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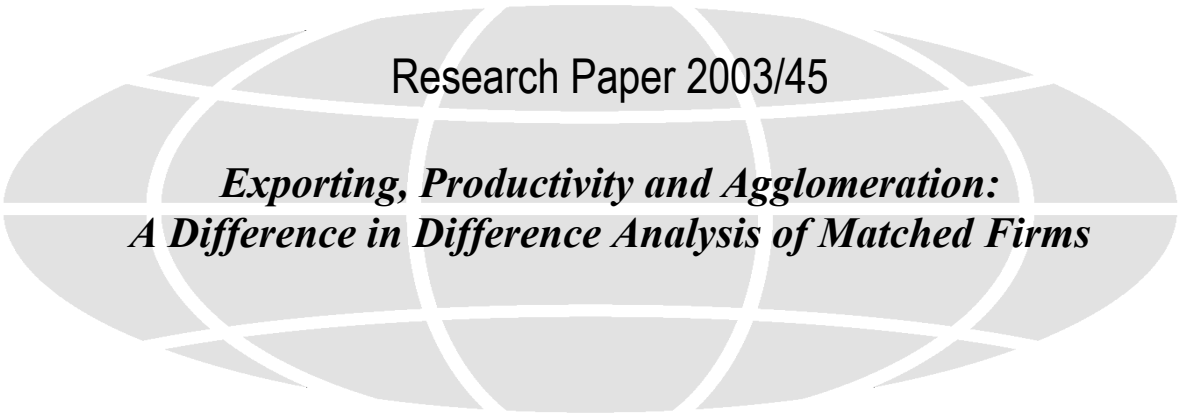

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Exporting, Productivity and Agglomeration: A Difference in Difference Analysis of Matched Firms

by

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Abstract

In this paper we consider three questions. Why do only some firms enter export markets? What are the benefits to the firm from export market entry? Why do some of these firms exit the market at a future date? Using data on UK manufacturing firms from 1988 to 2002 we find evidence that information spillovers between firms can raise the probability of entry and for a matched sample of firms there are additional benefits once entry has occurred. Exit is driven partly by the size and TFP of the firm, and partly by industry characteristics.

JEL classification: F14, F12

Keywords: exporting, productivity, agglomeration, matching

Outline

1. *Introduction*
2. *Literature Review*
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4. *Export Market Entry, Agglomeration and Firm Productivity*
5. *Post-Entry Productivity Effects*
6. *Firm Survival in Export Markets*
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Non-Technical Summary *(500 words)*

In this paper we consider the answers to three questions. Why do only some firms enter export markets? What are the benefits to the firm from export market entry? Why do some of these firms exit the market at a future date? Recent theoretical developments provide uninteresting answers; the choices of firms with respect to export markets are passive. Only the most productive firms enter export markets, they receive no additional benefit from doing so; and the least productive are forced out of the market. The implication is that policy intervention is unwarranted.

Using data on UK manufacturing firms over the period 1988 to 2002 we find a number of results that suggest instead some value to policy intervention. There is evidence that information spillovers between firms can raise the probability of entry and there are benefits to the firm once entry has occurred. Exit is driven partly by firm characteristics, such as size and TFP, and partly by industry characteristics.

Controlling for a number of firm and industry characteristics we find strong evidence of demonstration effects between potential entrants from existing exporters. The greater the number of existing exporters and other new entrants raises the greater the probability that non-exporter will become exporters. Moreover we find a geographical and industrial bias to these demonstration effects, they are strongest for geographical and industrial clusters of exporters. These result are found to be robust to a number of changes in specification, for example controlling for the fact that some industries are more agglomerated than others, and for the effect of macroeconomic shocks, such as those on the exchange rate.

We also find evidence that firms that new exporters receive a boost to their performance. Comparing new exporters with non-exporting firms that had similar characteristics we find that new exporters achieve faster productivity growth after entry. There is no additional benefit to new entrants clustered close to existing exporters, but the benefits are greater the more exposed to foreign markets is the firm. We might conclude that to the extent that information flows across firms, then spillovers or demonstration effects from domestic exporters to non-exporters are important for entry but not post-entry, where domestic firms learn more from exposure to foreign firms.

Finally we also look at the drivers of exit. We find that on average exit is driven by the size of the firm and negative output shocks, both of which are negatively correlated with exit. We also find a number of industry characteristics to be important. The higher the level of sunk-costs the more likely exit will be, while exit is more likely from homogenous than heterogeneous goods industries, measured by the level of intra-industry trade. However the level of import penetration does not lead to increased export market exit. Controlling for industry characteristics we find that the weakest firms are the ones forced out of the market, firms with low TFP are more likely to exit.

1. INTRODUCTION

In recent years the focus of econometric analysis of adjustment to globalisation has shifted from countries and industries to plants and firms. As a result, new insights are being gained into the forces which shape the decision to participate in export markets, the choice between exporting and foreign direct investment, the choice of location for footloose firms, interactions between the productivity of domestic and foreign firms and so on. Moreover, analysis of adjustment at the firm level to specific shocks such as trade liberalisation, regional integration and exchange rate changes are also proving possible. The emergence of this new literature has been fashioned by three developments: the growing availability of large scale firm level datasets; the development of new microeconometric tools for interrogating these datasets; and the development of new theories to explain some of the stylised facts that the data is revealing.

The most rapidly growing part of this literature has been focused on various aspects of entry to, participation in and exit from export markets. Questions addressed include why some firms export and others do not, whether exporting brings productivity benefits, whether survival depends on ongoing productivity improvement. This paper contributes to that literature. Its focus is the exporting behaviour of manufacturing firms in the United Kingdom. Some of the questions we ask are similar to those asked in the context of research on exporting in other countries. For instance, are exporters generally more productive than non-exporters? Other questions are new: for example, are agglomeration forces important to entry? when firms are matched, do we still observe productivity effects? does intra-industry trade affect the likelihood of exit?

Like most other work, we find that on average exporting firms are larger and more productive than non-exporting firms. We also find that agglomeration, both spatial and industrial, is important to entry and observe some subtle but potentially important differences between small and large firms. To see whether productivity benefits can be reliably attributed to the decision to start exporting, we use *nearest neighbour matching* to ensure we have controlled for all unobserved heterogeneity between firms that go on to enter export markets and those that do not. This econometric strategy is particularly well suited to isolating the real effects attributable to export market entry. We find that productivity increases on entry relative to our sample of matched non-exporters. We track

firm performance for up to four years after entry but can find no robust evidence of further productivity benefits, except in those firms most exposed to export markets. New entrants that are located close to other export firms from the same industry and region receive no additional benefit. Finally, our survival analysis strongly suggests that, unlike in other countries it is not productivity shocks that trigger exit, but losses of market share.

