market, with a fairly small fraction of firms exporting to a large number of markets. This pattern holds across all sixteen industries in the data.

This paper adds to this literature by making use of a unique survey data of Irish firms. Like the Eaton-Kortum-Kramarz data, this survey contains detailed information on firm exports and destinations. However, unlike their data, this survey is a panel dataset that follows firms over a period of five years. This dataset allows us to better understand the dynamic processes underlying the patterns of firm exporting. Some of the facts which emerge from the data fit with the predictions of existing models, other patterns would not be expected but perhaps can prove useful in providing direction for further theoretical developments.

Four aspects of our analysis are worth emphasising. First, when examined at the level of individual markets, the exporting process exhibits far more dynamics than is evident when one only observes exporting status. Although firms rarely become exporters or cease exporting entirely, firm entry into or exit out of individual markets is commonly observed. Indeed, simultaneous entry and exit of firms is observed in all markets.

Second, this dataset can be used to establish new stylized facts about the evolution of firms' exporting patterns over time. In particular, this dataset allows for the calculation of the probability that a firm will change status from exporting to  $n$  markets to  $n - 1$  or  $n + 1$  markets. Our data show that firms tend to get into exporting in a very gradual fashion. Firms usually start out exporting to one market, and then tend to add other markets slowly over time. Conversely, once firms are active in a large number of markets, changes in market coverage become very common. This information can also be used to explain how the cross-sectional distribution of export markets per firm emerged. Specifically, we use a matrix of transition probabilities to generate predictions about the long-run distribution of export market coverage. The hypothetical distribution from this Markov-chain process turns out to be remarkably consistent with observed distribution of firms across markets.

Third, we can use this dataset to examine the contributions made to export growth of firms adding (or subtracting) markets versus firms increasing (or decreasing) sales in existing markets. These calculations have relevance for policies aimed at export promotion because policies aimed at expanding into new markets may be quite different from those aimed at expansion in existing markets. Our data show that the relative contributions to net exports of firms entering and exiting markets are much larger than the contributions of firms becoming or leaving exporting altogether. That said, the gross flows due to firms increasing and decreasing sales in existing markets are much larger than those related to adding or subtraction of markets.

Fourth, information on the identity of the destinations can be used to test for the accuracy of theories such as that of Eaton, Kortum and Kramarz (2005) which predict a “hierarchy” of markets, such that firms will only enter the  $k$ th most popular market if they are first in the market ranked  $k - 1$ . This theoretical prediction that firms enter markets in a predetermined order is not strictly supported by the data. However, we can identify a weaker version of a hierarchical pattern whereby firms tend, on average, to export to more popular markets before entering less popular ones.

The contents of the paper are as follows. Sections 2 and 3 describe the data and present summary cross-sectional statistics. Sections 4 to 7 use the panel dimension of our dataset to address the four issues just noted. Section 8 discusses implications of our findings for theoretical modelling and for policy. Section 9 concludes.

## 2 Data

The data used in this paper come from a survey of Irish firms undertaken by Enterprise Ireland and Forfás, which is the Irish national policy advisory board for enterprise, trade and technology and operates under the Government Department of Enterprise, Trade and Employment. The focus of survey is on Irish-owned and predominantly exporting firms. Of the 751 firms in the sample, 83% are exporters, compared to 44% of all Irish-owned firms

(Central Statistics Office 2004). As such the dataset is better suited to understanding the dynamics of exporting firms, rather than the determinants of export status per se, which has been the focus of most of the existing literature in this area.

The Enterprise Ireland survey records information on a number of firm characteristics such as employment, sales, inputs and exporting activity. More importantly for our analysis, the survey records detailed information on exports to over fifty individual markets. Also, in contrast to the French dataset used by Eaton, Kortum and Kramarz (2004), which is a single cross-section, the Enterprise Ireland survey provides firm-level data on five years of exporting activity (2000-2004). Together, these two features allow for a far more detailed analysis of firm export decisions than has been possible to date. For instance, one can use these data to track changes over time in individual firms' portfolios of export markets.

Comparing the total exports of the firms covered by this survey to the census totals from the Irish Central Statistics Office (2000-2004), our data cover approximately two-thirds of exports from Irish-owned firms. This was a period during which exports did not change much: The aggregate data show export growth of 3% in 2000-2001, followed by a significant decline over the next three years, falling by over 10% in 2001-2002 for example. The survey data used in this paper follow a similar but slightly less extreme pattern, the decline in 2001-2002 is 5% and a return to positive growth is observed by the end of the sample (see Table 1). This difference is likely due to a slight under-representation of small firms in our sample. The export participation patterns of these firms tends to be more volatile.<sup>1</sup>

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. In 2004, foreign owned companies accounted for just over 90 per cent of the country's manufacturing exports (Central Statistics Office, 2004). Therefore, although the current sample can be considered representative of indigenous Irish exporting

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<sup>1</sup>Gleeson and Ruane (2006) discuss the contribution by firm size in their decomposition of export participations and growth of Irish firms.

firms, this constitutes only a small proportion of overall Irish exports. 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. So, it is probably fair to conclude that understanding the export decisions and patterns of indigenous Irish firms is more likely to yield conclusions that apply more broadly across countries.

### 3 Exports and Exporting Firms

The unique feature of this dataset is that it allows us to follow firms exporting activity in detail over time. Before exploiting this aspect of the dataset, we first report cross-sectional statistics similar to those that have been reported in other recent studies.

