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## *Do financial factors affect exporting decisions?*

**by**

David Greenaway, Alessandra Guariglia, and Richard Kneller

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**Abstract**

Financial constraints are often cited as an important obstacle to firms' investment. This paper explores, for the first time, whether this conclusion also applies to firms' export market participation decisions. Using a panel of 9352 UK manufacturing firms over the period 1993-2003, we find that financially constrained firms are less likely to export. Moreover, balance sheet variables are significant determinants of firms' decisions to enter foreign markets. This happens because a healthier balance sheet makes it easier for firms to meet the sunk export market entry costs. Our results are robust to the use of different financial variables and different methods of estimation.

**JEL Classification:** D24, F14, D92.

**Keywords:** Financial constraints, Exports, Firm heterogeneity.

**Outline**

1. *Introduction*
2. *Economic background*
3. *Data sample and summary statistics*
4. *Econometric specifications and estimation methodology*
5. *Empirical results*
6. *Conclusions*

## Non-Technical summary

A number of papers in the trade literature have recently focused on the sunk costs that firms have to incur in order to enter foreign markets. These include expenses of gathering information on foreign markets, upgrading product quality, changing packaging, and establishing marketing channels. These papers also highlight the role of firm productivity and size heterogeneity in explaining why not all firms are engaged in international trade. They conclude that it is only the most productive and largest firms that will find it profitable to meet the sunk costs and enter export markets. Another extensive literature has focused on the effects of financing constraints on firms' investment and concluded that because smaller, younger firms, and, in general, firms more likely to face financial constraints have either limited access to external finance, or have to pay an external finance premium, their investment is constrained by the internal funds available to them.

This paper integrates these two so far disjointed literatures by evaluating the extent to which financial constraints affect the export participation decision of firms. More specifically, our paper adds a completely new dimension of firm heterogeneity to the trade literature, namely a financial dimension.

Our analysis is based on a panel of 9352 UK manufacturing firms over the period 1993-2003. Focusing our study on UK firms can be motivated by two considerations. First, the UK is the fifth largest exporter of manufactures in the world (within our sample, 72% of all firms exported in at least one year). Second, our dataset contains profit and loss and balance sheet information on a very large number of firms, including firms not quoted on the stock market, and therefore particularly likely to face financing constraints. We estimate static and dynamic Probit models for the export participation decision, which control for firm-specific variables (including financial variables), macroeconomic conditions, and unobserved heterogeneity.

Our main findings can be summarized as follows. First, in our static models, financial variables are significant determinants of firms' decisions to enter foreign markets. Second, the effects of financial variables are stronger for financially constrained firms, which are less likely to export. Third, our dynamic models, which take into account sunk export market entry costs through the lagged dependent variable, show that exporting is a highly persistent phenomenon: past participation in export markets strongly affects today's probability of being an exporter. This confirms that firms have to face large entry costs in foreign markets. Finally, it is essentially because they find it more difficult to bear these costs that financially constrained firms are less likely to export.

Our results are important from a policy point of view. If small, financially constrained firms are less likely to enter export markets because of difficulties in meeting entry costs, then policies ensuring that there is efficient intermediation of funds to these firms might help the small business community thrive not only domestically, but also internationally. In an increasingly globalized world, these policies have the potential to promote growth.

## 1. Introduction

Recent developments within the trade literature have used a combination of sunk start-up costs and heterogeneity in firm productivity to explain why, even in narrowly defined industries, not all firms are engaged in international trade[1]. According to this line of research, new exporters face significant start-up costs as they gather information on foreign markets, develop marketing channels, adapt products and packaging to foreign tastes, and learn to deal with new bureaucratic procedures. In turn, these sunk costs generate hysterisis in export markets. Moreover, only the most productive and largest firms enter export markets, as it is only for these firms that the expected profits from exporting will be sufficiently high to cover the sunk entry costs[2].

Our paper adds a completely new dimension of firm heterogeneity to the empirical trade literature, namely a financial dimension[3]. In particular, we focus on whether financial constraints might limit firms' ability to overcome sunk costs, and consequently their entry into export markets, even when other characteristics might predict profitable entry. In so doing we build on an extensive literature that has focused on the effects of capital market imperfections on firms' activities. Within this literature, a general conclusion has been that financial constraints impact on firm investment, employment and R&D decisions (see Hubbard, 1998; and Bond and van Reenen, 2005, for surveys).

There are good grounds for supposing that financial constraints might limit entry into export markets. Chaney (2005) incorporates liquidity constraints in the Melitz (2003) model and finds that they do have an impact on firm entry. Financial variables have also featured within the firm-export literature in Campa and Shaver (2002), who show that financial constraints are less binding for Spanish exporters compared to non-exporters, and Guariglia and Mateut (2005), who find that globally engaged firms in the UK face lower liquidity constraints than their purely domestic counterparts[4].

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[1] See, for instance, Bernard and Jensen (2004); Bernard et al. (2003); Campa (2004); Das et al. (2004); Head and Reis (2003); Helpman et al. (2004); Melitz (2003); Roberts and Tybout (1997); Roberts et al. (1997); and Tybout (2003).

[2] Empirical papers such as Clerides et al., (1998); Bernard and Jensen (1999); Aw et al. (2000); Girma et al. (2004); Greenaway and Kneller (2003, 2004) have confirmed that exporters tend to be more productive and larger than non-exporters.

[3] While productivity and size have been the main dimensions of firm heterogeneity to be considered as determinants of export market participation, other dimensions have been recognised in the literature as important. For example, Yeaple (2005) considers heterogeneity with respect to different types of workers hired and different technologies used; Davidson et al. (2005) allow for different wages to be paid; while Manasse and Turrini (2001) consider different levels of entrepreneurial ability.

[4] Also see Van Biesebroeck (2005), who considers access to formal channels of credit for firms in Sub-Saharan Africa, and Blalock and Roy (2005) who evaluate the impact of the Indonesian financial crisis on firm exports. Neither finds that financial variables have great importance in determining firms' export behavior.

Our analysis is based on a panel of 9352 UK manufacturing firms over the period 1993-2003, extracted from the *Financial Analysis Made Easy* (FAME) database. Focusing on UK firms can be motivated by two considerations. First, the UK is the fifth largest exporter of manufactures in the world, and within our sample, 72% of all firms exported in at least one year. Second, FAME contains profit and loss and balance sheet information on a very large number of firms, including firms not quoted on the stock market, which are particularly likely to face financial constraints.

Our results suggest that firms less likely to face financial constraints are more likely to export: it is therefore not only the largest and most productive firms that enter export markets, but also the financially healthiest. Moreover, balance sheet variables are important determinants of export market participation decisions. This effect is most pronounced for firms that face the most severe financing constraints: healthier balance sheets make it in fact easier for these firms to meet the sunk export markets entry costs[5].

These results are relevant from a policy perspective. If small, financially constrained firms are less likely to enter export markets because of difficulties in meeting entry costs, then policies ensuring that there is efficient intermediation of funds to these firms might help the small business community thrive not only domestically, but also internationally. In an increasingly globalized world, such policies therefore have the potential to promote growth.

The rest of the paper is organized as follows. In Section 2, we set out the theoretical and empirical background of our analysis. Section 3 describes our dataset and presents some summary statistics. In Section 4, we outline and discuss our main econometric specifications and describe our estimation methodology. Section 5 presents our empirical results, and Section 6 concludes.

## 2. Economic background

*Theoretical background*

To motivate our empirical analysis, we draw upon the models of Bernard and Wagner (2001), Bugamelli and Infante (2003), and Tybout (2003). We start from a firm's static problem of export participation with no sunk costs. Denoting with $EXP_{it}$ a dummy variable equal to 1 if firm $i$ exports in year $t$, and 0 otherwise, the foreign market participation problem of firm $i$ at time $t$ can be written as follows:

[5] It should be noted that we do not claim that financially healthy firms actually face lower export market entry costs compared to other firms. We only claim that they find it easier to meet these costs.

$$\underset{EXP_{it}\in\{0,1\}}{Max}\{\pi_{it}(e_t, c_{it}, y_t) + v_{it}\} EXP_{it} \quad (1)$$

where $\pi_{it}$ denotes profits made by exporting, in excess of those made on the domestic market. $\pi_{it}$ depends on the exchange rate ($e_t$), on marginal production costs ($c_{it}$), on a foreign demand shifter ($y_t$), and on a serially uncorrelated error term ($v_{it}$). Firm $i$ will decide to export at time $t$ ($EXP_{it}$=1) if $\pi(e_t, c_{it,} y_t) + v_{it} > 0$, otherwise it will only serve the domestic market.

