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Borrowing constraints and export decision: the case of Vietnamese exporters

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Abstract

This paper examines the impact of borrowing constraints and productivity on the export decision of Vietnamese firms, where we approximate borrowing constraints by leverage and the tangible asset ratio. Using a large firm-level dataset for the years 2009-2014, we show that borrowing constraints play an important role in the export decision. There is an inverse U-shaped relationship between leverage and the export probability for private manufacturers. The marginal effect of leverage is declining with leverage, but positive up till a leverage ratio of about 47 percent and negative beyond. Borrowing constraints matter both for the decision to start exporting and for the decision to continue exporting, but more so for the latter. Medium and high productive firms are more sensitive to borrowing constraints than low productive firms.

Keywords: international trade; heterogeneous firms; non-linear effects; probit analysis; leverage; productivity; credit constraints

JEL classification: D8, F1, G1, G2

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1. Introduction

The recent literature on international trade increasingly features firm heterogeneity and emphasizes the decisions of individual firms in understanding the causes and consequences of aggregate trade. A handful of empirical studies uncovered that a very small percentage of firms are engaged in exporting and that exporters are more productive, larger, and more capital intensive (Aw and Hwang,1994; Bernard, Jensen, 1999).This work triggered a theoretical revolution to account for such firm heterogeneity in international trade (Melitz, 2003). One key implication of the Melitz model is the so-called self-selection effect. That is, due to the presence of high fixed (and variable) costs, only the most productive firms are able to export, while medium productivity firms serve domestically, and low productivity firms exit. Building on this framework, Chaney (2005) and Manova (2013) introduced financial constraints as another dimension of firm heterogeneity in trade theory. Empirical papers accounting for financial constraints in trade such as Greenaway et al. (2007), Berman and Hericourt (2010), Muuls (2015) have provided evidence on the role of financial constraints on firms participating into export market. Despite this body of literature, the issue is not fully settled yet. First, how financial constraints shape exports remains unclear and not fully understood. Second, it is still ambiguous how the impact of financial constraints on the export decision varies among firm types and exporter types. Last, the role of financial constraints in shaping the export decision for firms at various level of productivity has been largely disregarded so far and remains to be determined.

This paper attempts to fill the void in the literature by providing empirical evidence for the relationship between financial constraints, productivity, and exports at the firm level. It explores several closely related questions. How do financial constraints affect the export decision? How do these effects vary with different types of firm ownership or types of exporter? And how do financial constraints determine export decision for firms at different productivity levels? Our analysis differs from the existing literature in three respects. First, we hypothesize a non-monotonic relationship between leverage and export decision. While increasing debt can benefit firms in participating into international trade, the benefit can become a drag if the debt ratio exceeds a threshold. Second, we distinguish between new exporters and continuous exporters. This allows us to explore the role of borrowing constraints not only in the entry decision but also in

remaining export status. Last, rather than focusing on the separate role of financial constraints and productivity on export, we demonstrate their joint role in shaping the export decision.

We address these questions by using a rich firm level data set for Vietnam during 2009-2014. Vietnam has emerged as the 24th largest exporter of the world currently from the lowest position on the international trade map only a few decades ago, providing a considerable interest of study. The sample consists of firms with different ownership types. The large majority of firms are private-owned. In addition, there are state-owned and foreign-owned firms. We find strong results for privately owned firms. Higher leverage and tangible asset ratios are found to lead to higher export probability, but too much leverage has an adverse effect on that probability for private manufacturers. More precisely, we document that leverage increasingly becomes a constraint beyond a threshold of approximately 47%. Furthermore, we differentiate between new exporters and continuous exporters and show that borrowing constraints matter more for maintaining exporting than for starting to export. In addition, we find strong persistence in being either an exporting or non-exporting firm. Last, we allow the interaction between productivity and financial constraints to examine the impact of borrowing constraints on the decision to export of firms at different levels of productivity. We find that medium and high productive firms are more sensitive to borrowing constraints than the low productive ones.

The remainder of this paper is organized as follows. Section 2 reviews and discusses the relevant literature. Section 3 presents the data. Section 4 provides descriptive statistics. Section 5 presents the estimation strategy and methodology. Section 6 presents the estimation results. Section 7 concludes.

2. Literature review

The topic of international trade has received extensive attention in the literature. Early studies established the role of comparative advantage in explaining patterns of inter-industry trade. Initiated by Ricardo (1817) and developed by Heckscher-Ohlin (1933), classic trade theories explain differences in the opportunity costs of production based not on differences in technology but on variations in the factor endowments of each country and in the factor intensity of each

industry. Observable intra-industry trade triggered a new trade theory (Krugman, 1980; Helpman, 1981), in which economies of scale and consumer preferences are the key drivers.