Previous work has found that international engagement by firms tends to be very concentrated. Bernard, Jensen and Schott (2005) find that the top 1% of US trading (i.e. both exporting and importing) firms accounted for 81% of US trade in 2000. In the case of our Irish data, exporting activity is also concentrated amongst a fairly small number of larger firms. Firms employing over 500 generated 30% of the total exports in 2004 even though they make up less than 3% of the firms in the sample. The smallest firms, although the most numerous at almost 33% of the sample, export only 2-3% of the total.

Table 1 presents summary information on the market coverage of the firms, both overall and by the different size groups. The distribution of the number of export markets is also shown in Figure 1. Consistent with the findings of Eaton, Kortum and Kramarz (2004) for France and of Bernard, Jensen and Schott (2006) for US firms, most firms export to only a small number of markets, with over one-third exporting to a single market.

The average number of markets exported to over the five-year period was 5.9, with a median of 2.8. The average number of destination markets per firm is higher than was found by Bernard, Jensen and Schott (2006). The firms in their analysis exported to 3.3 markets in 2000. The highly skewed nature of the distribution is common across the Irish, French and US firms. Only 17% of the firms in this paper export to more than 10 markets

and just 3% to more than 25. Eaton, Kortum and Kramarz (2004) found approximately 20% of firms exporting to more than 10 markets and reported 1.5% exporting to over 50.

In further comparisons of exporting firms reported in Table 2, we find some consistent differences in the characteristics of firms selling in many markets relative to those in a small number of markets. Firms with greater market coverage tend to be larger in terms of employment (the first column) and there is some evidence suggesting they are more productive: the second column shows sales per employee are higher in firms exporting to more markets. The fourth column shows that firms selling in multiple markets have a fairly similar level of exports per market as those in only one or two markets. This result initially appears counterintuitive given that these firms with many markets export much more in total (third column). The apparent puzzle is resolved when exports to particular markets are compared. Taking the UK as an example: the fifth column of Table 2 shows that firms with more export markets sell much more in the UK than do firms with few export markets. The figure for average exports per market is reduced for firms with many markets because the additional markets they operate in tend to be smaller in scale. These figures denote a pattern of firm export growth in which firms *both* increase sales in their existing markets and expand their portfolio of markets into new destinations.

## 4 Firm Export Dynamics

Figure 1 is a snapshot describing the average distribution for the number of markets prevailing over the five years sample available. We can now use the panel dimension of our dataset to examine the process by which firms move between various points in this distribution—for instance from  $n$  to  $n + 1$  or  $n - 1$  markets—as well as the forces that determine the shape of the cross-sectional distribution.

## 4.1 Entry and Exit Patterns

Table 3 is a summary of the matrix of transition probabilities, characterised as changes in market coverage by number of existing markets. The probabilities are calculated as averages of actual movements for the five years of sample data. Changing coverage by more than plus or minus four markets remains highly unusual so these are not reported. This results in the matrix containing a large number of zeros.

These calculations provide a detailed description of how firms enter exporting and how their export coverage tends to change over time. Firms that enter exporting activity for the first time tend to do so in a very gradual fashion, usually only entering a single market. After this initial entry, firms are more likely to add an additional market than they are to exit. However, the most common pattern is for the number of markets to remain unchanged: 81 percent of firms that exported to one market still exported to only a single market in the following year. When firms that export to a small number of markets do change their coverage, they tend to do so by adding or subtracting only one more market. However, as coverage of existing markets becomes larger, we are more likely to find firms adding or subtracting multiple markets, but rarely by more than four markets.

That the process determining the portfolio of markets becomes more dynamic as firms add more markets is illustrated by the ‘No Change’ line (representing the diagonal in the full matrix). This shows that levels of persistence are high for firms exporting to few markets but decline substantially as market coverage increases. Once a firm exports to more than three markets, it is more likely to change its market coverage from one year to the next than it is to stay in the same cell. As well as the decrease in persistence as market coverage increases, the probability of exiting markets begins to overtake the probability of entry. This gives us a preliminary indication that there will be convergence to a stable long-run distribution.

## 4.2 Transitions and Long-Run Distribution

The matrix of transition probabilities can be used to address two further issues: firstly, what do we know about how this distribution evolved, and secondly can anything be said about its long-run stability? To answer these questions, we follow that approach of Quah (1993) who applied a Markov transition probability methodology to the evolution of country income distributions. This method was also employed by Eaton and Eckstein (1997) for their analysis of the evolution of city size distributions.

In this context, we use a matrix of transition probabilities to generate a hypothetical distribution of firm market coverage. Let  $F_t$  denote the distribution of firms according to the number of export markets they serve at time  $t$  and assume that the evolution of  $F$  can be described by :

$$F_{t+1} = MF_t \tag{1}$$

where  $M$  is a 25x25 transition probability matrix, which maps where points in  $F_t$  end up in  $F_{t+1}$ . Through a process of iteration, the  $s$ -period-ahead predictor for the distribution is given by:

$$F_{t+s} = M^s F_t \tag{2}$$

Taking  $M^s$  to the limit as  $s \rightarrow \infty$  we can represent the long-run (ergodic) distribution of  $F_t$  if it exists and is unique. Using the transition probabilities in Table 3, and calculating higher powers of  $M^n$  until it converged, we generated the asymptotic distribution of market coverage consistent with the transitions observed during our five years of data. Remarkably, the implied long-run distribution fits very closely with the cross-sectional distribution observed in our data: Figure 2 plots the fitted distribution against that observed in the data.