Using a reduced-form approximation for the determinants of firm profits from exporting, this leads to the following static discrete choice of export market participation:

$$EXP_{it} = 1 \text{ if } \beta X_{it} + u_i + u_t + v_{it} > 0 \quad (2)$$
$$= 0 \text{ otherwise.}$$

In this model, $\pi_{it}$ is approximated as a reduced-form expression in exogenous firm and market characteristics. In particular, the vector $X_{it}$ contains size, productivity, and other firm-level characteristics which typically determine the marginal production costs faced by the firm ($c_{it}$), and consequently the expected profits it is likely to generate by exporting[6]. $u_i$ is a firm-specific error term, which encompasses those time-invariant firm characteristics that determine profits. $u_t$ is a time-specific effect: it takes into account those business cycle and macroeconomic effects (such as $e_t$ and $y_t$), which are not firm-specific.

In this scenario, the firm's payoff from exporting has not been adjusted for sunk costs of foreign market entry. Yet, it is reasonable to assume that the firm has to incur such costs. These include the establishment of distribution networks, modifications to products, advertising, as well as gathering information and dealing with the different legal and economic environment in the foreign country[7]. We deal with these up-front costs of export market entry in two ways. First, as they are unobservable, we initially do not take them directly into account in the firm's payoff from exporting, but augment instead our export participation decisions with variables measuring the firm's capacity to finance them. Denoting with $f_{it}$ these variables, which could include the amount of liquidity available to

[6] Full details of the variables included in the equations that we will actually estimate are given in Section 4.

[7] These costs are sunk in the sense that once incurred, they cannot be recovered. Das et al. (2004) econometrically estimate that the sunk export market entry costs average over one million US dollars for Colombian plants producing industrial chemicals.

the firm or measures of the health of its balance sheet, leads to the following reduced-form specification:

$$EXP_{it} = 1 \text{ if } \beta X_{it} + \gamma f_{it} + u_i + u_t + v_{it} > 0 \qquad (3)$$
$$= 0 \text{ otherwise.}$$

A statistically significant $\gamma$ coefficient tells us that financial variables are important determinants of the firm's export market participation decision. This is likely to happen as firms with higher levels of liquidity are able to cover the sunk costs using these internal funds. Moreover, a healthy balance sheet makes it easier for those firms entering export markets for the first time to obtain external finance at better terms, which can be used to pay the sunk costs (Bernanke and Gertler, 1995)[8].

The second way in which we deal with sunk costs follows the dynamic setting introduced in Bernard and Wagner (2001), Bugamelli and Infante (2003), and Tybout (2003). In this scenario, the decision to enter is made by a rational firm with the objective of maximising expected profits over the expected period of participation in export markets, net of fixed costs. We denote with $F$ the sunk costs and assume they are common to all firms and are time-invariant. The firm's payoffs from exporting take the following form:

- $\pi(e_t, c_{it,} y_t) + v_{it}$ if $EXP_{it}$=1 and $EXP_{i(t-1)}$=1
- $\pi(e_t, c_{it,} y_t) - F + v_{it}$ if $EXP_{it}$=1 and $EXP_{i(t-1)}$=0 (4)
- 0 if $EXP_{it}$=0 and $EXP_{i(t-1)}$=0.

Denoting with $\delta$ the one-period discount rate, the optimal pattern of export market participation over time should satisfy the following Bellman equation:

$$V(e_t, c_{it,} y_{t,} v_{it}, EXP_{i(t-1)}) = \underset{EXP_{it}}{Max} \{\pi(e_t, c_{it,} y_t) - (1-EXP_{i(t-1)})F + \delta E_t V(e_{t+1}, c_{i(t+1),} y_{t+1,} v_{i(t+1)}, EXP_{it})\} \qquad (5)$$

[8] Assuming that there are also variable per-unit trade costs that exporting firms have to face each period (such as transport costs and tariffs), financial variables could also affect export participation decisions by making it easier for firms to finance these costs. Alternatively, they could simply affect the expected profits that firms generate by exporting.

Firms will find it optimal to export when:

$$\pi(e_t, c_{it,} y_t) - (1\text{-}EXP_{i(t-1)})F + v_{it} + \delta\{E_t V(e_{t+1}, c_{i(t+1),} y_{t+1,} v_{i(t+1)}, EXP_{it}/EXP_{it}=1) - E_t V(e_{t+1}, c_{i(t+1),} y_{t+1,} v_{i(t+1)}, EXP_{it}/EXP_{it}=0)\} >0 \quad (6)$$

The expression in curly brackets can be interpreted as the expected current value of being able to export in period $t$+1 without having to pay the sunk costs. Its size depends on the expected profits the firm is likely to generate by exporting. Equation (6) can be rewritten as:

$$\pi(e_t, c_{it,} y_t) + \delta\{E_t V(e_{t+1}, c_{i(t+1),} y_{t+1,} v_{i(t+1)}, EXP_{it}/EXP_{it}=1) - E_t V(e_{t+1}, c_{i(t+1),} y_{t+1,} v_{i(t+1)}, EXP_{it}/EXP_{it}=0)\} + v_{it} > (1\text{-}EXP_{i(t-1)})F, \quad (7)$$

and indicates that firm $i$ will decide to export if the current and expected revenues from entering export markets are greater than the sunk entry costs. Using a reduced-form approximation for the first two terms on the left-hand side of (7) and the same notation as in (2), leads to the following dynamic discrete choice of export market participation:

$$EXP_{it} = 1 \text{ if } \beta X_{it} + \eta\, EXP_{i(t-1)} + u_i + u_t + v_{it} > 0 \quad (8)$$
$$= 0 \text{ otherwise.}$$

This dynamic specification, which is close to that used in Bernard and Wagner (2001) and Bernard and Jensen (2004), takes into account sunk entry costs directly through persistence in the firm's export behavior. A positive and significant $\eta$ indicates that sunk costs are present. If it is indeed the case that the financial variables used in (3) ($f_{it}$) affect export market participation through the firms' ability to meet the sunk costs, then adding them to (8) would involve a "double-counting" of the sunk costs, and should result in insignificant coefficients on these variables.

*Empirical background*

The model in Equation (3), which includes financial variables as determinants of export market participation decisions is similar to models of fixed investment, inventory investment, and R&D investment, as a function of cash flow or other financial variables,

which have been frequently estimated in the financing constraints literature. A high sensitivity of investment to cash flow has typically been interpreted as an indicator of financial constraints. In fact, a financially constrained firm, for which it is difficult or too expensive to obtain external finance such as loans, will only invest if it has sufficient internal funds, and will invest more the higher its cash flow. Evidence in favor of this hypothesis (the financing constraints hypothesis) has been found for the US (see for instance Fazzari et al., 1988; Whited, 1992; Kashyap et al., 1994; Carpenter et al., 1994, 1998); for the UK (Blundell et al., 1992; Bond and Meghir, 1994; Guariglia, 1999, 2000; Bond et al., 2003; Carpenter and Guariglia, 2003; Benito, 2005); for other European countries (Vermeulen, 2002; Angeloni et al., 2003; Bond et al., 2003; Chatelain et al., 2003; Konings et al., 2003); for Japan (Hoshi et al., 1991); and for some developing countries (Jaramillo et al., 1996; Harrison and McMillan, 2003).

In recent years, however, the hypothesis has been challenged. In particular, authors such as Kaplan and Zingales (1997), and Cleary (1999) have found that it is in fact the financially healthiest firms that display the highest sensitivities of investment to cash flow. Furthermore, studies such as Cummins et al. (2005), Bond and Cummins (2001), and Bond et al. (2004) have shown that once investment opportunities are properly taken into account in investment models, the sensitivity of investment to cash flow disappears altogether for all groups of firms. With the exception of Bond et al. (2004), these challenges to the financing constraints hypothesis have all been based on US data. Less controversy surrounds the working of the hypothesis in the UK. Estimating export participation equations as a function of financial variables can be seen as a novel test of the financing constraints hypothesis for the UK.

## 3. Data sample and summary statistics

*The dataset*

We construct our dataset from profit and loss and balance sheet data gathered by Bureau Van Dijk Electronic Publishing in the *Financial Analysis Made Easy* (FAME) database. This provides information on companies for the period 1993-2003[9]. It includes a majority of firms which are not traded on the stock market, or which are quoted on alternative exchanges such as the Alternative Investment Market (AIM) and the Off-Exchange (OFEX)

[9] A maximum of 10 years of complete data history can be downloaded at once. Our data were downloaded early in 2004: the coverage period is therefore 1993-2003.

market[10]. Unquoted firms are more likely to be characterized by adverse financial attributes such as a short track record, poor solvency, and low real assets compared to quoted firms, which are typically large, financially healthy, long-established companies with good credit ratings. Our data allows us therefore to find proxies for financial constraints, characterized by a wide range of variation across observations in the sample.