The remainder of the paper is organised as follows. In Section 2 we briefly review the existing literature to set the context for our analysis. Section 3 sets out our matching and differences-in-differences model and reports on the details of our dataset. In Section 4 and 5 we report on and discuss our results relating to entry and post entry performance of firms and in Section 6 we do the same for exit. Section 7 concludes.

2. LITERATURE REVIEW

The literature on aspects of transitions into and out of export markets is relatively recent and has grown rapidly. Research has been empirically led, with the most important early contributions being Bernard and Jensen (1995 and 1999) on the US and Clerides, Lach and Tybout (1998) on Columbia, Mexico and Morocco. This has stimulated work on China (Kraay 1999); Germany (Bernard and Wagner 1997 and Wagner 2002); Spain (Delgado, Fariñas and Ruano 2002); Italy (Castellani 2002); United Kingdom (Girma, Greenaway and Kneller 2003, 2004); Canada (Baldwin and Gu 2003); Sweden (Hansson and Lundin 2004; Greenaway, Gullstrand and Kneller 2003); and further work on the US (Bernard and Jensen 2001, 2004).

This literature now spans a number of countries and time periods. Most work relies on panel data techniques, though some is cross-section and one (Delgado, Fariñas and Ruano 2002) uses non-parametric methods. Analysis of the results from this literature reveals a number of regularities. First, across all of these countries, the number of firms involved in export markets has increased through time. Since the last quarter of the twentieth century was a period of rapid globalisation, this is not surprising. Second, the proportion of firms involved in exporting seems to be correlated with country size: around 25 per cent of US firms export, compared with 45 per cent in Germany and over 80 per cent in Sweden. Third, almost all studies (with the exception of Wagner 2003) report that exporters are on average larger than non-exporters.

A fourth common, but not universal, finding is that exporters are more productive than non-exporters; a finding that is usually taken to be confirmatory evidence of there being sunk costs associated with globalising. Most studies report that productivity is boosted by entry, but few report evidence of post-entry benefits to productivity. Fifth, export intensity may matter in that firms whose activities are more focused on overseas rather than domestic markets benefit more from exporting. Sixth, ownership can matter, with productivity benefits being greater for foreign owned than domestic owned firms. Finally, when exit occurs, it is typically because a firm has been subject to a productivity shock.

Recently a number of important theoretical contributions have been made by way of building models that help explain these empirical regularities. The key contributions here are Clerides, Lach and Tybout (1998), Melitz (2003), Jean (2002), Bernard, Eaton, Jensen and Kortum (2003), Medin (2003) and Helpman, Melitz and Yeaple (2003). The first is essentially an empirical analysis, motivated by a simple partial equilibrium model. Clerides, Lach and Tybout (1998) show that if there are sunk costs associated with export market entry, firms have to become more efficient prior to entry and self-select into export markets. They also show that firms can be expected to show increased costs prior to exit. Thirdly they not only demonstrate the potential for learning effects but go on to show how productivity dispersion will be higher among exporters when learning effects are present.

In a very important paper, Melitz (2003) develops a general equilibrium model with heterogeneous firms. Export entry is again costly. As a result the most productive firms self-select into the export market. This is taken a stage further by Helpman, Melitz and Yeaple (2003), where firms also have the opportunity, subject to incurring a fixed cost, of setting up an affiliate overseas. The model is again general equilibrium and yields the intuitively appealing result that the most productive firms engage in FDI, the next most productive export and the less productive produce only for the domestic market, with the least productive ceasing production altogether.[1]

[1] Head and Reis (2003) and Girma, Kneller and Pisu (2003) offer the first tests of this model and report supportive evidence.

By contrast, Medin (2003) and Jean (2002) are representative firm models. They too incorporate fixed costs and trade costs so that exporters and non-exporters can co-exist. Fixed costs ensure that only a share of firms export and that share varies with trade costs. Interestingly, in the Medin (2003) model, small countries have a higher share of exporting firms when there are increasing returns to scale, a reversal of the standard home market effect which is common to increasing returns/monopolistic competition trade models.

3. METHODOLOGY, DATA AND SAMPLE CHARACTERSITICS

Sample Frame and Data Characteristics

The United Kingdom is a relatively large industrialised economy and an important exporter of manufactures; in fact the fifth largest globally. Unfortunately its production census (the Annual Respondents Database) does not collect information on firms' exporting activity. However, two other firms level surveys do, namely OneSource and FAME.[2]

Our sample frame does not encompass the full dataset from either source however, for three reasons. First, we are only interested in manufactures since, in general, export data on service providers is not available. Second, we exclude foreign owned companies since they will have different motives for exporting than indigenous firms. Third we exclude firms for which there is incomplete information on output and factor inputs. Our final data set therefore contains comprehensive information on 11,225 firms for the period 1989-2002 yielding a total of 78,606 observations. On average there are six years of data on each firm. This sample frame is around 50 per cent larger than that for the only other study on the UK to date (Girma, Greenaway and Kneller 2004).[3]

Of the 11,225 firms in the sample 8,525 firms, or 75 per cent, have exported in at least one year. As a result of switching in and out of export markets the percentage exporting within any given year is lower than this however. Taking 1995 as a representative year we find

[2] Both *Onesource* and *FAME* are non-stratified samples with an oversampling of large firms. This in part provides a motivation for the matching analysis of later sections, although throughout we consider the robustness of the results to the use of a sample of small firms (employment less than 50).
[3] This reflects a combination of both more years (1988-2002) and more firms; there are approximately 20,000 new observations over the period used in the first study (1988-1999) and 4,000 observations in the extension to the time period (2000-2002).

that 66 per cent of firms exported.[4] The incidence of exporting in the UK is consistent with evidence from other countries. According to Bernard, Eaton, Jensen and Kortum (2003) the export ratio in the US is around 25 per cent (1992 figure); while for other European countries the comparable figures are; Germany 45 per cent (Bernard & Wagner, 1997 – 1992 figure); Italy 73 per cent (Castellani, 2002); Spain 62 per cent (Delgado et al., 2002 – 1996 figure); and Sweden 90 per cent (Greenaway et al, 2003 – 1997 figure).