This result shows that, while we cannot observe transitions prior to 2001, the currently-observed cross-sectional distribution is consistent with the hypothesis that transitions of this form have been determining the distribution all along. This is important because it implies that the transition probabilities reported here - which show relatively high rates of

adjustment of market coverage - are not anomalous. Figure 2 also suggests that the current cross-sectional distribution is likely to be stable. In other words, even though the market transitions reported here relate to a period of increased globalisation, they do not imply that the cross-sectional distribution is likely to change much.

## 5 Patterns of Entry and Exit by Market

We now turn from examining the number of markets that firms export to, and focus instead on the dynamics of entry and exit viewed from the point of specific markets. Table 4 documents the distribution of firms across markets and the levels of entry and exit, averaged over the time period. Unsurprisingly, given its proximity and historical links, the UK is the predominant export destination for Irish exporters. The 584 firms who sell at least some of their exports to this market represent 94% of the sample. The second largest market (the USA) has less than half of the number of firms exporting to it than the UK. With the exception of the US, the top ten markets for Irish firms are all located in Western Europe. The ordering of the countries and the issue of a “hierarchy” in entering markets will be discussed further in Section 7, which looks more closely at the identity of the markets.

The most striking feature of the data presented in Table 4 is the extent to which entry and exit exists in all markets. Although the number of exporters in each destination changes only slightly over the period, the gross flows in to and out of markets strongly outweigh net changes in firm numbers. To take the UK as an example, there is an average increase in exporter numbers of 4 each year, not a particularly large change considering the weight of this destination to Irish firms. The underlying pattern is perhaps more dynamic than this relatively small net change might imply. An average of 30 exporters began selling to the UK each year and 26 exited. As a percentage of existing exporters, the UK has one of the lowest rates of entry and exit, presumably due to the fact that the majority of exporters are already present in that particular market. In general, the rates of entry and exit to and from markets tend to increase as we move from more popular to less popular destinations.

These results point to there being unpredictable factors relating to demand and the competitive environment in individual export markets that are difficult to provide information on in advance. One particularly interesting pattern documented in our data is that rates of entry and exit to and from markets are significantly higher in the less popular markets than in the more popular ones. This could be interpreted as weak evidence that firms find it more difficult to assess their prospects of success in advance in markets that are less familiar to the firm and on which information on market conditions may not be as widely available.

## 6 Contributions to Export Growth

We have seen that there are substantial gross flows of exporting firms into and out of markets. However, if these are primarily small or marginal exporters, the contribution to total exports may not be quantitatively important. This section provides estimates of the importance of these flows in terms of total exports. Section 6.1 begins by separating the variation in total exports across markets into the contributions from the number of exporting firms and average exports per firm. This approach finds that the number of firms matters but does not differentiate between the flows of entering, continuing and exiting firms. Section 6.2 exploits the panel nature of the data to make this distinction and evaluates the contributions to net export change of the different categories of firm.

### 6.1 Number of Firms and Average Firm Exports

Before examining the role of gross flows of firms, a preliminary question is if the number of exporting firms matter. One way to evaluate this is to separate total exports  $X$  to each destination market  $n$  into the number of exporting firms  $N$  and the average exports per firm  $\bar{x}$ .

$$X_n \equiv N_n \bar{x}_n \tag{3}$$

This identity is expressed in logs below.

$$\ln X_n = \ln N_n + \ln \bar{x}_n \quad (4)$$

The variation in total exports to different markets can thereby be decomposed into the contributions of variation in the number of firms, the average exports per firm and a term related to the covariance of these two elements.

$$\text{Var}(\ln X_n) = \text{Var}(\ln N_n) + \text{Var}(\ln \bar{x}_n) + 2\text{Cov}(\ln N_n, \ln \bar{x}_n) \quad (5)$$

Performing this calculation for each year of data and averaging, we find that the contributions to variation in exports are almost equally divided between the three elements. To be more precise, 31% is accounted for by variation in the number of exporters per market, 33% by variation in average exports per firm and 36% by the covariance. The size of the covariance factor is unsurprising as larger destination markets are likely to both attract more firms and allow each firm to sell more.

The relative contributions of number of firms and average exports per firm can also be determined for export growth.

$$\Delta \ln X_n = \Delta \ln N_n + \Delta \ln \bar{x}_n \quad (6)$$

Looking at export growth rather than cross-sectional variation across markets, we find the exports per firm dominate. Averaging over the five years, changes in exports per firm explains 97% of export growth, while growth in the number of firms account for the residual 3% of total export growth. The drawback of this type of calculation is that the number of exporters is a net figure, and we have already observed that there are substantial gross flows of exporting firms across all destinations. The next subsection presents an alternative decomposition to evaluate the importance of these flows to overall export growth.

## 6.2 Decomposition of Gross Export Flows

One way to make use of the panel nature of the data to decompose net changes in exports is to separate the positive contributions from firms who start exporting or increase their

exports minus the effect of firms who reduce their exports or stop exporting altogether.<sup>2</sup> This method follows a popular approach in the literature on labour markets (see for example Davis, Haltiwanger and Schuh, 1996). This decomposition has been applied to exporting firms before by Wagner (2003) for German firms and Gleeson and Ruane (2006) using Irish data. Both of these papers evaluate the contribution of entry and exit to exporting, focusing in the German case on a sizeable export boom, and in the Irish case on two exceptional episodes - an export boom with growth of 35% and in contrast a collapse of 26% in net exports. Wagner's results show the majority of export dynamics are accounted for by increases and decreases in exports by existing exporters. Gleeson and Ruane find a somewhat greater contribution from entry and exit, and demonstrate substantial volatility particularly for the smallest firms with exit and re-entry being a more common feature than had previously been identified in the literature.