The firms in our dataset operate in the manufacturing sector. We excluded companies that changed the date of their accounting year-end by more than a few weeks, so that data refer to 12 month accounting periods. Firms that did not have complete records on exports, assets, wages, labor productivity, and the relevant financial variables were also dropped. Finally, to control for outliers, we excluded observations in the 1% tails for each of the variables[11]. As only larger firms are required to report information about whether they export or not, dropping firms with incomplete information on their export behavior is likely to create sample selection bias. The magnitude of this problem and the likelihood that it affects our econometric results are discussed in Appendix 2.

Our panel therefore includes a total of 52594 annual observations on 9352 companies, covering the years 1993-2003. It has an unbalanced structure, with an average of 7 observations per firm. By allowing for both entry and exit, the use of an unbalanced panel partially mitigates potential selection and survivor bias.

*Summary statistics*

Table 1 reports means and standard deviations of the main variables used in the literature as regressors in export participation equations, as well as of a number of financial variables. We use these statistics to determine which of the financial variables are most appropriate to explain export market participation decisions. Column 1 refers to the entire sample; column 2 to the sub-sample of non-exporting firm-years; column 3 to the sub-sample of exporting firm-years; column 4 to the sub-samples of firms which never exported; and column 5 to the sub-sample of firms that always exported[12].

[10] We only selected firms that have unconsolidated accounts: this ensures that the majority of the firms in our dataset are relatively small. Moreover, it avoids the double counting of firms belonging to groups, which would be included in the dataset if firms with consolidated accounts were also part of it.

[11] These cut-offs are aimed at eliminating observations reflecting particularly large mergers, extraordinary firm shocks, or coding errors. See Appendix 1 for more information on the structure of our panel and complete definitions of all variables used. Also note that because a number of regressors in our estimating equations are lagged once, the dataset actually used in estimation only covers the years 1994-2003.

[12] Our empirical analysis focuses on firm-years rather than simply firms, because firms can switch between exporter and non-exporter status. In our dataset, 1040 firms out of 9352 switched status once or more times during the period considered.

As frequently found in the literature (see, for example, Girma et al., 2004, for the UK), firm-years that export are larger than non-exporting firm-years, in terms of assets, employees, and sales, and are typically older. In particular, those firms that never exported are much smaller and younger than average. Furthermore, foreign owned firms and firms with one or more subsidiaries are more likely to export. Regarding labor productivity, calculated as the ratio of total real sales to number of employees, there does not seem to be much difference between exporting and non-exporting firm-years.

Of the financial variables included, the first is the ratio of the firm's current assets to its current liabilities (labelled liquidity). This is used as an indicator of a company's ability to meet short-term debt obligations: the higher the ratio, the more liquid it is. The second financial variable is the coverage ratio, defined as the ratio of a firm's total profits before tax and interest, and its total interest payments. This variable measures the extent to which cash flow is sufficient to pay for financial costs and is therefore related to creditworthiness. It can also be thought of as a proxy for the premium firms have to pay for external finance (Guariglia, 1999)[13].

Four measures of leverage are then considered: short-term debt to total assets ratio and total debt to assets ratio, which are indicators of the general indebtedness of the firm; short-term debt to current assets ratio, which shows whether short-term liabilities are backed with relatively liquid assets; and short-term debt to current liabilities ratio, which can be seen as a measure of bank-dependence. The final two variables measure the cash flow to assets ratio, which can be interpreted as an indicator of the availability of internal funds for the firm, or as a measure of the firm's profitability; and a measure of the firm's riskiness (labelled "quiscore"). The quiscore variable is based on information about the credit ratings of the firm and measures the likelihood of company failure in the twelve months following the date of calculation. The lower its quiscore value, the more risky the firm is considered to be.

Differences in these financial variables between exporting and non-exporting firm-years are generally negligible, with two exceptions. Exporting firm-years are characterized by considerably higher liquidity (1.64) than non-exporting firm-years (1.49), while non-exporting firm-years display higher average leverage measured by the short-term debt to current asset ratio (0.42) compared to exporting firm-years (0.38). These differences are

[13] The coverage ratio has been widely used in the literature on the effects of financing constraints on firms' activities (see Carpenter et al., 1998; Gertler and Gilchrist, 1994; Guariglia, 1999, 2000; and Whited, 1992).

slightly more pronounced if we compare firms that never exported throughout the period, with firms that always exported.

Table 2 compares percentages of firms that export by industry, for the total sample and sub-samples of firms more and less likely to face financial constraints defined using various criteria[14]. We use this Table to select the criteria used in our subsequent analysis to distinguish observations into financially constrained and financially healthy. On average, across the sample, 72% of the firm-years export. Column 1 also shows that the industrial sectors characterized by the highest percentages of exporting firm-years are chemicals and man-made fibres (85%); mechanical engineering (86%); and electrical engineering (84%). Those characterized by the lowest percentages are food, drink, and tobacco (50.5%); and others (54.9%). The remaining columns report the percentage of observations that export by industry, distinguishing firm-years across financially constrained and unconstrained on the basis of their real assets (columns 2 and 3); liquidity (columns 4 and 5); ratio of short-term debt to current assets (columns 6 and 7); ratio of short-term debt to current liabilities (columns 8 and 9); coverage ratio (columns 10 and 11); and quiscore value (columns 12 and 13). In each case, we consider as financially constrained in year *t* within an industry, those firms whose real assets, liquidity, coverage ratio, quiscore value (short-term debt to current assets ratio, short-term debt to current liabilities ratio) in year *t* fall in the lowest (highest) three quartiles of the distribution of the same criteria for all the firms in that particular industry and year.

The Table shows that when firms are divided on the basis of assets, in all the industrial sectors, it is the largest firm-years that tend to export most. Furthermore it is those firm-years with highest liquidity which are generally more likely to export, as are those firms with highest quiscore. However, when firms are divided on the basis of the leverage measures or coverage ratio, we cannot observe any systematic difference in the percentage of firm-years that export across financially constrained and unconstrained firm-years.

In summary, the results in Tables 1 and 2 show that, as reported in previous literature, size is a significant determinant of firms' exporting decisions. In addition, liquidity and the short-term debt to current assets ratio are important determinants of the decision to participate in export markets. Furthermore, firm-years with low liquidity and/or low quiscore are less likely to export. Based on these descriptive statistics, we include

[14] Firms are allocated to one of the following nine industrial sectors: metals and metal goods; other minerals, and mineral products; chemicals and man made fibres; mechanical engineering; electrical and instrument engineering; motor vehicles and parts, other transport equipment; food, drink, and tobacco; textiles, clothing, leather, and footwear; and others (Blundell et al., 1992).

liquidity as our main financial variable in our equations for export participation. For robustness purposes, we also include the short-term debt to current assets ratio[15]. We then assess whether it is the more financially constrained firm-years that are more strongly affected by financial variables when deciding whether or not to export. For this purpose, we divide firm-years into financially constrained and healthy on the basis of their liquidity and value of their quiscore.

## 4. Econometric specifications and estimation technology

*Econometric specifications*

We initially estimate the following reduced form model:

$$EXP_{it} = a_0 + a_1\, size_{i(t-1)} + a_2\, size^2_{i(t-1)} + a_3\, wage_{i(t-1)} + a_4\, laborprod_{i(t-1)} + \\ + a_5\, subsidiaries_i + a_6\, foreign_i + a_7 financial_{i(t-1)} + u_i + u_t + e_{it}, \qquad (9)$$

where the subscript *i* indexes firms; and *t*, time. $EXP_{it}$ is a dummy variable equal to 1 if firm *i* exported in year *t*, and 0 otherwise. $Size_{it}$ represents the size of the firm measured in terms of the logarithm of its real assets, and $size_{it}^2$, its square, which we include to allow for non-linearities in the relationship between size and propensity to export[16]. $Wage_{it}$ is given by the ratio of the firms' total wage bill to number of employees; $laborprod_{it}$ represents labor productivity and is measured as the ratio of the firm's total real sales to its total number of employees[17]. $Subsidiaries_i$ is a dummy variable equal to 1 if the firm has subsidiaries, and 0 otherwise; $foreign_i$ is a dummy equal to 1 if the firm is foreign owned, and 0 otherwise. $Financial_{it}$ denotes our financial variable, which will be in turn the ratio of the firms' current assets to its current liabilities (liquidity), and the ratio of its short-term debt to its current assets. Finally, the error term is made up of three components: $u_i$, which captures time-invariant firm-specific effects not included among the regressors (such as managerial

[15] Vermeulen (2002) and Benito (2005) used similar variables in their investigation of the effects of financial constraints on firms' investment in fixed capital and inventories, respectively. Peersman and Smets (2005) and Dedola and Lippi (2005) also used similar variables to study the role played by industry heterogeneity in the transmission mechanism of monetary policy.