The central focus of this work is the relationship between transitions into and out of export markets and firm level productivity. The latter was calculated as both labour productivity and total factor productivity (TFP). We estimate several alternative measures of TFP, all as residuals from an econometrically estimated production function. In the first measure, labelled TFP1, TFP is expressed relative to the 2-digit SIC industry, the second (TFP2) is expressed relative to the 3-digit SIC industry, while the third (TFP3) controls for fixed firm characteristics.

The basic data characteristics of exporters and non-exporters in our sample are set out in Table 1. On average exporting firms appear to be 20 per cent larger than non-exporters in terms of output and almost 13 per cent larger in terms of employment. They also appear to be more productive: on average the productivity of exporters is 5.4 per cent above the industry mean whilst that of non-exporters is 4.6 per cent below the mean, yielding a total differential of 10 per cent.

Table 1: Basic Data Characteristics of Exporters and Non-Exporters

Non-exporters	*Obs*	*Mean*	*St. deviation*
Productivity	25943	-0.0456	0.67
Output	26278	32604.47	388943.5
Employment	26278	341.86	2058.03
Exporters	*Obs*	*Mean*	
Productivity	52019	0.0539	0.61
Output	52328	39382.48	214334.7
Employment	52328	384.80	1681.29
First time exporters	*Obs*	*Mean*	*St. deviation*
Productivity	5117	0.0208	0.63
Output	5152	39784.81	22594.3
Employment	5152	463.85	2557.94

But it would be a mistake to attribute this productivity differential entirely to exporting. Exporters might be concentrated in skill intensive, high productivity industries for example;

[4] These results are robust to the use of 1993 as an alternative year.

size per se may give them an advantage and so on. To isolate the productivity related aspects of exporting we deploy matching and differences-in-differences analysis, a detailed explanation of which can be found in Blundell and Costas Dias (2000).

Matching and Differences in Differences Methodology

Let $EXP_{it} \in \{0,1\}$ be an indicator (dummy variable) of whether firm *i* entered export markets for the first time at period t, and g^1_{it+s} the outcome, in this case the growth rate of TFP, at time *t*+*s*,[5] following entry. The term Δg^1_{it+s} measures the change in TFP growth over a given period for the treatment group and the term Δg^0_{it+s} defines the change in the rate of TFP growth in firm *i had it not* entered export markets. The causal effect of export market entry for firm *i* at time period *t* + *s* is therefore defined as the change in TFP growth over period *t*+*s* if export market entry occurred, less the change in TFP growth over the same period if export market entry had *not* occurred. We can write the average expected effect as:

$$E\left\{\Delta g^1_{t+s} - \Delta g^0_{t+s} \mid EXP_{it} = 1\right\} = E\left\{\Delta g^1_{t+s} \mid EXP_{it} = 1\right\} - E\left\{\Delta g^0_{t+s} \mid EXP_{it} = 1\right\} \qquad (1)$$

It is of course the case that the change in TFP growth experienced by firm *i* had it *not* chosen to enter export markets, Δg^0_{it+s}, is unobservable. Causal inference therefore relies on the construction of this counterfactual. Our strategy is to construct this using firms that had similar observable characteristics in period *t* but who did not enter export markets, and remained non-exporters. The average rate of growth $E\left\{\Delta g^0_{t+s} \mid EXP_{it} = 1\right\}$ in equation (1) is measured instead using $E\left\{\Delta g^0_{t+s} \mid EXP_{it} = 0\right\}$.

An important feature in the construction of our counterfactual is the selection of a valid control group. This is where matching techniques come in. The purpose of matching is to pair first time export firms on the basis of some observable variables with a firm that remains a non-exporter. Since matching involves comparing first time exporting and non-exporting firms across a number of observable pre-entry characteristics (productivity, size,

[5] Where $s \geq 0$.

skill and fixed industry and time effects) it is difficult to determine along which dimension to match the firms or what type of weighting scheme to use. We employ *propensity score-matching* (Rosenbaum and Rubin, 1983), which uses the probability of receiving a given treatment, conditional on the pre-entry characteristics of firms, to reduce the dimensionality problem. Matching is therefore performed on the basis of a single index that captures all the information from the (observable) characteristics of the firm pre-entry.

To identify the probability of export market entry (or propensity score) we exploit the findings of the literature on the determinants of export market entry (See for example Bernard and Jensen 1999; Girma, Greenaway and Kneller 2004). In that literature the probability of export market entry is found to depend upon firm level characteristics such as the level of TFP, the size of the firm, relative skill intensity, as well as fixed industry and time effects. Accordingly we estimate a panel random effects equation that includes the following set of variables,

$$P(EXP_{it}=1)=F(TFP_{it-1}, size_{it-1}, ownership_{it-1}, skills_{it-1}) \qquad (2)$$

Let P_{it} denote the predicted probability of entry at time *t* for firm *i* (the firm that enters the export market). A non-exporter *j*, which is 'closest' in terms of its propensity score to firm *i*, is then selected as a match for the latter using the *caliper matching method*[6]. More formally, *at each point in time*[7] and for each new entrant firm *i*, a non exporter firm *j* is selected such that[8]

$$\lambda > \left|P_{it} - P_{jt}\right| = \min_{k\in\{EXP=0\}}\{|P_i - P_j|\} \qquad (3)$$

where λ is a pre-specified scalar (the caliper). If there is no untreated firm that lies below λ for a given treated firm then the treated firm is excluded from the subsequent analysis - it is

[6] The matching is performed in Stata Version 7 using the software provided by Sianesi (2001).
[7] Note that the matching strategy is only appropriate on a cross-section by cross-section basis. Once the matched firms are identified, we pool all observations on them to form a panel data of matched firms. This panel is used in subsequent analyses.
[8] A non-exporter can be matched to more than one entering firm.

left unmatched.[9] This type of matching procedure is preferable to randomly or indiscriminately choosing the comparison group, because it is less likely to induce estimation bias by picking firms with markedly different characteristics.