The top panel of Table 5 reports the results of this method of decomposing exports. Confirming the findings of the existing research, the main contributions to net export change come from changes in exports by incumbent firms, with starters and stoppers featuring only marginally. For example, the 4% growth in net exports in 2000-2001 comes from increaser firms changing exports by 12% and decreasers by -8%. Starters and stoppers contribute less than 1% in all years. The survey nature of the data and its focus on exporters may explain why the entry and exit contributions are significantly smaller in these results than in Gleeson and Ruane (2006). It should also be noted that the period covered by the current data was one of relatively stagnant export performance, unlike the other papers which are examining significant boom or bust episodes.

Moving beyond the contribution of firms who start exporting or quit it altogether, the rates at which firms change their market coverage raise the question of how important entry and exit of firms to individual markets are for aggregate exports. This question can be addressed by applying the Davis-Haltiwanger decomposition to each individual market. In

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<sup>2</sup>A fifth possible category is firms with unchanged exports across two years, but there are no observations of this in the data. Additional breakdown by identifying re-starters and re-stoppers as Gleeson and Ruane (2006) do is also not feasible given the shorter time span of data available in this paper

other words, net export growth can also be separated into increases and decreases in exports across individual markets, and within these markets one can calculate the importance of entry, exit, increasers and decreasers. The four groups again combine to give the net change in exports, this time the contributions being from markets rather than from firms. While entry and exit to exporting was only a tiny proportion of export changes, the contribution of changes in market coverage are substantially larger. The middle panel of Table 5 shows firms entering a new market generate gross exports of between 2-5% of the total. The bulk of gross export flows still comes from incumbent firms in any market increasing or decreasing exports.

The contributions of starters and stoppers to exporting in different destinations may however be under-estimated by the decomposition above. Comparing measurements of export sales of incumbent firms and firms switching markets has two potential drawbacks. The first is a matter of accountancy; incumbent firms are reporting exports for an entire year, whereas it is highly improbable that this is true of firms changing their markets. Unless all firms entering a new market do so on the first day of the accounting period, we are not comparing like with like. A second potential issue could come from assumptions made about the nature of sunk costs in exporting. If, as several papers have suggested (e.g. Roberts and Tybout, 1997), a sunk cost is encountered on becoming an exporter and this is borne completely within the first exporting period it is fairly reasonable to assume that firms take some time to establish their exporting activity.

An attempt to address this issue is to redo the decomposition of changes in exports by market over varying time periods. The final panel of Table 5 reports these results. Focusing on the final column, contributions to net export growth (or rather decline in this instance) between 2000 and 2004 are calculated. Firms who were exporting to a market in 2004 where they had not been present in 2000 added 7%, while firms who stopped exporting to a market they had exported to in 2000 contributed -10%. Increasers and decreasers essentially cancel one another out with gross changes of 24% each. Taking this approach the relative contributions of firms changing markets becomes even more evident.

## 7 Market Characteristics

The preceding analysis has not involved any information on the identity of markets. Knowing precisely where the firms export to, and not simply the number of markets, allows some aspects of the geographic patterns of trade to be examined in more detail. This section does this by testing the prediction of a “hierarchy” in export markets, as proposed by Eaton, Kortum and Kramarz (2005). According to this hypothesis, countries can be strictly ranked according to the factors that act as barriers to trade. Thus, those firms that export to one market will enter the most popular market, and if they add a market, it will be the second most popular market. Section 7.1 shows some evidence of the existence of a ranking of markets by looking at where firms with different levels of market coverage export to. There is, however, considerable heterogeneity amongst the firms, particularly in terms of which of the less popular markets they export to. Section 7.2 tests the hierarchy concept using a slightly different approach, asking if firms expanding their market coverage only enter less popular markets than those they already sell to and vice versa for firms exiting markets. Again, there is evidence to support this hypothesis, but exceptions can and do exist.

### 7.1 Destination Hierarchy

Knowing which markets are exported to by firms can be used to examine the prediction of the existence of a hierarchy of markets. Eaton, Kortum and Kramarz (2005) suggest a simple mechanism that leads to such a hierarchy. In their model, firms differ only by their productivity levels, and thus have different levels of unit costs. If trade barriers are identical for all firms, then these cost differentials will determine which export markets can be profitably entered. Specifically, each market will have a cost threshold. If the firm is efficient enough to enter the  $k$ -th market, then by definition it is efficient enough to be exporting to all markets with a higher cost threshold than  $k$ 's.

Eaton, Kortum and Kramarz point to “substantial deviations” from such a hierarchy in their data and similarly no rigid ordering of destinations is observed amongst the Irish

firms. There is, however, some weaker evidence to support the idea of a sequence of export markets. This can be seen by dividing the firms into four groups according to the number of markets they export to: 1-3 markets, 4-6 markets, 7-10 markets and 11 or more. Markets are ranked by the number of firms exporting to them (as in Table 4). For each group of firms, the percentage exporting to each market is graphed in Figure 3. Almost all firms export to the top market (the UK). The second most highly ranked market is exported to by 15% of firms in the 1-3 markets group, 51% of firms in 4-6 markets and 75% of firms who export to more than 10. Moving left down the ranking of markets, there is no crossing of the lines representing the different firm groups - this can tentatively be interpreted as evidence that firms only export to less popular markets if they also have an export presence in the more popular destinations.

This suggests that a hierarchy of markets may exist, but is not necessarily the same for all firms. One potential explanation for deviations from the strict hierarchy is that preferences for products may not be identical in all markets. Another is that trade barriers across countries may not be the same across all sectors. Finally, it should be kept in mind that the popularity ranking of the markets in our dataset may not be precise enough. There are a large number of markets with very similar numbers of exporters, so their relative positions may be determined by the presence of just one additional firm.