[16] As an alternative measure of size, a number of authors have used the number of employees. Our results were robust to the use of the latter variable.

[17] A more appropriate measure of productivity would be Total Factor Productivity (TFP). However, given the lack of information on materials in our dataset, we could not calculate it. Our results were, however, robust to replacing labor productivity with a proxy for TFP calculated as in Griffith, 1999 (also see Van Biesebroeck, 2003, for a description of this and other procedures aimed at calculating TFP). These results are not reported for brevity, but are available from the authors upon request.

ability); $u_t$, which is a time-specific component, accounting for business cycle effects; and $e_{it}$, which is an idiosyncratic error term. All time-varying regressors are lagged once to avoid possible simultaneity problems. Motivated by the sharp differences in firm exporting behavior across industries documented in Table 2, we include industry dummies in all regressions. These control for any fixed effects common across industries. When Equation (9) is estimated on the entire time period, time dummies are also included to account for business cycle effects.

A positive and significant $a_7$ coefficient would indicate that financial variables are important determinants of export participation decisions, probably because they affect the ability of firms to finance sunk export market entry costs. In this case, one would expect the effect of financial variables to be larger for those firm-years more likely to face financial constraints. We therefore estimate the following modified version of Equation (9):

$$EXP_{it} = a_0 + a_1\, size_{i(t-1)} + a_2\, size^2_{i(t-1)} + a_3\, wage_{i(t-1)} + a_4\, laborprod_{i(t-1)} +$$
$$+ \; a_5\, subsidiaries_i + a_6\, foreign_i + a_{71} financial_{i(t-1)} * FINDUM_{it} +$$
$$+ a_{72}\, financial_{i(t-1)} * (1-FINDUM)_{it} + u_i + u_t + e_{it}, \qquad (10)$$

where $FINDUM_{it}$ is a dummy variable equal to 1 if firm $i$ is classified as financially constrained in year $t$, and 0 otherwise. As mentioned earlier, we shall focus on two criteria to classify firm-years into financially constrained and healthy: liquidity and the value of the firm's quiscore. In particular, we will consider as financially constrained in year $t$ within an industry, those firms whose liquidity/quiscore value in year $t$ falls in the lowest three quartiles of the distribution of the liquidity/quiscore values of all firms in that particular industry and year[18]. This specification is aimed at evaluating whether the effects of the financial variables on export market participation decisions are stronger for firm-years more likely to face financial constraints[19].

Finally, to assess rigorously whether the importance of financial variables in determining export market participation decisions is related to sunk export market entry costs, we augment Equations (9) and (10) to contain the lagged export status of the firm. This measure of experience has been typically interpreted as capturing the importance of sunk costs on export market participation (Roberts and Tybout, 1997; Bernard and Wagner,

[18] Note that, as discussed in Section 3, the lower its quiscore value, the more risky the firm is considered to be.
[19] Instead of using interaction terms, we could have estimated Equation (10) separately on various sub-samples of firms. Our chosen approach is preferable as it allows us to avoid problems of endogenous sample selection; to gain degrees of freedom; and to take into consideration the fact that firms can transit between groups.

2001; Tybout, 2003; Bernard and Jensen, 2004). If our liquidity and leverage variables are significant in the static, but not in the dynamic specifications, we can conclude that they are important determinants of firms' export market participation decisions as higher liquidity and/or lower leverage make it easier for firms to meet the sunk costs.

*Estimation methodology*

We initially estimate Equation (9) separately on the nine cross-sections available in our dataset[20]. As our dependent variable is dichotomous, we use a Probit approach. We subsequently estimate both Equations (9) and (10) on the entire dataset using both a pooled Probit estimator, which corrects for clustering[21], and a random-effects panel Probit estimator. In so doing, we follow Bernard and Wagner (2001) in testing the robustness of our results to a number of different estimators. On the one hand, although clustering takes into account the fact that observations within the same firm are not independent, unobserved heterogeneity is not fully controlled for in our pooled Probit model[22]. On the other hand, the random-effects Probit, which takes unobserved heterogeneity into account, requires that firm-specific unobserved effects are uncorrelated with the regressors, which might not be a plausible assumption in our context. As our main focus is on financial variables, we believe that if the two estimators deliver similar coefficients on the latter, then these coefficients can be considered as reliable[23].

Similar considerations apply when estimating the dynamic versions of Equations (9) and (10). In this case, however, because the unobserved characteristics are potentially permanent, or at least highly serially correlated, and unobserved, if not accounted for, they will induce persistence in export behavior, and therefore an overestimation of the coefficient on the lagged participation variable. Similarly, if the heterogeneity of the unobserved firm effects is large, the random-effects Probit estimator will deliver biased estimates of the latter

[20] One cross-section is lost due to the fact that our regressors are lagged once.

[21] Given that we have repeated observations on firms, clustering allows the observations to be independent between firms, but not necessarily within firms. Clustering affects the estimated standard errors and variance-covariance matrix of the estimators, but not the estimated coefficients.

[22] Unobserved heterogeneity arises because unobserved firm-specific effects such as managerial ability, product characteristics, technology, foreign experience, which are not included among the regressors are likely to affect firms' decisions to export.

[23] Alternatively, one could use a conditional fixed effects Logit model (Chamberlain, 1980). An advantage of this method of estimation is that it allows the regressors and the firm-specific component of the error term to be correlated. A disadvantage is that all the firms for whom the dependent variable is either always 0 or always 1 are dropped from the sample used in estimation. In our case, this would mean dropping 45788 out of 52594 observations. Other disadvantages of the conditional Logit estimator are that all the time invariant variables would have to be dropped from the estimation, and that the precision of those variables with negligible variance across time would be compromised.

coefficient (Heckman, 1981). As our objective with our dynamic specifications is not to obtain a precise estimate of the lagged participation variable coefficient, but just to see whether taking sunk costs into account by introducing hysterisis in the model actually makes the financial variables insignificant, these problems are unlikely to affect our main conclusions.

A number of studies (e.g. Bernand and Jensen, 2004; Damijan et al., 2005) estimate dynamic models of export participation using linear probability estimators, namely either Ordinary Least Squares, fixed-effects, or GMM (Arellano and Bond, 1991) estimators. Although the latter two estimators take into account unobserved heterogeneity, and GMM, also allows for the possible endogeneity of the regressors, we consider it inappropriate to use linear probability models as they fail to properly capture the curvature of the regression function in the proximity of 0 and 1. This problem is likely to be particularly severe in our dataset as 8312 firms out of a total of 9352 always or never exported throughout the sample period, leading to a large number of very high and very low probabilities to export[24].

## 5. Empirical results

*Main results*

Table 3 presents the results from estimating Equation (9) where the financial variable is given by the firm's liquidity, separately for each of the nine years available. Of the firm level determinants, a number are consistent with those found in the previous literature. Size, as measured by the logarithm of assets, always has a positive effect on export participation, whereas size squared has a negative effect, suggesting the existence of an inverted U-shaped relationship between firm size and decision to export. This indicates that a minimum size is required to enter export markets, beyond which increases in size have no impact on export behavior. Similar findings were reported for the UK in Kneller and Pisu (2004).

For most years, the effect of skills, as measured by the average wage, is negative, although generally insignificant. Labor productivity has no significant affect on the firms' decision to export[25]. Consistent with Kneller and Pisu (2004), foreign owned firms are more likely to export than other firms, as are firms with subsidiaries. This suggests some

[24] Another problem associated with the linear probability model is that predicted probabilities may lie outside the 0-1 range.

[25] This particular finding is puzzling as other studies generally found that productivity is a strong determinant of export market participation decisions (e.g. Damijan et al., 2005, who used labor productivity; Girma et al., 2004, and Greenaway and Kneller, 2003, who used TFP). It might be due to the fact that firms' size and productivity are strongly correlated.

additional strategic motives for exporting for multinational firms even when controlling for their generally more favorable underlying characteristics.

Finally, in all years, our liquidity variable has the expected positive coefficient, which is statistically significant in 6 of the 10 years. This suggests that more liquid firm-years are generally more likely to export. The marginal effects for this variable suggest that increasing liquidity by one unit, would raise the probability of exporting in a range between 0.9 (in 1995) and 2.7 percentage points (in 2000), effects which are economically significant.