Having constructed the control group of firms we follow Blundell and Costa Dias (2000) and compare the average rate of growth of the two sets of firms using a difference-in-differences estimator. The advantage of using this in conjunction with matching is in accounting for additional covariates that may determine performance over the period $t+s$. The difference-in-difference equation estimated takes the form:

$$g_{kt}^{EXP} = \beta_{ik} + \beta_{2t} + \sum_{l=-1}^{3} \beta_3 D_{t+l} + \sum_{l=-1}^{3} \beta_4^{EXP} D_{t+l}^{EXP} + \sum \beta_5 X_{kt} + + \varepsilon_{it}^{L} \quad (4)$$

where k denotes firms (firms i and j in equation 5), the vector of coefficients β_2 captures the effect of events that occur in calendar time t but are common to all firms, β_3 for events that occur to all firms in event time t, while the vector of coefficients β_4 the change in the rate of growth of TFP specific only to those firms that entered export markets for the first time at event time t. It is the significance or otherwise of β_4 that is of primary interest in this paper. Firm performance is compared across a number of time periods, the pre-entry period, the year in which entry takes place and three years after entry. These are expressed such that they measure growth relative to the time period before entry, the increase in growth caused by the change in export status. We also control for unobserved firm level fixed effects as well as the lagged level of TFP (to control for possible convergence effects) and lagged size and skill effects (measured by the lagged level of employment and wages respectively). Equation 4 therefore attempts to control for as much of the variation in TFP growth rates for the firm that cannot be attributed to the change in export status.

Clearly, applying this methodology reduces the number of observations available since, if firms are not matched they do not figure in the final econometric analysis. However, although the sample size is reduced, we do end up with a more valid control group than otherwise and can therefore more confidently assign any observed productivity effects to

[9] The chosen caliper value cannot be judged according to any statistical criteria. For this reason we set it a value such that it excludes approximately half of all first time exporters from the sample. The relaxation of this assumption led to no substantive change in the results.

exporting. Prior to evaluating productivity effects however, we begin our empirical analysis with the determinants of export market entry.

4. EXPORT MARKET ENTRY, AGGLOMERATION AND FIRM PRODUCTIVITY

There is now a considerable body of evidence that suggests that agglomeration forces are important to a range of economic processes (see Overmann, Redding and Venables 2003 for a review). Since start-up costs are known to be important, agglomeration forces may also have a role to play. For example, firms may find it easier to enter export markets if there are already exporters in the sector; and/or find entry easier if they are co-located in a particular locality or region with other exporters. Although export spillovers from multinationals have been investigated by Greenaway, Sousa and Wakelin (2004), industry and regional spillovers have not.

To test for regional and industry effects we estimate probit regressions of the probability of export market entry, controlling for firm specific characteristics such as productivity, size and human capital intensity. We also control for macroeconomic shocks through fixed time effects as well as for industry and region fixed effects. These latter fixed effects capture the possibility that sunk costs could vary across region and/or industry, for the effects of comparative advantage on the probability of exporting in a given industry, and for regional agglomerations of firms. We consider the robustness of the results to alternative treatments of macro shocks and regional agglomerations below. We follow the widely used convention of equating an industry with a 3 digit division of the Standard Industrial Classification (SIC), which gives us 101 industries. For our regional categorisation we rely on the NUTS classification and experiment with data at three levels yielding 16, 65 or 120 identifiable regions. We then explore all possible industry/region combinations. In addition we explore whether size matters. Our results are reported in Tables 2 to 4.

The results in Table 2 are very striking. These are for 101 industries and 65 regions. There is a strong positive and statistically significant effect from being in the same industry and a similar (independent) effect from being in the same region. There is no significant impact on entry from exporting firms located in other regions or other industries.

Table 2: Export entry affected and number of exporters within the same region or industry?

	Region	Industry	Region and Industry	Region (broad) and Industry	Region (narrow) and Industry
Same region	0.002 (4.13)**				
Different region	0.000 (0.28)				
Same Industry		0.003 (4.61)**			
Different industry		0.000 (1.40)			
Same region Same industry			0.014 (13.52)**	0.013 (13.24)**	0.070 (17.50)**
Diff. region Same industry			0.002 (2.72)**	0.002 (2.37)*	0.001 (2.08)*
Same region Diff. industry			0.001 (1.87)+	0.000 (0.18)	0.002 (1.75)+
Diff. region Diff. industry			-0.000 (0.12)	0.000 (0.60)	-0.000 (0.15)
Observations	18819	18819	18819	19073	18809

Note: t-statistics are in parenthesis.
* Significant at 10% **significant at 5%; *** significant at 1%

When we combine information on regions and industries, the number of firms within the same region *and* same industry has the largest impact on export entry, followed by those within the same industry but a different region, then those in a different industry but the same region. The number of export firms in a different region and different industry has no statistically significant impact.

At the sample mean the effect of an additional export firm located in the same region and industry raises the probability of exporting by 0.2 of a percentage point. An increase from zero to the sample average of 8 export firms in the same region and location therefore increases the probability of exporting by 1.6 percentage points. The average estimated probability of starting to export is just over 10 per cent (at the sample mean) such that the effect of agglomeration is economically significant. It should be noted however that as expected these agglomeration effects on the probability of exporting are less important than internal characteristics of the firm. For example a 1 percentage point increase in the size of the firm increases the probability the firm will start to export by 2.3 of percentage point.

The estimated marginal agglomeration effects from being located in the same region and industry are about 10 times stronger than the other agglomeration effects in column 3 of Table 2. For example, the effect of an additional export firm located in the same industry and a different region raises the probability the firm will start exporting by 0.03 of a

percentage point and 0.01 percentage points if it is located in the same region but a different industry. Information spillovers decay quickly when we move away from the industry and region in which the potential entrant is located.[10]

Finally, these effects are sensitive to how we measure regions. The strongest effects associated with being in the same firm and same industry arise when we use the most detailed measure of regions, i.e. postal districts. This suggests that if a non-exporting firm is co-located in the same narrow region with exporters from the same industry it is much more likely to export than if it is in a located in the same broad region or industry. Indeed a comparison of the marginal effects for the broad and narrow regions shows that at the sample mean the agglomeration effects in the narrow regions are about six times greater at 0.012 than those in broad regions.

Of course, the possibility exists that the gains from information or demonstration spillovers decay through time. One way of investigating this is to distinguish between the presence of existing exporters in a given region or industry and the presence of other contemporaneous entrants. In other words, we are asking whether the number of other export market entrants in the same time period encourages or discourages entry. To explore this we count the number of export market entrants (being careful, of course, not to double count the effect of entry of the firm in question or to double-count entrants with existing exporters).