## 7.2 Entry and Exit in the Hierarchy

An alternative test for the existence of a hierarchy in destinations is to look at entry and exit by market popularity. To do this, the markets are ranked 1 to 53, with 1 being the most popular market (UK) and 53 being the least popular (Tunisia). This allows us to identify the lowest ranked market for each firm. If the theoretical prediction is at all accurate we would expect a firm entering an additional market to enter a less popular market than those it already serves. Likewise, exiting firms should be moving out of their least popular markets first. This is a fairly weak test in that it does not say that a firm exporting to the  $k$ -th most popular market has to next move to the  $k + 1$ -th as the strict hierarchy

would suggest. It therefore allows for particular markets to be skipped over by firms (for whatever reason), so long as the general pattern is of movement from exporting to highly ranked markets first followed by movement into less popular destinations (or vice versa for exitors).

Figure 4 plots changes in market coverage against changes in the rank of the least popular previous market. Although some exceptions do exist, the vast majority of observations fit with the conjecture that firms increasing market coverage are moving into lower ranked markets (upper-right quadrant) and those reducing market coverage are exiting their lowest ranked markets (lower-left quadrant).

## 8 Implications of our Findings

This paper has presented a range of calculations exploring exporting activity at the firm-level. This section now draws together these results and interprets them in terms of models of exporting and the implications they may have for export policy. Section 8.1 examines where the empirical findings fit with the current theories of firm exporting and where predicted patterns do not appear to hold in the data. Section 8.2 discusses some general policy lessons suggested by the results.

### 8.1 Implications for Models of Firm Exporting

The high levels of persistence in exporting status found in papers such as Roberts and Tybout (1997) has generally been interpreted as evidence of significant sunk costs related to learning about foreign markets and setting up export operations. These costs have been assumed to represent a major barrier to participating in trade. In addition, the reluctance to re-incur these sunk costs are assumed to explain why firms rarely exit exporting altogether. However, our data suggest a more complex picture than suggested by the sunk costs theory.

Rather than overcoming a major hurdle, firms that enter exporting activity for the first time tend to do so in a very gradual fashion, usually only entering a single market. Some

of these firms tend to move on to add markets and to expand sales within their existing markets. However, the transition probabilities reported in Table 3 show that this is a relatively slow and gradual process. Moreover, those firms that export to many markets tend to be larger and more productive, and are at little risk of exiting exporting altogether. Thus, our data provide an alternative explanation for why exit from exporting is rarely observed. Most firms involved in exporting are sufficiently established in enough export markets that they are very unlikely to exit from exporting altogether. Indeed, in our data, it turned out that the only firms that reported exiting from exporting activity were those who had been previously in one or two markets.

These results suggest a picture of firms gradually establishing their exporting activity over time, with the initial entry into exporting being less important than suggested by the sunk costs theory. The literature on sunk costs has often stressed that learning about individual foreign markets and setting up export operations may represent significant barriers to export participation. To the extent that our data show changes in firms' portfolio of export markets to be quite common, the importance of sunk costs of this type may be less important than previously thought.

Moving beyond the issue of sunk costs, there does not appear to be any single existing model of exporting which predicts all of the patterns, documented here, from the evidence on changing rates of transition as the number of markets increase to the evidence on which markets firms export to.

The type of model that seems to best fit the data is one incorporating firm-level productivity differentials and varying thresholds to entry across markets, along the lines of the model proposed by Eaton, Kortum and Kramarz (2005). This type of model, which allows for both firm-specific and market-specific shocks can explain why firms in more markets are more likely to change market coverage. With the possibility of both types of shock, firms exporting to many markets might have a higher probability of experiencing a negative shock in at least one of their destinations. Higher rates of market entry for firms already exporting to many markets, on the other hand, could be linked to positive productivity

shocks. Another possibility is that these higher entry rates could fit with models where there is some process of learning by exporting.

Finally, the patterns documented in Section 7 of firms exporting to closer or more popular markets first before entering more distant destinations fits with the general idea of a hierarchy predicted by the Eaton-Kortum-Kramarz model. Although the actual data showed more heterogeneity than the strict prediction, the general pattern of sequential entry into markets appears to hold and could be investigated more closely as longer time-spans of data become available.

## **8.2 Implications for Policy**

These results point to a number of implications for export promotion policy. The first stems from our finding that firms tend to gradually evolve as exporters, usually only entering a single market and adding markets slowly. This suggests that there is room for policy agencies to assist firms at all stages of their involvement in exporting. This contrasts somewhat with the emphasis in the literature on sunk costs, which has viewed the initial entry into exporting as the major barrier and generally pointed towards policies aimed at helping firms overcome this hurdle.

In addition to knowing how many markets the individual firms export to, the data identifies exactly which countries the firms are active in. This showed that the set of firms exporting to each market is constantly changing. A second implication of the results therefore suggests that policies aimed towards promoting exports to a particular destination should not just focus on those firms currently in the market. Flexibility of policy is important to deal with the constant turnover of firms exporting to each market.

A third implication arises from the observation of simultaneous entry and exit in all markets. This should be interpreted as cautioning against any export promotion policy that tries to identify and target specific markets. Policy-makers should be particularly aware of the importance of firm-specific factors that will mean some firms will not thrive

in a particular market even if they successfully export in others.