Table 4 reports estimates of Equation (9) for all years pooled together. Column 1 reports estimates obtained using a pooled Probit estimator, which takes clustering into account. Our results are robust to this change. The inverted U-shaped relationship between firm size and probability of exporting is confirmed, while the liquidity variable again has a positive and statistically significant effect. The marginal effect suggests that increasing liquidity by one unit raises the probability of exporting by 1.7 percentage points, within the range of the cross-sectional results. Column 2 reports estimates obtained using a random-effects Probit estimator: the results are similar to those in column 1. Columns 3 and 4 report pooled and random-effects Probit estimates when the liquidity variable is replaced with the ratio of short-term debt to current assets. In both cases, this new financial variable has a negative and precisely determined coefficient, suggesting that more leveraged firm-years are less likely to export, possibly because they face greater difficulties obtaining funds. All results so far suggest that financial variables play a significant role in determining firms' decisions to export.

*Differentiating the effects of the financial variables across financially constrained and financially healthy firm-years*

Table 5 presents estimates of Equation (10). In columns 1 and 2, the relevant financial variable is liquidity, whereas in columns 3 and 4, it is the ratio of short-term debt to current assets, which is included instead of liquidity. In all four columns firms are split into financially constrained and financially healthy each year using liquidity as a sample separation criterion. In particular, a firm is classified as financially constrained in a given year if its liquidity falls in the lowest three quartiles of the distribution of liquidity of all firms in that industry and year. Columns 1 and 3 report pooled Probit estimates corrected for clustering, and columns 2 and 4 report random-effects Probit estimates.

We can see from column 1 that the effect of liquidity is positive and statistically significant for both financially constrained and unconstrained firm-years. However, the coefficient for the former (0.10) is larger than the latter (0.07). The corresponding marginal effects are 0.026 and 0.019, suggesting that increasing liquidity by one unit would raise the probability of exporting at financially constrained firm-years by 2.6 percentage points and that of the healthy firm-years by 1.9 percentage points. Similar results hold when a random-effects estimator is used, although the difference in the coefficients associated with the liquidity variable for financially constrained and healthy firms is less pronounced (column 2). When the short-term debt to current assets ratio is included (columns 3 and 4), it has a negative and precisely determined coefficient only for those firm-years more likely to face financial constraints. The effect of a weak balance sheet is more keenly felt by financially constrained firm-years.

Columns 5 and 6 present a further robustness test: we make use of our base-line specification with liquidity, but use the firm's quiscore instead of liquidity as a sample separation criterion, again classifying a firm as financially constrained in a given year if the value of its quiscore in that year falls in the lowest three quartiles of the distribution of quiscores of all firms in that industry and year. Column 5 presents pooled Probit estimates, whereas column 6 presents random-effects Probit estimates. Column 5 shows that the liquidity variable has a positive and significant coefficient for both types of firm-years, which is once again larger in magnitude for the constrained firm-years. A similar conclusion applies to column 6, although in the latter case, the difference in the coefficient associated with liquidity for constrained and unconstrained firm-years is smaller.

We therefore conclude that there is strong evidence that our financial variables play a positive and significant role in firms' export participation decisions, and this effect is generally stronger for those firm-years more likely to face financial constraints. This supports the financing constraints hypothesis. Our results are robust to using different financial variables, different ways of classifying firm-years into financially healthy and financially constrained, and different methods of estimation. They are in line with the conclusions reached by many articles in the investment literature, which report that financial variables affect firms' investment decisions, and that financially constrained firms generally display higher sensitivities of investment to financial variables, supporting therefore the financing constraints hypothesis (see for instance Fazzari et al., 1988; and Hubbard, 1998 for a survey).

*Dynamic specifications*

The above results raise the question of why financial variables have such a strong influence on export decisions. According to our hypothesis, higher liquidity and/or lower leverage make it easier for firms to bear sunk costs, and consequently easier to enter export markets. To test this, we estimate dynamic Probit export models, which include financial variables. In these models, the lagged export status of the firm, by measuring previous export market experience, can be interpreted as sunk costs (Roberts and Tybout, 1997; Tybout, 2003; Bernard and Jensen, 2004). If financial variables are no longer significant in these specifications, which take sunk costs directly into account, then we will be able to conclude that our hypothesis is supported by the data.

The results of our dynamic specifications, estimated using a random-effects Probit approach, are reported in Table 6[26]. Column 1 presents the estimates with a single liquidity variable; column 2, those where the effects of the liquidity variable are differentiated for firm-years that are more or less likely to face financial constraints, on the basis of their liquidity; columns 3 and 4 report the corresponding specifications when the ratio of short-term debt to current assets is used instead of liquidity as a right-hand-side variable; and column 5, those where liquidity is used as a regessor, but firm-years are divided into financially constrained and financially healthy on the basis of the value of their quiscore.

In all specifications, the coefficient on previous export experience is positive and highly significant. Focusing on the marginal effects, export experience in the previous period raises the probability of exporting in the current period by about 90 percentage points[27]. This suggests that the sunk costs of export market entry in the UK are significantly higher than in the US (Bernard and Jensen, 2004, estimate them to be 36 per cent), but comparable to other European countries such as Italy and Spain (Bugamelli and Infante, 2003; and Campa, 2004). Interestingly, once sunk costs are accounted for in the regression, the financial variables lose their significance, for all types of firms. Therefore, conditional on past experience, financial variables do not help to predict participation. This indicates that financial variables played an important role in our earlier specifications capturing the effect of sunk costs. This result contrasts with the other firm level determinants such as size, which remain precisely determined although smaller in magnitude.

[26] Similar results were obtained when a pooled Probit approach was used in estimation. These are not reported for brevity, but are available from the authors upon request.

[27] This finding is not unexpected as, according to our dataset, 82.2% of the firm-years exporting in one given period were also exporting in the following period; and 73.5% of the firm-years not exporting in one given period were also not exporting in the following period. Note, however, that as discussed in Section 4, our estimate of the lagged dependent variable coefficient is likely to be biased.

Our results also suggest that the main effect of size on export participation stems from its role in affecting the ability of firms to generate sufficient profits from exporting net of sunk entry costs. However, the fact that the coefficients on the size-related variables become smaller in the dynamic models indicates that size also plays some role in affecting the firm's ability to finance export market entry costs. This can be explained by smaller firms being particularly susceptible to information asymmetry effects. Given that they are generally younger, little public information is available for them, and it is more difficult for financial institutions to gather this information. Obtaining external finance is therefore likely to be particularly costly for smaller firms. Size has been extensively used in the financing constraints literature as a proxy for the financial constraints faced by firms (see for instance Carpenter et al., 1994, 1998; Gertler and Gilchrist, 1994; Carpenter and Guariglia, 2003).

In summary, our results suggest that financial variables are an important determinant not only of firms' investment in fixed capital, inventory investment, investment in R&D, or employment, as found in previous literature, but also of their ability to enter export markets. This finding supports the financing constraints hypothesis and confirms the importance of adding a financial dimension to firm heterogeneity, when explaining why some firms engage in international trade while others do not.

## 6. Conclusions

In this paper, we have introduced a completely new dimension of firm heterogeneity to understand why some firms engage in international trade while others do not, namely a financial dimension. In particular, we have used a panel of 9352 UK firms over the period 1993-2003 to analyze the role played by financial variables in determining firms' decisions to export. We found that those firms more likely to face financial constraints are less likely to export. Moreover, balance sheet variables are important determinants of export market participation decisions. This happens essentially because healthier balance sheets make it easier for firms to meet the sunk export markets entry costs. Our results are robust to the use of different financial variables, different ways of splitting the sample into financially constrained and unconstrained firms, and different methods of estimation.

The policy implications of our findings are considerable. If small, financially constrained firms are less likely to enter export markets because of difficulties in meeting entry costs, then policies ensuring that there is efficient intermediation of funds to these firms might help the small business community thrive not only domestically, but also

internationally. In an increasingly globalized world, these policies would therefore have the potential to promote growth.

## Appendix 1: Data

Structure of the unbalanced panel for the entire economy:

| Number of observations per firm | Number of firms | Percent | Cumulative |
|---|---|---|---|
| 1 | 1292 | 13.82 | 13.82 |
| 2 | 899 | 9.61 | 23.43 |
| 3 | 862 | 9.22 | 32.65 |
| 4 | 829 | 8.86 | 41.51 |
| 5 | 736 | 7.87 | 49.38 |
| 6 | 715 | 7.65 | 57.03 |
| 7 | 656 | 7.01 | 64.04 |
| 8 | 752 | 8.04 | 72.08 |
| 9 | 1086 | 11.61 | 83.69 |
| 10 | 1525 | 16.31 | 100.00 |
| Total | 9352 | 100.00 | |

Definitions of the variables used:

*EXP:* dummy variable equal to 1 if the firm exports a positive amount.