It would seem from Table 3 that the number of contemporaneous entrants has a stronger effect than existing firms. The effect is still strongest in the same region and industry, followed by the same industry but a different region. Overall, the effect of these two variables on the decision to start exporting is stronger than the effect from existing firms in the same industry and region. This pattern is also reflected in the marginal effect of an increase in the number of other export firms on the probability of exporting. The marginal effect of an increase of one additional export firm that enters in the current period located in the same industry and region is 0.6 of a percentage point, compared to 0.3 if the firm is located in the same industry and a different region. The effect of the same increase in existing (i.e. non-contemporaneous) export firms located in the same industry and region and the same industry and different region are 0.2 and 0.02 respectively.

[10] We do not consider linkages between industries through the input-output tables or border effect between regions that may help to raise the size of the marginal effect, we instead choose to leave them to future work.

Table 3: The Effect of Clusters of Entrants

	Separating first time entrants and existing exporters	Small firms	Small firms	Medium sized firms	Medium sized firms
Same region Same industry	0.011 (7.12)**	0.012 (6.41)**	0.010 (3.93)**	0.014 (8.57)**	0.008 (3.31)**
Diff. region Same industry	0.001 (1.60)	0.000 (0.21)	-0.001 (0.56)	0.003 (2.72)**	0.002 (2.27)*
Same region Diff. industry	-0.000 (0.20)	0.000 (0.12)	-0.001 (0.96)	0.001 (1.41)	0.000 (0.51)
Diff. region Diff. industry	-0.000 (8.79)**	0.000 (0.76)	-0.000 (1.98)*	-0.000 (1.43)	-0.000 (2.58)**
New Same region New Same industry	0.035 (6.26)**		0.023 (2.64)**		0.050 (5.42)**
New Diff. region New Same industry	0.015 (8.04)**		0.016 (4.48)**		0.015 (5.10)**
New Same region New Diff. industry	0.005 (3.54)**		0.003 (1.07)		0.003 (1.38)
New Diff. region New Diff. industry	0.001 (11.01)**		0.001 (3.49)**		0.001 (8.28)**
Observations	18819	5906	5906	8997	8997

Note: t-statistics are in parenthesis.
* Significant at 10% **significant at 5%; *** significant at 1%

We also explored whether firm size was relevant by excluding those firms with more than 50 employees when focusing on small firms and all those with employment outside the 50-250 range when focusing on medium sized firms. The results suggest that small firms benefit from existing firms only if they are in the same region and SIC, whereas medium size firms benefit in the same way as all firms. Both small and medium firms benefit in the same way as all firms from the contemporaneous entry to export markets of other firms.[11] The marginal effects are not noticeably different across firms.

Thus far we have controlled for the effect of common macroeconomic shocks (to all industries and regions). In Table 4 we allow macroeconomic shocks to have a regional and/or industry dimension. Column 1 controls for shocks to NUTS-2 regions, column 2 for

[11] We also investigate whether the effect of information spillovers differs across NUTS-2 regions and SIC-2 industries. Detailed results are available from the authors on request. In summary, compared to Central London (the omitted category) the effect of other existing export market firms within the same region and industry is significantly stronger in Central Southern, Home Counties, North East England, South West England, Southern Scotland and Wales to Central London. The effect is significantly weaker in the West Midlands. The effect of other new export market entrants in the same industry and region is statistically greater in Central Southern, East Midlands, Home Counties, North East, North Scotland, North West, South West Southern Scotland, Wales and the West Midlands compared to Central London. One interpretation of this pattern is that demonstration effects are more important in regions in which the incidence of exporting is lower than the average region. That is information about export markets is more concentrated in a few firms.

shocks to SIC-2 industries and column 3 for shocks to regions and industries.[12] This has no effect on the results. Indeed the stability of results for new entrants in the same time period is noteworthy, where macroeconomic shocks might have been expected to have their biggest influence. The co-location of existing and new exporters in the same region and industry has a significant positive effect on the probability of export market entry.

In this section of the paper we are interested in the effect that agglomeration of export firms have on the probability of export market entry. To control for the fact that some industries are concentrated in some locations we included fixed regional effects. In the final column of Table 4 we add to the estimated regression an additional variable that explicitly measures the agglomeration of industries at the 5-digit level from Duranton and Overmans (2002). The industry concentration variable enters the regression with the expected positive coefficient. Irrespective of the number of export firms located in the same region or industry we find that agglomerated industries raise the probability of export market entry. The addition of this variable has no effect on the results for the agglomeration variables, moreover it does not affect the estimated marginal effects.

Table 4: Adding region shocks and industry shocks and regional agglomerations

	shocks to industries	**shocks to regions**	**shocks to both**	**Industry concentration**
Same region Same industry	0.014 (6.77)**	0.012 (6.54)**	0.016 (6.84)**	0.010 (6.21)**
Diff. region Same industry	0.006 (4.03)**	0.002 (2.26)*	0.006 (4.31)**	0.002 (2.13)*
Same region Diff. industry	0.000 (0.29)	0.002 (2.91)**	0.003 (3.14)**	-0.000 (0.22)
Diff. region Diff. industry	-0.000 (0.88)	0.000 (0.32)	-0.000 (1.04)	-0.000 (3.01)
New Same region New Same industry	0.059 (8.01)**	0.060 (8.06)**	0.083 (9.44)**	0.034 (6.07)**
New Diff. region New Same industry	0.031 (7.59)**	0.019 (9.11)**	0.034 (7.86)**	0.015 (7.20)
New Same region New Diff. industry	0.005 (3.57)**	0.019 (6.87)**	0.019 (6.29)**	0.004 (2.40)**
New Diff. region New Diff. industry	0.001 (4.58)**	0.003 (5.92)**	0.002 (3.47)**	0.001 (9.76)**
Industry concentraion				3.89 (8.49)
Observations	18602	17397	17226	16380

Note: t-statistics are in parenthesis.
* Significant at 10% **significant at 5%; *** significant at 1%

[12] We capture the effect of macroeconomic shocks by adding time dummies that vary for different regions or industries.

5. POST-ENTRY PRODUCTIVITY EFFECTS

The analysis in the previous Section tells us quite a lot about the determinants of entry. The next stage of the analysis is to investigate the impact of entry on productivity, using our matching and differences in differences analysis.