Not until 1990sdidthe availability of firm-level data allow researchers to explore the role of firm heterogeneity in trade. Empirical papers like Clerides et al. (1998), Bernard and Jensen (1999), Kraay (1999) have suggested the self-selection of firms into international trade because only the most productive firms can cover the trade cost to enter export markets. This work triggered a theoretical revolution to account for such firm heterogeneity in international trade.[b] The seminal paper by Melitz (2003) developed a framework in which firm are heterogeneous regarding their productivity level to explain the self-selection effect. A key insight in the Melitz model is that trade liberalization in the form of falling trade costs drives the low productivity firms out of the market and only the most productive firms can survive. As a result, that reallocation toward high productivity firms raises aggregate productivity.

Other theoretical models extend the Melitz model, such as Helpman et al. (2004) who explain the choice between export and foreign direct investment. Following Melitz, a substantial number of firm level studies on firm heterogeneity in trade have been conducted for a selection of countries, including Blalock and Gertler (2004) for Indonesia, Arnold and Hussinger (2005) for Germany, Alvarez and Lopez (2005) for Chile, Damijan et al. (2007) for Slovekia, and Haidar (2012) for India. The focus in this literature has mainly been on establishing the positive role of productivity in explaining firm self-selection into export markets and on explaining individual country characteristics. In the Melitz model and its empirical applications, the extensive side of trade – the number of firms that decide to export - is entirely determined by firm productivity differences. Exporting is costly because of higher sunk and variable trade costs. The financing side of these costs is typically ignored in these papers.

Only a few theoretical papers introduce financial constraints as another dimension of firm heterogeneity in trade. Chaney (2005) allows the interaction between liquidity constraints and productivity in a Melitz setting to explain the disconnection between firm productivity and export

[b]Before the heterogeneous firm revolution in international economics, theoretical models introduced a representative firm such that, at equilibrium, either all firms export or no firms export. In the monopolistic competition framework of Dixit-Stiglitz, the identical cost-structure assumption and constant mark-ups create invariant export performance within industries.

participation in the presence of financial frictions. In Chaney's model, the correlation between productivity and export participation is not perfect but depends on financial constraints. In detail, the most productive firms always export because they can cover the upfront fixed trade costs using the profits from high revenues in the domestic market; no firms at the bottom of the productivity distribution can profitably export due to liquidity shock, but mid-productivity firms can export conditional on their ability to overcome financial constraints. Manova (2013) also analyzes the impact of financial constraints on the selection into exporting. Firms need external funds to finance foreign expansions, and they differ with regard to the level of collateral they can pledge. The model implies that productivity cut-off levels for the selection into exporting differ across firms. Highly productive firms can offer higher returns to creditors and are less credit-constrained than less productive firms. In this sense, credit constraints reinforce the negative impact that low productivity has on the entry into foreign markets. Our paper builds on both Chaney (2005) and Manova (2013) that firm depends on external finance for oversea trading.

Empirical work accounting for financial constraints in relation to firm heterogeneity in trade is rare. Berman and Hericourt (2010) test Chaney's model using a cross-country firm-level database and confirm the role of financial constraints as barriers that reduce the impact of productivity on export participation. In contrast to Chaney's prediction, their results suggest that even low-productivity firms export and that some high-productivity firms do not. Campa and Shaver (2002) use a panel of Spanish firms to test whether there is any link between liquidity constraints and firms' export. They do find that liquidity constraints are less binding for exporters than for non-exporters. They also find that cash flow is more stable for exporters than for non-exporters. They argue that it is the stability provided by foreign sales that relaxes the constraints of exporters' liquidity, and not the reverse. Exporters earning profits in different markets with imperfectly correlated business cycles can pledge more stable future earnings, which alleviates agency problems in their relationship with financial intermediaries, and relaxes their liquidity constraints. Both Feenstra et al. (2014) and Amiti and Weinstein (2011) argue that exporters face tighter credit constraints due to the nature of international trade: the time between realized revenue and goods is longer and the default risk is higher than domestic sales. Djankov et al. (2010) indeed show that cross-border shipping and delivery usually take 30–90 days longer to complete than domestic orders.

So far, empirical evidence shows that credit constraints restrict firms from participating into export markets. Only Greenaway et al. (2007) find evidence that exporters display higher financial constraints than non-exporters. However, the positive relationship between financial constraints and export probability in Greenaway et al. (2007) is for new exporters but not for continuous exporters. Their explanation is that new exporters have to pay sunk cost while continuous exporters do not. Therefore, a classification of exporter type is important to understand the nature of the relationship between credit constraints and export participation. This paper extends the empirical literature on the role of credit constraints by analyzing the joint role of credit constraints and productivity on export behaviour while distinguishing between new and continuous exporters.