*Total assets*: sum of the firm's fixed (tangible and intangible) assets and current assets. Current assets are defined as the sum of stocks, work-in-progress inventories, trade and other debtors, cash and equivalents, and other current assets.

*Sales:* includes both UK and overseas turnover.

*Labor productivity*: the ratio of the firm's total real sales to its total number of employees.

*Wage*: the ratio of the firms' total wage bill (which includes wages, salaries, social security and pension costs) to number of employees.

*Foreign:* dummy variable equal to 1 if the firm is foreign owned, and 0 otherwise. This variable is only available in the last year of observations available for each firm. We therefore assume that a firm which was foreign owned in its last available year was foreign owned throughout the period in which it was observed.

*Subsidiaries:* dummy variable equal to 1 if the firm has subsidiaries, and 0 otherwise. This variable is only available in the last year of observations for each firm. We therefore assume that a firm which had subsidiaries in its last available year also had them throughout the period in which it was observed.

*Liquidity*: ratio of the firm's current assets to its current liabilities. Current liabilities are defined as the sum of short-term debt, trade credit, and other current liabilities that include some forms of finance resembling commercial paper or bonds.

*Coverage ratio*: ratio between the firm's total profits before tax and before interest and its total interest payments.

*First measure of leverage*: the firm's short-term debt to total assets ratio. Short-term debt includes the following items: bank overdrafts, short-term group and director loans, hire purchase, leasing, and other short-term loans, but it is predominantly bank finance.

*Second measure of leverage*: the firm's total (short- and long-term) debt to total assets ratio.

*Third measure of leverage*: the firm's short-term debt to current assets ratio.

*Fourth measure of leverage*: the firm's ratio of short-term debt to current liabilities.

*Cash flow*: sum of after tax profit and depreciation.

*Quiscore*: indicator produced by Qui Credit Assessment Ltd, which measures the likelihood of company failure in the twelve months following the date of calculation. Quiscore is given as a number in the range from 0 to 100. The lower its quiscore the more risky a firm is likely to be.

*Deflators*: all variables are deflated using the aggregate GDP deflator.

**Appendix 2: Sample selection problems**

*Data reporting requirements*

In principle, in the UK, all limited companies have to prepare accounts and file them with the Registrar of Companies. However, there are a number of exemptions. Moreover, as export turnover is not one of the basic headings of the Profits and Loss accounts of a firm, but is part of the so called segmental information, which appear in the Notes to some of the sections of the Profit and Loss account, further exemptions apply to the reporting of this variable. We will discuss these exemptions in turn.

Some firms are exempted from the preparation and filing of a Profit and Loss account. In particular, small firms are not required to submit a Profit and Loss account at all, and medium-sized firms are only required to submit an abridged Profit and Loss account containing only the main headings of income and expenditure, but providing no detail (Companies Act, 1985, Schedule 4, Paragraph 55) [28].

[28] In particular, these firms are not required to disclose turnover details.

To be a small company, at least two of the following conditions must be met for two consecutive years:

- annual turnover must be £2,800,000 or less;
- the balance sheet total must be £1,400,000 or less;
- the average number of employees must be 50 or fewer.

To be a medium-sized company, at least two of the following conditions must be met for two consecutive years:

- annual turnover must be £11,200,000 or less;
- the balance sheet total must be £5,600,000 or less;
- the average number of employees must be 250 or fewer.

It should be noted that if a firm is not required to submit a Profit and Loss account, this does not mean that it will not submit it. It might submit it anyway. A reason for doing so is that when asking for specific loans, mortgages, or other contractual obligations, the accounts for the last three years should be presented.

Only firms that are not small or medium-sized are therefore required to report their turnover in principle. Yet, according to the Statement of Standard Accounting Practice 25 (1989), further exemptions appear regarding overseas turnover. In particular, only those geographical segments that are significant to an entity as a whole should be identified as reportable segments (materiality test) [29]. For the purposes of this accounting standard, a segment should normally be regarded as significant if:

- its third party turnover is ten per cent or more of the total third party turnover of the entity; or
- its segment result, whether profit or loss, is ten per cent or more of the combined result of all segments in profit or of all segments in loss, whichever combined result is the greater; or
- its net assets are ten per cent or more of the total net assets of the entity.

To summarize, small and medium-sized companies are not required to report their export turnover, whereas larger firms are required to report it only if it is significant[30].

[29] A geographical segment is defined as a geographical area comprising an individual country or a group of countries in which an entity operates, or to which it supplies products or services. Furthermore, the accounting standard requires the disclosure of sales by origin, but reporting entities should also disclose turnover by destination, unless there is no material difference between the two.

[30] A similar rule is applicable in the US where the Financial Accounting Standard Board 131 requires companies to report information about an operating segment (including geographic segments) if: its revenues are at least 10% of all operating segments, or the segment's profit/loss is at least 10% of the profit/loss for all segments, or the segment's assets are at least 10% of all operating segments.

These laws and/or regulatory requirements/accounting standards can explain the large number of missing values characterizing our data on export turnover. These data might be missing throughout the entire period for those firms that start-off as small or medium-sized and remain such for the entire period available. Yet, other firms might transit between size-classes: this might explain why export turnover for a given firm might be reported in some years and not in others. Furthermore, even for relatively large firms, it is possible that export turnover is at times significant, and thus reported; and at times insignificant, and thus not reported (and coded therefore as missing).

In this paper, we have excluded those observations characterized by missing values on export turnover. The size of our sample was therefore reduced from 122266 annual observations, corresponding to 15368 companies, to 52594 annual observations on 9352 companies. This strategy is likely to lead to sample selection problems, as the criteria according to which a firm is required or not to report information are obviously non-random.

*Dealing with sample selection problems*

In some cases, although present, the selectivity bias may be considered as ignorable. In particular, explicit corrections for sample selection bias are not necessary if the specifications are estimated over relatively short panels. It is in fact reasonable to assume that in this case, any correction would be time-invariant and would hence be absorbed in the firm-specific component of the error term (Baltagi, 1995). As our data consists of an unbalanced panel, such that the maximum number of years available for each firm is 10, it can be considered as a short panel.

In Table A.1, we present the results of the estimation of Equation (10) using a pooled Probit model corrected for selectivity using the method proposed by Van de Ven and Van Pragg (1981). As discussed above, only relatively large firms are required to report their total turnovers, and consequently their overseas turnover. Therefore, the latter variable is characterized by a number of missing values. We therefore estimate the probability to export jointly with the probability of reporting export turnover, which we assume to be dependent on firms' size measured in terms of total real assets, number of employees, industry and time dummies. The results are largely similar to those reported in column 1 of Table 5. This confirms that sample selection is unlikely to introduce strong biases in our estimated coefficients.

**Table 1: Summary statistics of the key variables**

| | Total sample | Observations such that $EXP_{it}$=0 | Observations such that $EXP_{it}$=1 | Firms that never exported | Firms that always exported |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| *Real assets*$_{it}$ | 2396.28 | 15764.63 | 27151.8 | 13860.36 | 26936.64 |
| *Number of employees*$_{it}$ | 285.58 | 209.86 | 312.55 | 194.64 | 312.39 |
| *Real sales*$_{it}$ | 309.37 | 202.88 | 350.86 | 174.47 | 348.82 |
| *Age*$_{it}$ | 27.67 | 21.76 | 28.98 | 24.13 | 29.18 |
| *Labor productivity*$_{it}$ | 1.34 | 1.31 | 1.35 | 1.32 | 1.33 |
| *Wage*$_{it}$ | 22.0 | 21.76 | 22.09 | 21.71 | 22.13 |
| *Foreign*$_{i}$ | 0.46 | 0.33 | 0.50 | 0.31 | 0.50 |
| *Subsidiaries*$_{i}$ | 0.32 | 0.25 | 0.34 | 0.24 | 0.34 |
| *Liquidity*$_{it}$ | 1.60 | 1.49 | 1.64 | 1.49 | 1.65 |
| *Coverage ratio*$_{it}$ | 30.70 | 30.73 | 30.70 | 31.91 | 30.48 |
| *(Short-term debt/total assets)*$_{it}$ | 0.24 | 0.24 | 0.24 | 0.23 | 0.24 |
| *(Total debt/ total assets)*$_{it}$ | 0.38 | 0.37 | 0.39 | 0.37 | 0.39 |
| *(Short-term debt/current assets)*$_{it}$ | 0.39 | 0.42 | 0.38 | 0.41 | 0.37 |
| *(Short-term debt/current liabilities)*$_{it}$ | 0.38 | 0.37 | 0.39 | 0.36 | 0.38 |
| *(Cash flow/total assets)*$_{it}$ | 0.087 | 0.10 | 0.08 | 0.11 | 0.082 |
| *Quiscore*$_{it}$ | 54.94 | 54.11 | 55.25 | 54.69 | 55.38 |
| Observations | 52546 | 37828 | 14718 | 12200 | 33537 |

*Notes:* $EXP_{it}$ is a dummy variable equal to 1 if firm *i* has positive exports in year *t.* *Liquidity*$_{it}$ is defined as the ratio of the firm's current assets to its current liabilities. *Subsidiaries*$_{i}$ is a dummy variable equal to 1 if firm *i* has subsidiaries, and 0 otherwise. *Foreign*$_{i}$ is a dummy equal to 1 if firm *i* is foreign owned, and 0 otherwise. *Quiscore* measures the likelihood of company failure in the twelve months following the date of calculation. The lower its quiscore value, the more risky the firm is considered to be. See Appendix 1 for more accurate definitions of the variables in this Table.