Estimating equation 4 on our matched sample of firms yields the results reported in Table 5. The first point to note is the absence of any pre-entry productivity differential between exporters and non-exporters. This we take as evidence of the success of our matching. The strategy has yielded a control group with very similar firm characteristics to our group of exporters. This being so, we can plausibly interpret the entry effect reported as due directly to exporting. As can be seen, productivity growth is estimated as some 2 to 4 percentage points greater in the year of entry than in the period before, after controlling for productivity growth in firms that did not enter. Entry is also associated with a significant increase in firm size and labour productivity, but not wages.

Table 5: The Impact of Export Market Entry on Productivity

	TFP1	***TFP2***	***TFP3***	***Labour Productivity***	***Employ-ment***	***Output***	***Wages***
Period Before	-0.008	-0.007	-0.018	-0.032	0.000	0.002	-0.000
Entry	(0.65)	(0.57)	(1.88)*	(1.06)	(0.00)	(0.12)	(0.02)
Entry	0.045	0.046	0.027	0.057	0.050	0.048	0.007
Effect	(2.78)***	(2.87)***	(2.08)**	(2.05)**	(2.87)***	(2.33)**	(0.49)

Notes: t statistics are in parenthesis
*** significant at 1%; ** significant at 5%; * significant at 10%

Some theoretical models point to the possibility of post-entry productivity benefits. The intuition here is that learning takes place or a sustained presence in export markets results in on-going benefits from reducing X-inefficiency. A number of empirical studies have searched for such effects but generally in vain. To explore this dimension, we re-estimate our matching model, extending the post-entry period by up to four years. The results are reported in Table 6.

Table 6: Post-Entry Productivity Effects

	TFP1	***TFP2***	***TFP3***	***Labour Productivity***	***Employ-ment***	***Output***	***Wages***
Period Before Entry	-0.008 (0.65)	-0.007 (0.57)	-0.018 (1.88)*	-0.032 (1.06)	0.000 (0.00)	0.002 (0.12)	-0.000 (0.02)
Entry Effect	0.045 (2.78)***	0.046 (2.87)***	0.027 (2.08)**	0.057 (2.05)**	0.050 (2.87)***	0.048 (2.33)**	0.007 (0.49)
One Year Later	0.026 (1.68)*	0.029 (1.83)*	0.025 (1.91)*	0.033 (1.03)	0.035 (2.20)**	0.042 (2.05)**	-0.005 (0.40)
Two Years Later	0.024 (1.36)	0.027 (1.57)	0.027 (1.65)	0.038 (1.21)	-0.004 (0.27)	0.013 (0.62)	0.017 (1.20)
Three Years Later	0.004 (0.23)	0.006 (0.35)	0.002 (0.11)	0.036 (1.13)	-0.005 (0.36)	-0.012 (0.62)	-0.003 (0.23)
Four Years Later	0.013 (0.77)	0.014 (0.85)	0.018 (1.35)	0.036 (1.14)	-0.012 (0.87)	0.001 (0.07)	0.002 (0.17)
Obs.	20237	20237	20237	20289	17882	17881	17877
R^2	0.11	0.11	0.31	0.03	0.05	0.08	0.08

Note: t-statistics are in parenthesis.
* Significant at 10% **significant at 5%; *** significant at 1%

As can be seen, there is modest evidence of persistence in employment and output effects up to one year after entry and on productivity for up to two years but only at the 10 per cent level. There is no robust evidence of productivity effects beyond the first few years however. Formally we test whether we can reject the hypothesis that the export entry effect, the effect one year and two years later are jointly equal to zero (column 1) and can reject this hypothesis at the 5 per cent (4.8%) level of significance (F(3, 20234)=2.63). We cannot also reject the hypothesis that the full set of export entry dummies (from year zero to four) are equal to zero at the 10 per cent (5.5%) level (F(5,20232)=2.16).[13]

Two further questions can be addressed: first, does agglomeration matter in determining the size of entry effects. The co-presence of exporters in the same region and industry was found to significantly increase the probability of export market entry. As argued above this is consistent with demonstration effects between potential entrants and existing exporters. To investigate whether similar information spillovers between existing exporting firms and new entrants maximises the productivity benefits after entry we interact the entry variables with various measures of industry and regional agglomerations used in the previous section.

[13] In regression 3.9 we can reject the hypothesis that the coefficients on the full set of export entry effects are jointly equal to zero at the 5 per cent level of significance (F(5, 20232)=2.48).

In the first column of Table 7 we interact the entry effect with a count of the number of exporters that exist in the same region as the new exporter, while in regression 2 we interact with the entry effect the number of existing firms within the same industry. Neither of these interaction effects differ significantly from zero, while evidence of an entry effect for all firms remains.

Agglomeration effects in the previous section were found to be strongest from firms in the same region and industry and other firms entering in the same time period from the same region and industry. In the final columns of Table 7 we explore the interaction of these terms with the entry effect. Again while there remains evidence of a productivity effect in the year of entry for all firms and this effect does not appear to differ according to the number of other new entrants in that year that were similar in terms of its industry or location.

Table 7: Post-Entry Effects and Agglomeration

	TFP* *Same region	***TFP* *same industry***	***TFP* *same region & industry***	**TFP New entrants same region & industry**
Period Before Entry	-0.004 (0.35)	-0.004 (0.32)	-0.004 (0.35)	-0.004 (0.34)
Entry Effect	0.026 (1.85)+	0.050 (3.28)**	0.030 (2.71)**	0.033 (3.03)**
One Year Later	0.018 (1.90)+	0.019 (1.94)+	0.018 (1.89)+	0.018 (1.91)+
Two Years Later	0.013 (1.06)	0.013 (1.09)	0.013 (1.05)	0.013 (1.07)
*Entry effect *same region*	0.000 (0.96)			
*Entry effect *same industry*		-0.000 (1.23)		
*Entry effect *same region and industry*			0.001 (1.24)	
*Entry effect *new firms in same region and industry*				0.002 (1.22)
Observations	14939	14939	14939	14939
R-squared	0.13	0.13	0.13	0.13

The second question we address is whether export market exposure makes a difference. This question is motivated by the possibility that it is those firms which are most oriented to export markets which are most likely to benefit from learning or competition effects. To

test this, we interact entry with the share of exports in total sales: the latter being a good proxy for exposure to export markets. Our results are reported in Table 8.