Finally, the results of the decomposition exercise helps to shed light on the relative effectiveness of two different broad categories of policies: Policies that focus on assisting firms to expand their exports versus policies that focus on increasing the export sales of firms in their existing destinations. Comparing these two potential approaches, we can show that although entry into new markets is somewhat important in its contribution to overall export flows, increasing sales in existing markets is the dominant force behind export growth. Aiding existing exporters to grow in their current markets is therefore as important a focus for policy-makers as assistance aimed at getting firms into additional markets.

## 9 Conclusions

The empirical literature on firm exporting has been restricted by a lack of data, most notably in terms of any breakdown of destination markets. This paper uses a unique survey of Irish firms over a five-year period, which contains detailed information on exports to over fifty markets. This allows us to document some new facts on the distribution of firms' export markets and on changes in market coverage.

There are five main findings from this analysis. First, the rates at which firms enter and exit individual markets are much higher than models of sunk costs in exporting might have led one to suppose. It appears that despite the well-documented persistence in exporting status, exporting is a very dynamic process and changes in market portfolios of exporters are a relatively common occurrence. Second, the market transitions contained in the five years of data can be used to provide a detailed description of the how firms' exporting patterns evolve over time. Most firms start out by entering only a single market and then slowly add markets; in contrast, firms that are in a large number of markets exhibit frequent changes in their portfolio of destinations. Third, the calculated transition rates can be used to generate predictions for a hypothetical long-run distribution, which turns out to fit remarkably well with the observed distribution. Fourth, the flows related to firms entering

and exiting individual markets make a significant contribution to total export flows, but changes in sales to existing destination are more important. Fifth, utilising information on the identity of the markets gives some evidence of a hierarchy of export destinations, albeit one with considerable firm heterogeneity.

## References

- [1] Bernard, Andrew B. and J. Bradford Jensen (1995). “Exporters, Jobs and Wages in US Manufacturing: 1976-1987” *Brookings Papers on Economic Activity: Microeconomics* Vol. 1995, pp. 67-112
- [2] Bernard, Andrew B. and J. Bradford Jensen (2004). “Entry, Expansion and Intensity in the US Export Boom, 1987-1992,” *Review of International Economics* 12(4), pp. 662-675
- [3] Bernard, Andrew B., J. Bradford Jensen and Peter K. Schott (2005). “Importers, Exporters and Multinationals: A Portrait of Firms in the U.S. that Trade Goods,” *NBER Working Paper* No.11404
- [4] Bernard, Andrew B., Jonathan Eaton, J. Bradford Jensen and Samuel Kortum (2003). “Plants and Productivity in International Trade,” *American Economic Review*, Vol. 93, No.4, pp. 1268-1290
- [5] Bernard, Andrew B. and Joachim Wagner (2001). “Export Entry and Exit by German Firms,” *Review of World Economics* Vol. 137, No.1
- [6] Central Statistics Office (2000-2004). *Census of Industrial Production*, Dublin
- [7] Chaney, Thomas (2005a). “Distorted Gravity: Heterogeneous Firms, Market Structure and the Geography of International Trade” mimeo, University of Chicago
- [8] Chaney, Thomas (2005b). “Liquidity Constrained Exporters” mimeo, University of Chicago

- [9] Davis, Steven, John Haltiwanger and Scott Schuh (1996). *Job Creation and Destruction*, Cambridge, MIT Press
- [10] Eaton, Jonathan and Zvi Eckstein (1997). "Cities and Growth: Theory and Evidence from France and Japan" *Regional Science and Urban Economics* 27, pp. 443-474
- [11] Eaton, Jonathan and Samuel Kortum (2002). "Technology, Geography and Trade" *Econometrica* 70(5) pp. 1741-1779
- [12] Eaton, Jonathan, Samuel Kortum and Francis Kramerz (2004). "Dissecting Trade: Firms, Industries and Export Destinations," *American Economic Review* Vol. 94, No.2, pp. 150-152
- [13] Eaton, Jonathan, Samuel Kortum and Francis Kramerz (2005). "An Anatomy of International Trade: Evidence from French Firms", mimeo, New York University
- [14] Gleeson, Anne Marie and Frances Ruane (2006). "Export Dynamics in Small Open Economies: Indigenous Irish Manufacturing Exports, 1985-2003" *IIIS Discussion Paper* No.140/May 2006
- [15] Melitz, Marc J. (2003). "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity", *Econometrica* Vol. 71, No.6, pp. 1695-1725
- [16] Quah, Danny (1993). "Empirical Cross-Section Dynamics in Economic Growth" *European Economic Review* (37) pp. 426-434
- [17] 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, No.4, pp. 545-564
- [18] Wagner, Joachim (2003). "On the Micro-Structure of the German Export Boom: Evidence from Establishment Panel Data 1995-2002" *HWWA Discussion Paper* No.249

Table 1: Market Coverage and Firm Size (Average 2000-2004)

	All Firms	Firm Employment					
		1-24	25-49	50-99	100-249	250-499	500+
Average Markets	5.93	4.70	4.87	5.93	8.05	12.29	9.88
Median Markets	2.80	2.00	2.00	3.20	5.40	9.20	7.10
% Exporting to 1 Market	0.34	0.43	0.40	0.28	0.23	0.16	0.13
% Exporting to 2-5 Markets	0.33	0.30	0.35	0.41	0.27	0.14	0.31
% Exporting to 6-10 Markets	0.15	0.14	0.11	0.15	0.23	0.26	0.20
% Exporting to 11-25 Markets	0.14	0.11	0.12	0.13	0.22	0.32	0.30
% Exporting to > 25 Markets	0.03	0.02	0.02	0.03	0.05	0.12	0.07