**Table 2: Percentages of exporters by industry and financial characteristics**

| | Entire sample | Low real assets (size) | High real assets (size) | Low liquidity | High liquidity | High short-term debt/ current assets | Low short-term debt/ current assets |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| *Metals and metal goods* | 77.4 | 73.2 | 89.7 | 76.1 | 80.9 | 77.9 | 78.0 |
| *Other minerals & mineral products* | 67.0 | 62.0 | 81.7 | 67.2 | 66.8 | 69.6 | 68.2 |
| *Chemicals and man-made fibres* | 84.6 | 81.0 | 95.4 | 83.6 | 88.0 | 84.8 | 84.9 |
| *Mechanical engineering* | 85.6 | 83.4 | 92.3 | 84.9 | 87.8 | 86.2 | 84.7 |
| *Electrical engineering.* | 84.4 | 81.5 | 93.1 | 83.1 | 88.3 | 84.9 | 84.4 |
| *Motor vehicles, parts, other transport equipment* | 77.0 | 75.2 | 82.2 | 76.1 | 80.2 | 79.6 | 73.8 |
| *Food, drink, tobacco* | 50.5 | 46.2 | 63.5 | 49.0 | 55.2 | 50.9 | 54.4 |
| *Clothing, leather, footwear* | 79.4 | 76.7 | 87.6 | 78.0 | 84.6 | 80.1 | 80.3 |
| *Other* | 54.9 | 49.4 | 71.9 | 53.0 | 61.6 | 54.4 | 58.0 |
| All | 71.9 | 68.0 | 83.9 | 70.6 | 76.3 | 72.4 | 73.2 |

| | High short-term debt / current liabilities | Low short-term debt / current liabilities | Low coverage ratio | High coverage ratio | Low quiscore | High quiscore |
|---|---|---|---|---|---|---|
| | (8) | (9) | (10) | (11) | (12) | (13) |
| *Metals and metal goods* | 78.3 | 76.6 | 76.7 | 77.3 | 77.2 | 78.6 |
| *Other minerals & mineral products* | 70.8 | 64.7 | 73.2 | 57.1 | 66.5 | 67.1 |
| *Chemicals and man-made fibres* | 85.4 | 82.9 | 86.6 | 83.4 | 83.7 | 87.1 |
| *Mechanical engineering* | 86.5 | 83.8 | 85.4 | 88.1 | 86.3 | 85.4 |
| *Electrical engineering* | 85.4 | 82.3 | 84.7 | 84.1 | 83.7 | 87.3 |
| *Motor vehicles, parts, other transport equipment* | 80.0 | 72.6 | 80.7 | 73.2 | 75.4 | 80.5 |
| *Food, drink, tobacco* | 51.9 | 51.5 | 50.9 | 51.1 | 50.9 | 52.2 |
| *Clothing, leather, footwear* | 80.3 | 79.0 | 82.8 | 81.6 | 78.4 | 82.0 |
| *Other* | 54.9 | 56.1 | 56.1 | 57.6 | 54.2 | 55.8 |
| All | 72.9 | 71.4 | 73.1 | 72.4 | 71.4 | 73.5 |

*Notes:* Observations with low (high) real assets, liquidity, coverage ratio, quiscore values (short-term debt to current assets ratio, short-term debt to current liabilities ratio) in year *t* fall in the lowest (highest) three quartiles of the distribution of the same variable for all the firms in that particular industry and year. Also see Notes to Table 1.

## Table 3: Cross-sectional Probit models of export participation

| | 1994 | 1995 | 1996 | 1997 | 1998 |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $Size_{i(t-1)}$ | 1.207 | 1.338 | 1.311 | 1.374 | 1.339 |
| | (5.23)*** | (6.83)*** | (7.15)*** | (7.74)*** | (7.50)*** |
| $Size^2_{i(t-1)}$ | -0.054 | -0.060 | -0.058 | -0.062 | -0.061 |
| | (4.46)*** | (5.82)*** | (5.95)*** | (6.73)*** | (6.53)*** |
| $Wage_{i(t-1)}$ | -0.007 | -0.006 | -0.006 | -0.002 | -0.009 |
| | (1.28) | (1.26) | (1.48) | (0.58) | (2.31)* |
| *Labor* $productivity_{i(t-1)}$ | 0.005 | -0.004 | -0.020 | -0.040 | -0.030 |
| | (0.24) | (0.22) | (1.13) | (2.57)** | (1.80) |
| $Subsidiaries_i$ | 0.145 | 0.093 | 0.072 | 0.125 | 0.147 |
| | (1.79)* | (1.41) | (1.16) | (2.07)** | (2.50)** |
| $Foreign_i$ | 0.203 | 0.157 | 0.159 | 0.161 | 0.252 |
| | (2.86)*** | (2.66)*** | (2.86)*** | (3.02)*** | (4.84)*** |
| $Liquidity_{i(t-1)}$ | 0.114 | 0.040 | 0.066 | 0.073 | 0.041 |
| | (2.63)*** | (1.19) | (1.84)* | (1.91)* | (1.29) |
| Observations | 2054 | 2972 | 3335 | 3579 | 3706 |

| | 1999 | 2000 | 2001 | 2002 | 2003 |
|---|---|---|---|---|---|
| | (6) | (7) | (8) | (9) | (10) |
| $Size_{i(t-1)}$ | 1.357 | 1.411 | 1.215 | 1.063 | 1.981 |
| | (7.72)*** | (8.04)*** | (7.21)*** | (5.99)*** | (4.24)*** |
| $Size^2_{i(t-1)}$ | -0.062 | -0.065 | -0.055 | -0.048 | -0.096 |
| | (6.73)*** | (7.06)*** | (6.25)*** | (5.14)*** | (3.80)*** |
| $Wage_{i(t-1)}$ | -0.014 | -0.009 | -0.004 | -0.003 | -0.017 |
| | (3.80)*** | (2.51)** | (1.07) | (0.73) | (1.75) |
| *Labor* $productivity_{i(t-1)}$ | 0.012 | -0.007 | -0.012 | -0.013 | 0.046 |
| | (0.70) | (0.42) | (0.70) | (0.69) | (0.79) |
| $Subsidiaries_i$ | 0.174 | 0.108 | 0.118 | 0.136 | 0.365 |
| | (3.02)*** | (1.92) | (2.08)** | (2.30)** | (2.42)** |
| $Foreign_i$ | 0.229 | 0.248 | 0.226 | 0.223 | 0.520 |
| | (4.52)*** | (4.94)*** | (4.49)*** | (4.25)*** | (2.97)*** |
| $Liquidity_{i(t-1)}$ | 0.092 | 0.097 | 0.065 | 0.036 | 0.062 |
| | (3.36)*** | (3.87)*** | (2.60)*** | (1.59) | (1.06) |
| Observations | 3788 | 3779 | 3751 | 3480 | 566 |

*Note*: Robust z-statistics are reported in parentheses. Industry dummies were included in all specifications. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level. Also see Notes to Table 1.