3. Data and variable measurements

In this section, we provide details on the data on which the analysis of the paper is based, and then justifythe selection of variables and measurement. Finally, we provide details on the cleaning of the data.

3.1. Data

We use an extensive dataset that covers the majority of the Vietnamese manufacturers during the period 2009-2014.This is a firm-level survey dataset provided by the Government Statistical Office (GSO), which is the most reliable source of government statistics in Vietnam. Manufacturers are categorized as SOEs if the state ownership is greater than 50 percent, POEs if private ownership is greater than 50 percent, and FOEs if the firm is either 100 percent foreign owned or is a joint venture with domestic firms (either with state-owned firms or private owned firms). The survey covers all SOEs and FOEs. The POEs are randomly selected to reflect the size structure, the sector, and the geography distribution. Appendix 1 presents the selection of POEs into the survey over the years. Category 1 to 4 reflects the geographic distribution of POEs, in which firms from rural provinces (category 3) are all selected into the survey while only a percentage of firms from big cities (category 1 and 2) were chosen. The survey gives information on balance sheet and income statement items, export status, export value, taxes, and investments.

3.2. Variable definition and measurement

3.2.1. Export status

In our analysis, the focus is on the firm's decision to export or not. Therefore, the dependent variable is the firm's export status (ESS) which equals 1 if the firm exports in a given year and 0 when it does not. In a substantial number of cases, information on the export status is missing. This is especially an issue in 2012.To overcome this problem to some extent, we code the export status in year t as 0 if firm exports in year t-1 and year t+1 are both zero. The underlying assumption is that firms with no export activity in both year t-1 and year t+1 are very unlikely to have export activity in year t.[c] By doing so, we fill in 26,179 additional firm-year observations for export status (see Appendix 2 for more details). In the empirical analysis, we test for the robustness of our results with respect to this procedure.

3.2.2. Financial constraints

Financially constrained firms in both Chaney(2005) and Manova (2013) are firms that are both not productive enough and lack sufficient collateral. A firm that is insufficiently productive cannot generate sufficient liquidity from domestic sales. That is, cash flows do not contribute enough to the overall liquidity needs for export activities. Simultaneously, the firm then is not attractive enough to investors because of low expected returns, which makes it difficult to raise external finance. Alternatively, a firm could obtain external finance pledging collateral. But a firm that lacks sufficient collateralizable assets is unable to borrow to finance the additional liquidity demand related to export activities. As a result, we may claim that a firm that is unable to raise sufficient internal and external finance when needed is a financially constrained firm.

Chaney does not provide an empirical test for his model. Manova (2013) does so by using two proxies to define financially constrained firms, the share of capital expenditure not financed with cash flow from operations and the ratio of tangible assets over total assets. While the first criterion displays the extent to which a firm is able to mobilize external finance, the second criterion displays a firm's ability to back up a loan, which directly affects firm's ability to borrow.

[c] We also do the interpolation for firms with positive export status in year t-1 and year t+1. We code the export status in year t is positive for those firms. This yields the additional of 829 firm-year observations for positive export status. We do not include this interpolation because the number of additional observations is rather small than the total observations.

In this paper, we use two proxies for borrowing constraints, the leverage and the tangible asset ratio.[d]The tangible asset ratio is not only used in Manova (2013) but alsoinBerman and Hericourt (2010),Feenstra et al. (2014), and Manova and Yu (2016) as a measure of how much firms are financially constrained by the size of its collateral. It is measured as the share of net property, plant, and equipment in the total book value of assets. The literature has shown that real assets, which are a means of security, are preferred in external borrowing in poorly developed capital markets (Braun, 2003) where the agency issue and information asymmetry is more pronounced (Booth et al., 2001; Chen, 2004; Nguyen and Ramachandran, 2006).

The leverage is defined as the ratio between debt and total assets. It is used in Greenaway et al. (2007), Tang and Zhang (2012), Minetti& Zhu (2010) and Berman and Hericourt (2010) to proxy for the financial constraints of exporters. To pay the large up-front cost associated with export activities, firms have to borrow from banks to finance the purchase of assets, or leverage their assets. A low existing leverage may indicate firms have more room to borrow, therefore are less financially constrained and more likely to export. A high leverage, vice versa, is a red flag that firms are too much in debt, therefore less appealing for banker because that firm may encounter trouble with paying principal and interest. Such firms are limited in raising additional funds, therefore are financially constrained and less likely to export.