Table 8: Post-Entry Effects and Export Intensity

	Export market exposure	**Export market exposure**
Period Before Entry	-0.007 (0.62)	-0.007 (0.62)
Entry Effect	0.032 (2.66)***	0.032 (2.64)***
One Year Later	0.016 (1.42)	0.016 (1.45)
Two Years Later	0.031 (2.46)**	0.032 (2.52)**
Three Years Later		-0.000 (0.01)
Four Years Later		0.004 (0.32)
*Entry effect *Export share*	0.059 (1.79)*	0.060 (1.83)*
*One year later *Export share*	0.043 (1.69)*	0.044 (1.75)*
*Two years later *Export share*	0.029 (0.93)	0.031 (0.97)
*Three years later *Export share*		0.050 (1.83)*
*Four years later *Export share*		0.057 (1.83)*
Observations	20199	20199
R-squared	0.11	0.11

Note: t-statistics are in parenthesis.
* Significant at 10% **significant at 5%; *** significant at 1%

There is suggestive evidence that productivity effects persist beyond the first few years for firms more exposed to export markets. In fact, productivity benefits appear to be being recorded up to four years after entry. It is a non-negligible effect but is only significant at the 10 per cent level. This suggests that if there are second order productivity benefits these are skewed towards firms whose activity is geared more to export than domestic markets.[14]

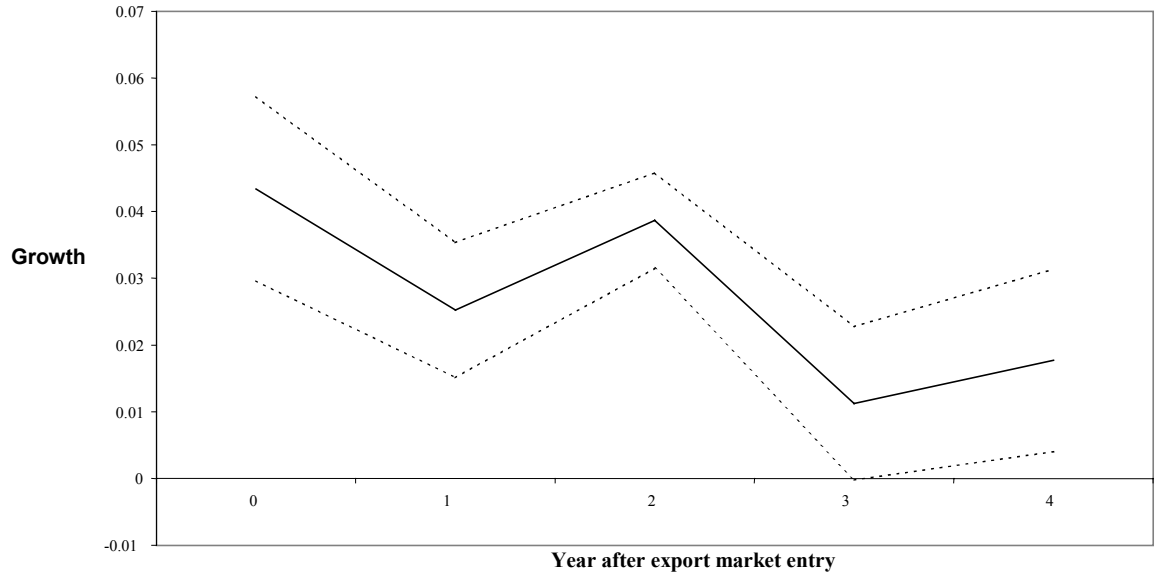
We might conclude from the results presented thus far that to the extent that information flows across firms, then spillovers or demonstration effects from domestic exporters to non-

[14] We also tested whether the average effect (the entry effects) and the export share interaction terms are jointly significantly different from zero. We find that we can reject the hypothesis that the entry effects are collectively equal to zero at the 5 per cent level (F(4, 20195)=2.48) and that the interaction terms are jointly equal to zero at the 1 per cent level of significance (F(5, 20194)=4.23).

exporters are important for entry but not post-entry, where domestic firms learn more from exposure to foreign firms.

In Figure 1 we plot the average increase in the rate of productivity growth for firms with the average export sales ratio for each of the years following entry.[15] We also plot the effect for firms that lie one standard deviation above and below this mean.

Figure 1: Productivity Growth Following Export Market Entry



6. FIRM SURVIVAL IN EXPORT MARKETS

From one year to the next some exit occurs. In fact, over our sample period close to 900 British manufacturing firms left export markets (although some did re-enter at a later date). From a policy standpoint it is clearly important to understand what the proximate drivers of exit are. Is it loss of market share? If so, is this driven by the competitiveness of the market in which the firm operates? Or perhaps it is due to some industry or region specific shock, resulting in a loss of productivity?

We begin by considering whether productivity or market share shocks significantly increase the probability of exit. To isolate the determinants of exit, we control for a number of firm

[15] This assumes that firm increases its export sales ratio from 0.19 in year zero to 0.24 in year 4 (0.21 in year 1, 0.215 in year 2, 0.225 in year 3)

level characteristics such as employment level, total factor productivity, human capital and export share. Our results are reported in Table 9. What stands out is that exit is more likely in smaller firms and in firms with limited export sales. By contrast, the likelihood of exit does not seem to be greatly affected by the level of total factor productivity. This is quite striking, suggesting that for UK firms export vulnerability is fashioned more by size and export exposure than by productivity.

Table 9: Firm Survival in Export Markets

	Base regression	**Shock to market share**	**Shock to market share**	**TFP shock**	**TFP shock**
Employment (lagged)	-0.096 (5.26)***	-0.096 (5.27)***	-0.095 (4.67)***	-0.096 (4.66)***	-0.096 (4.67)***
Average wage (lagged)	0.070 (0.80)	0.069 (0.79)	0.061 (0.59)	0.064 (0.66)	0.074 (0.76)
TFP (lagged)	-0.010 (0.19)	-0.009 (0.19)	0.010 (0.19)		
Export share (lagged)	-1.818 (8.01)***	-1.818 (8.00)***	-1.966 (7.22)***	-1.963 (7.19)***	-1.964 (7.19)***
Change in market share		-0.812 (1.09)			
Change in market share (lagged)			-3.340 (2.20)**	-3.496 (2.21)**	-3.790 (2.29)**
Change in TFP				0.046 (0.37)	
Change in TFP (lagged)					0.073 (0.99)
Observations	16091	16091	13416	13391	13384

Note: t-statistics are in parenthesis.
* Significant at 10% **significant at 5%; *** significant at 1%

To take this a stage further, we also investigated the role of changes in market share and in total factor productivity. Our findings are that the probability of exit increases significantly following a sudden loss of market share (as measured by the change in the firm's sales as a share of industry sales) but not on shocks to total factor productivity. The latter is interesting as it is often suggested that exit in response to a fall in productivity might be delayed in order to avoid the sunk costs of export market re-entry. We find evidence in favour of this delayed effect, it is not contemporaneous but lagged shocks that are important for exit.