## Table 4: Static Probit models of export participation

| | Pooled Probit | Random-effects Probit | Pooled Probit | Random-effects Probit |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $Size_{i(t-1)}$ | 1.306 | 2.101 | 1.246 | 1.840 |
| | (10.10)*** | (8.31)*** | (9.39)*** | (5.31)*** |
| $Size^2_{i(t-1)}$ | -0.059 | -0.074 | -0.056 | -0.064 |
| | (8.74)*** | (5.74)*** | (8.07)*** | (3.62)*** |
| $Wage_{i(t-1)}$ | -0.007 | -0.010 | -0.007 | -0.014 |
| | (2.51)** | (2.58)*** | (2.43)** | (1.98)** |
| *Labor productivity*$_{i(t-1)}$ | -0.014 | -0.006 | -0.018 | -0.035 |
| | (1.11) | (0.30) | (1.42) | (1.97)** |
| $Subsidiaries_i$ | 0.129 | 0.244 | 0.122 | 0.353 |
| | (2.74)*** | (3.02)*** | (2.56)** | (2.99)*** |
| $Foreign_i$ | 0.210 | 0.185 | 0.241 | 0.171 |
| | (5.05)*** | (2.77)*** | (5.70)*** | (1.48) |
| $Liquidity_{i(t-1)}$ | 0.065 | 0.059 | | |
| | (3.73)*** | (2.33)** | | |
| *(Short-term debt / current assets)*$_{i(t-1)}$ | | | -0.217 | -0.475 |
| | | | (6.24)*** | (7.74)*** |
| Observations | 31010 | 31010 | 29651 | 29651 |

*Note:* In the pooled Probit specifications, the standard errors are corrected for clustering. Robust z-statistics are reported in parentheses. Time-dummies and industry dummies were included in all specifications. Sample period: 1994-2003. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level. Also see Notes to Table 1.

**Table 5: Static Probit models of export participation: distinguishing firm-years on the basis of the degree of financial constraints that they face**

| | Pooled Probit | Random-effects Probit | Pooled Probit | Random-effects Probit | Pooled Probit | Random-effects Probit |
|---|---|---|---|---|---|---|
| | *FINDUM* based on liquidity | *FINDUM* based on liquidity | *FINDUM* based on liquidity | *FINDUM* based on liquidity | *FINDUM* based on quiscore | *FINDUM* based on quiscore |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $Size_{i(t-1)}$ | 1.304 | 3.270 | 1.246 | 1.487 | 1.323 | 1.926 |
| | (10.07)*** | (14.43)*** | (9.38)*** | (5.99)*** | (10.08)*** | (7.48)*** |
| $Size^2_{i(t-1)}$ | -0.059 | -0.142 | -0.056 | -0.041 | -0.060 | -0.065 |
| | (8.71)*** | (12.28)*** | (8.06)*** | (3.17)*** | (8.75)*** | (4.96)*** |
| $Wage_{i(t-1)}$ | -0.007 | -0.10 | -0.007 | -0.013 | -0.007 | -0.011 |
| | (2.52)** | (2.62)*** | (2.44)** | (2.76)*** | (2.62)*** | (2.44)** |
| $Labor\ productivity_{i(t-1)}$ | -0.014 | -0.021 | -0.018 | -0.008 | -0.013 | 0.000 |
| | (1.12) | (1.23) | (1.44) | (0.26) | (1.01) | (0.03) |
| $Subsidiaries_i$ | 0.128 | 0.056 | 0.123 | 0.182 | 0.133 | 0.150 |
| | (2.72)*** | (0.77) | (2.57)** | (2.37)** | (2.79)*** | (1.85)* |
| $Foreign_i$ | 0.211 | 0.357 | 0.240 | 0.396 | 0.213 | 0.378 |
| | (5.08)*** | (5.30)*** | (5.66)*** | (5.49)*** | (5.08)*** | (5.48)*** |
| $Liquidity_{i(t-1)} * FINDUM_{it}$ | 0.099 | 0.077 | | | 0.111 | 0.080 |
| | (4.03)*** | (1.85)* | | | (4.88)*** | (2.75)*** |
| $Liquidity_{i(t-1)} * (1-FINDUM_{it})$ | 0.071 | 0.068 | | | 0.061 | 0.071 |
| | (4.02)*** | (2.78)*** | | | (3.36)*** | (2.72)*** |
| $(Short\text{-}term\ debt / current\ assets)_{i(t-1)} * FINDUM_{it}$ | | | -0.217 | -0.425 | | |
| | | | (6.25)*** | (7.40)*** | | |
| $(Short\text{-}term\ debt / current\ assets)_{i(t-1)} * (1-FINDUM_{it})$ | | | -0.081 | -0.303 | | |
| | | | (0.81) | (1.83)* | | |
| Observations | 30947 | 30947 | 29591 | 29591 | 30213 | 30213 |

*Note:* $FINDUM_{it}$ is a dummy variable equal to 1 if the liquidity/quiscore of firm *i* in year *t* falls in the lowest three quartiles of the distribution of the liquidity/quiscore values of all the firms in the same industry as firm *i* in year *t*; and 0 otherwise. In the pooled Probit specifications, the standard errors are corrected for clustering. Robust z-statistics are reported in parentheses. Time-dummies and industry dummies were included in all specifications. Sample period: 1994-2003. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level. Also see Notes to Table 1.

## Table 6: Dynamic Probit models of export participation

| | *FINDUM* based on liquidity | *FINDUM* based on liquidity | *FINDUM* based on liquidity | *FINDUM* based on liquidity | *FINDUM* based on quiscore |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| $EXP_{i(t-1)}$ | 3.539 | 3.540 | 3.521 | 3.523 | 3.542 |
| | (109.65)*** | (109.49)*** | (107.00)*** | (106.80)*** | (108.21)*** |
| $Size_{i(t-1)}$ | 0.475 | 0.475 | 0.429 | 0.429 | 0.535 |
| | (4.42)*** | (4.42)*** | (3.86)*** | (3.86)*** | (4.90)*** |
| $Size^2_{i(t-1)}$ | -0.023 | -0.023 | -0.020 | -0.021 | -0.026 |
| | (4.01)*** | (4.51)*** | (3.51)*** | (3.52)*** | (4.49)*** |
| $Wage_{i(t-1)}$ | -0.005 | -0.005 | -0.004 | -0.004 | -0.005 |
| | (2.19)** | (2.26)** | (1.95)* | (1.99)** | (2.32)** |
| *Labor productivity*$_{i(t-1)}$ | -0.000 | 0.002 | -0.002 | 0.001 | 0.001 |
| | (0.02) | (0.24) | (0.19) | (0.08) | (0.10) |
| $Subsidiaries_i$ | 0.028 | 0.030 | 0.040 | 0.042 | 0.033 |
| | (0.76) | (0.82) | (1.07) | (1.10) | (0.87) |
| $Foreign_i$ | 0.112 | 0.110 | 0.118 | 0.119 | 0.113 |
| | (3.37)*** | (3.30)*** | (3.48)*** | (3.50)*** | (3.35)*** |
| $Liquidity_{i(t-1)}$ | -0.023 | | | | |
| | (1.71)* | | | | |
| $Liquidity_{i(t-1)} * FINDUM_{it}$ | | -0.043 | | | -0.018 |
| | | (1.60) | | | (0.92) |
| $Liquidity_{i(t-1)} * (1-FINDUM_{it})$ | | -0.017 | | | -0.022 |
| | | (1.22) | | | (1.53) |
| *(Short-term debt / current assets)*$_{i(t-1)}$ | | | -0.040 | | |
| | | | (1.19) | | |
| *(Short-term debt / current assets)*$_{i(t-1)} * FINDUM_{it}$ | | | | -0.043 | |
| | | | | (1.27) | |
| *(Short-term debt / current assets)*$_{i(t-1)} * (1-FINDUM_{it})$ | | | | -0.118 | |
| | | | | (0.92) | |
| Observations | 31010 | 30947 | 29651 | 29591 | 30213 |

*Notes:* A random-effects Probit estimator was used in all columns. Robust z-statistics are reported in parentheses. Time-dummies and industry dummies were included in all specifications. Sample period: 1994-2003. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level. Also see Notes to Tables 1 and 5.

**Table A1: Pooled Probit specifications corrected for sample selection using the method illustrated by Van de Ven and Van Pragg (1981).**

| | Coefficients<br>(1) | *z*-statistics<br>(2) |
|---|---|---|
| $Size_{i(t-1)}$ | 1.230 | *10.84**** |
| $Size^2_{i(t-1)}$ | -0.056 | *-9.65**** |
| $Wage_{i(t-1)}$ | -0.008 | *-3.78**** |
| *Labor productivity*$_{i(t-1)}$ | -0.008 | *-0.76* |
| $Subsidiaries_i$ | 0.110 | *2.66*** |
| $Foreign_i$ | 0.183 | *5.03**** |
| $Liquidity_{i(t-1)}$*$FINDUM_{it}$ | 0.040 | *2.10*** |
| $Liquidity_{i(t-1)}$*(1-$FINDUM_{it}$) | 0.020 | *1.78** |
| Observations | 71879 | |

*Notes*: Standard errors are corrected for clustering. Time-dummies and industry dummies were included in all specifications. Sample period: 1994-2003. * indicates significance at the 10% level. ** indicates significance at the 5% level. *** indicates significance at the 1% level. Also see Notes to Tables 1 and 5.

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