Table 2: Firm Characteristics and Market Coverage (Average 2000-2004)

Markets	Employment	Sales per Emp.	Exports	Sales per Market	UK Sales
1	55	134	1978	1978	1878
2	55	115	2681	1341	2191
3	106	130	5995	1998	4482
4	71	121	4771	1193	2627
5	85	121	6375	1275	3986
6-10	121	174	10979	1391	5073
11+	166	246	29095	1509	8611

Table 3: Market Transition Rates

	Market Coverage in t-1								
	0	1	2	3	4	5	6-10	11-25	>25
+4 Markets	0.00	0.00	0.01	0.01	0.02	0.01	0.03	0.05	0.04
+3 Markets	0.01	0.00	0.02	0.03	0.03	0.04	0.03	0.05	0.09
+2 Markets	0.01	0.02	0.04	0.09	0.04	0.10	0.08	0.10	0.13
+1 Market	0.15	0.08	0.14	0.13	0.16	0.18	0.16	0.11	0.09
No Change	0.83	0.81	0.56	0.46	0.38	0.33	0.28	0.17	0.27
-1 Market	0.00	0.08	0.17	0.21	0.22	0.20	0.14	0.14	0.12
-2 Markets	0.00	0.00	0.04	0.06	0.08	0.05	0.12	0.07	0.09
-3 Markets	0.00	0.00	0.00	0.00	0.02	0.02	0.05	0.08	0.02
-4 Markets	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.06	0.06
Memo items									
Total Entry	0.17	0.11	0.22	0.27	0.29	0.37	0.36	0.38	0.35
Total Exit	0.00	0.08	0.22	0.27	0.33	0.30	0.36	0.45	0.38

Table 4: Average Number of Exporters, Entry and Exit by Destination

	Exporters	Entry	Exit		Exporters	Entry	Exit
UK	584	30	26	Saudi Arabia	40	9	10
USA	228	30	25	Hong Kong	36	10	10
Germany	213	26	27	Hungary	38	12	9
France	210	26	22	China	39	11	7
Netherlands	183	26	22	S. Korea	31	8	8
Italy	144	21	19	Taiwan	32	7	6
Spain	136	24	20	India	35	11	9
Belgium	139	25	24	Brazil	23	5	6
Sweden	122	19	21	New Zealand	33	10	8
Denmark	110	20	17	Malaysia	31	7	6
Portugal	76	18	18	Egypt	26	7	7
Switzerland	87	19	15	Philippines	21	5	7
Japan	75	17	17	Argentina	19	4	4
Norway	74	15	16	Kuwait	23	6	6
Canada	71	15	14	Mexico	24	8	6
Austria	69	15	14	Lebanon	17	6	7
Finland	78	16	11	Nigeria	22	6	4
Poland	61	14	11	Slovak R.	14	6	6
Australia	65	16	13	Slovenia	19	6	5
South Africa	56	15	14	Jordan	17	6	6
Greece	59	12	11	Thailand	20	6	3
Russia	43	8	10	Pakistan	17	4	3
Israel	53	11	10	Chile	15	3	4
Turkey	41	11	14	Algeria	7	2	4
Czech R.	46	13	12	Morocco	8	3	3
UAE	44	11	12	Tunisia	5	3	2
Singapore	40	11	12				

Table 5: Contributions to Net Export Growth

	2000-2001	2001-2002	2002-2003	2003-2004
<i>Summed over Firms</i>				
Starters	0.0007	0.0034	0.0002	0.0002
Stoppers	-0.0024	-0.0033	-0.0031	-0.0006
Increasers	0.12	0.10	0.07	0.09
Decreasers	-0.08	-0.16	-0.13	-0.04
= Net Change	0.04	-0.05	-0.06	0.05
<i>Summed over Markets</i>				
Starters	0.03	0.05	0.03	0.02
Stoppers	-0.04	-0.05	-0.03	-0.01
Increasers	0.19	0.14	0.11	0.14
Decreasers	-0.14	-0.19	-0.17	-0.09
= Net Change	0.04	-0.05	-0.06	0.05
	2000-2001	2000-2002	2000-2003	2000-2004
<i>Summed over Markets</i>				
Starters	0.03	0.07	0.06	0.07
Stoppers	-0.04	-0.09	-0.10	-0.10
Increasers	0.19	0.20	0.21	0.24
Decreasers	-0.14	-0.19	-0.25	-0.24
= Net Change	0.04	-0.01	-0.08	-0.03