In the heterogeneous firm model of export behaviour (for example, Meltiz, 2003) the export market exit decision for the firm depends in part on industry characteristics such as the level of sunk-costs. If the productivity of the firm is not sufficient to ensure non-negative profits then exit will occur. The greater the level of sunk-costs in the industry the stronger

the self-selection effect, and therefore the greater the productivity of the marginal exiting firm.

In column 1 of Table 10 we measure industry sunk costs via the TFP of the marginal exiting firm, specifically, the highest TFP of firms that exit export markets (measured at the 3-digit level) in each time period. As expected, we find that the probability of exit is greater the higher the level of sunk-costs in the industry.[16] At the sample mean the marginal effect of a one-percentage point increase in the level of sunk-costs is mirrored by a one percentage point increase in the probability of exit.

Table 10: Industry determinants of export market exit

	Sunk-costs	Sunk-costs, Intra-industry trade	Sunk-costs and the structure of trade	Sunk-costs, intra-industry trade TFP interaction
Employment (lagged)	-0.096 (4.01)**	-0.084 (2.80)**	-0.082 (2.58)**	-0.088 (2.92)**
Average wage (lagged)	-0.044 (0.43)	-0.041 (0.31)	-0.098 (0.74)	-0.033 (0.24)
TFP (lagged)	-0.000 (0.01)	0.049 (0.67)	0.046 (0.56)	0.900 (2.12)*
Export share (lagged)	-2.115 (7.33)**	-2.401 (5.96)**	-2.601 (5.97)**	-2.419 (5.92)**
Change in market share (lagged)	-3.724 (1.04)	-8.965 (1.23)	-11.355 (1.27)	-8.245 (1.18)
Sunk costs In a industry	0.160 (3.55)**	0.139 (2.54)*	0.107 (1.92)+	0.136 (2.48)*
Intra-industry Trade (lagged)		-0.525 (2.35)*	-0.644 (2.66)**	-0.524 (2.28)*
Import penetration (lagged)			0.275 (0.65)	
Intra-industry Trade * TFP				-1.025 (2.04)*
Observations	6547	4118	3770	4118

Note: t-statistics are in parenthesis.
Significant at 10% **significant at 5%; *** significant at 1%

In an extension of the Melitz (2003) model to include intra-industry trade Falvey, Greenaway and Yu (2003) find that the self-selection effect is strongest when the degree of substitution across products is higher. That is, the more homogeneous are the goods being traded in consumers preferences the stronger the self-selection effect. In column 2 of Table 10 we include a measure of intra-industry trade at the industry level, where intra-industry

[16] This result is robust to the use of the same measure of sunk-costs at the 4-digit and 2-digit SIC level. It is also robust to the use of the mean TFP of exiting firms in each time period.

trade is more likely in heterogeneous goods industries. Using the Grubel-Lloyd index (at the 3-digit level) as the indicator of intra-industry trade we find support for the Falvey, Greenaway and Yu (2003) model. An increase in the intra-industry trade index significantly lowers the probability of exit.

It should perhaps also be noted that the addition of the industry variables removes the significance of the output shocks variable. Presumably the latter is picking up the effect of differences in the probability of exit across industries that are correlated with changes in market share. Output shocks and therefore exit is more likely to occur in the same industries. In other words, we may not be controlling effectively for unobserved heterogeneity across industries in earlier regressions. Since it is output shocks rather than productivity shocks that seem to increase the probability of exit, this is possible. For the intra-industry trade measure, that makes good sense as it suggests that exporters, when faced with a shock, adjust by switching into other tradables rather than leaving the market.

It is also possible to demonstrate that the structure of trade has a different effect to an increase in import penetration. In the Melitz (2003) model the self-selection effect is driven not by an increase in imports but by the pull of export markets. Profit opportunities in external markets encourages the entry of new firms. Some of these firms receive a productivity draw sufficient to make non-negative profits from exporting. This raises the level of productivity necessary for the marginal firms to remain within the market, which leads to some exit. We would therefore expect that once we control for intra-industry trade the level of import penetration should not help to explain export market exit. In column 3 of Table 10 we find that this is indeed the case. Whilst the measure of sunk-costs and intra-industry trade remain significant import-penetration has no effect on the probability of exit.

Finally in Table 10 we explore the interaction between the trade variables and the level of TFP. Thus far we have found that on average the level of TFP is unimportant for export market exit. In the final column of Table 10 there is the suggestion however that there are differences according to the structure of trade, and in the manner expected. For a given level of intra-industry trade the probability of a firm choosing to exit is greater the lower the TFP of the firm. It is therefore low TFP firms that are more likely to exit the market, which is consistent with the heterogeneous firm model.

7. CONCLUSIONS

This paper reports on the most comprehensive analysis of the characteristics and performance dynamics of the export activities of UK manufacturers to date. We have a large sample of exporters and non-exporters and we data that spans an extensive time period: one long enough to capture changes in activity and behaviour. Moreover, we have deployed an econometric strategy that allows us to match as closely as possible the characteristics of firms that export to those of comparable firms that do not. This permits us to be as confident as we can be about the reliability and robustness of our results and to conclude that the effects we identify can be confidently described as export market effects. Our empirical strategy has also allowed us to explore some new aspects of transitions identified by recent heterogenous firm models.

Our key findings are as follows: first, the proportion of UK firms active in export markets has increased through time; some two-thirds of firms in our sample being active in recent years. Second, exporters tend on average to be larger firms than non-exporters and tend to pay better wages. Third, regional and industry agglomeration appears to be important to the prospects of successful entry of new exporters; this is particularly so when there are clusters of new entrants. Fourth, UK manufacturers receive a significant boost to productivity in the year in which they enter export markets, relative to comparable firms that do not enter. The likelihood of this being boosted further in subsequent years is greater the more exposed are firms to export markets. Fifth, firms that leave export markets are more likely to do so due to a loss of market share rather than a loss of productivity and small firms are more vulnerable than large firms. Sixth, having a sales mix with a larger share of exports and being in activities with differentiated products seems to offer some protection against exit. This is a new result and one which is consistent with recent theoretical models.

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