Figure 1

Distribution of Firms by Market Coverage

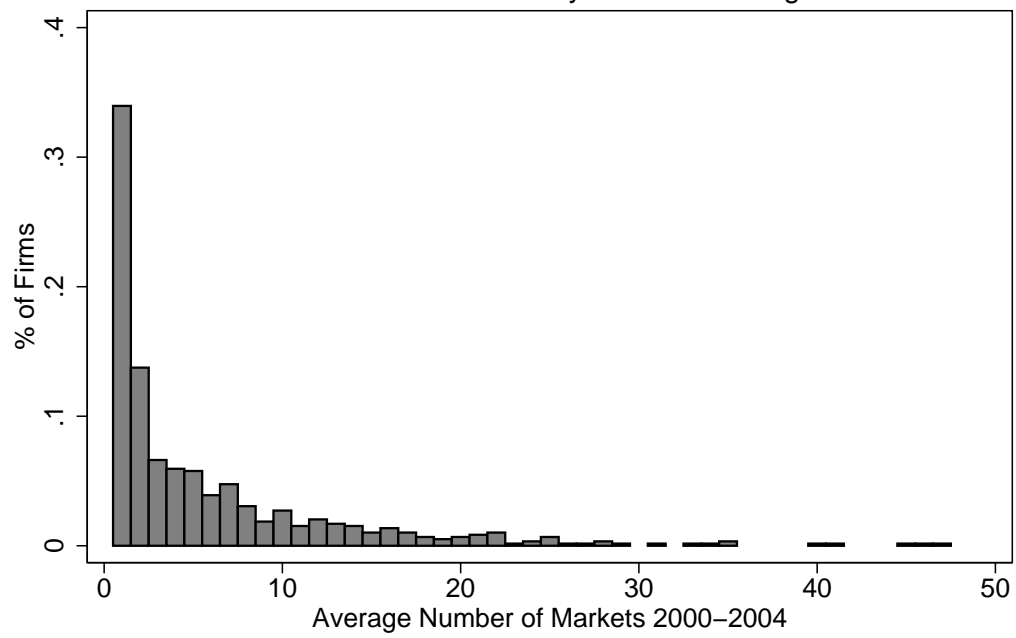


Figure 2

Distribution of Market Coverage: Actual and Long-Run Implied by Transition Matrix

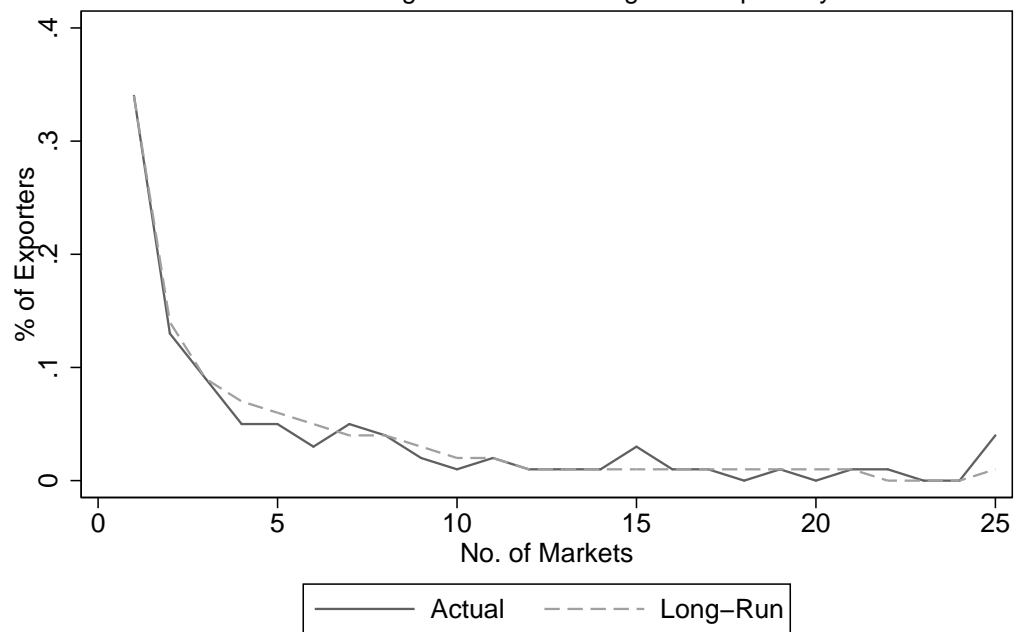


Figure 3  
Market Participation and Firm Market Coverage

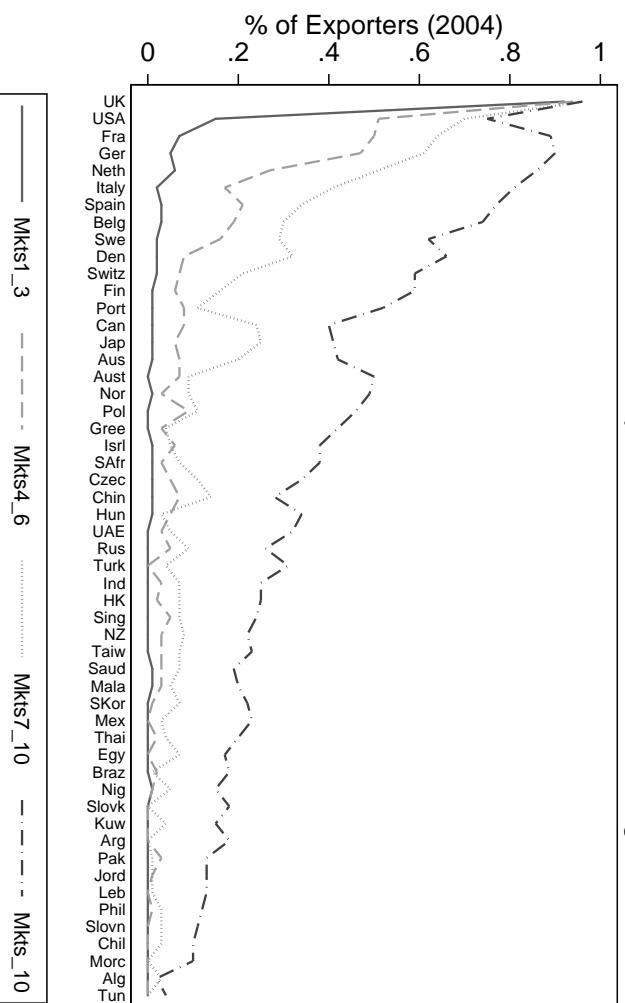


Figure 4  
Entry, Exit and Market Popularity