However, it is unclear whether the relation between leverage and credit constraints is linear or even monotonous. First, we do not know what level of leverage is low or high.Second, a leveragethat is very low or even equals zero does not unambiguously signal a lack offinancial constraints with considerable room for additional borrowing. It may also indicate lack of access to bank credit because of too small size or creditworthiness.In that sense, a moderate amount of bank debt may indicate the existence of established bank-client relationships and access to further borrowing. More generally, both the corporate finance literature and the macroeconomic finance-growth literature suggest the existence of non-monotonicity in the net benefit of debt. The trade-off theory in corporate finance literature states that the net benefit of debt is decreasing when leverage becomes high (Kraus and Litzenberger,1973; see Frank and Goyal (2009) for a review of the literature). The finance and growth literature has recently provided suggestive evidence of a non-

[d]Note that both the tangible asset ratio and leverage are crucial criteria in the credit evaluation process practiced by Vietnamese bankers (Leung, 2009; Nguyen and Ramachandran, 2006; Simavi et al., 2007).

monotonic relationship between credit to the private sector over GDP and economic growth (Arcand et al. 2015).To account for such non-linearities in the way leverage proxies for credit constraints, we use both the leverage and its square value in our specification.

3.2.3. Productivity

Productivity is an important explanatory variable in the literature on firm export status. In Melitz (2003) firms vary by productivity and only the more productive firms are able to export profitably.Following Melitz (2003), we hypothesize that all firms above a productivity cut-off level can export profitably in the absence of financial constraints.Financial constraints raise the cut-off level for exporting profitably. As a result, the impact of productivity on export activities is hindered by the present of financial constraints.

In this paper, we include productivity in our empirical model as a direct factor for the export decision, similar to Melitz. In addition, we allow for its interaction with borrowing constraints to provide insight in the issue that the impact of productivity on export activities is distorted by the present of borrowing constraints. We measure (labour) productivity as the ratio between net salesand total labour (Wagner, 2002; Kim, 2016; Chen and Guariglia, 2013). We test for the robustness of our results by using real value added per worker as an alternative measurement of productivity (Minetti and Zhu, 2011; Bricongne et al, 2012, Berman and Hericourt, 2010).

3.2.4. Other control variables

We include a number of firm-specific controlvariables, namely capital intensity, age, and size. The literature suggeststhata larger capital stock increases the probability of being an exporter (Roberts and Tybout, 1997; Minetti and Zhu, 2011). Firm size and age have often been found to be related to export activity (Tang and Zhang, 2012; Greenaway et al., 2007; Muuls, 2015; Berman and Hericourt, 2010). For firmsize, we use both the size of total assets and the size of the firm's labour force. Industry dummies are always included to capture industry-specific effects, as different industries require different levels of capital intensity and have different financial situations (Manova, 2008; Bellone et al., 2010; Jarreau and Poncet, 2014). We also control for business cycle effects by including year dummies in all specifications (Manova, 2008;Bellone et al., 2010). See appendix 3 for details the variable definitions and units of measurement.

3.3. Data cleaning

In constructing our sample, we apply several additional exclusion restrictions. First, we exclude firm-year observations with missing financial information. Second, following the procedure as designed by Feenstra et al. (2014), we exclude the following firm-year observations : (a) observations for which information on total assets, fixed assets, or net salesis missing; (b) observations that report strongly implausible numbers, such as (i) total assets that are smaller than current assets, (ii) total assets that are smaller than net fixed assets, (iii) total assets that are smaller than the cost of fixed assets, and (iv) negative financial costs. Second, we exclude firm-years if any of the following ratios are smaller than zero or larger than 100: (a) debt/total assets, (b) tangible assets/total assets. Third, we exclude firm-years if any of the following variables are negative: (a) net sales, (b) total assets/labour, (c) net sales/labour, (d) net sales/total assets. Fourth, following Greenaway et al. (2007), we eliminate outliers by dropping the first and last percentile of all explanatory variables listed in Table 1. After the cleaning, our final sample consists of 103,425 firms with 400,726 firm-year observations covering the years 2009-2014.

4. Descriptive statistics

This section provides a preliminary glance at the firm's export activities and financial characteristics in our sample. Table 1 presents the distribution of exporters and non-exporters for each year through the period of study. The proportion of exporters has decreased from 23% in 2010 to 17% in 2011, which contributes to the considerable missing export status for the firms in the survey of 2010. For our baseline analysis, we split firms into different groups based on ownership type. Roughly 92% of the firms in the sample are POEs, 1% are SOEs, and 7% are FOEs. The rise in the number of exporters comes from all types of manufacturing firms, but mostly from POEs. Most of FOEs are exporters (80%), which makes sense given the involvement of foreign investors. In addition, a large part of SOEs is exporter (43%), while only a small portion of POEs becomes exporters (11%).The high percentage of SOEs exporters may be due to the export state-monopoly before 1990.These percentages are quite stable in the period 2011-2014.

Table 1: Number of firms on export status

	All	2010	2011	2012	2013	2014
Total firms	400,726	59,176	67,465	70,436	73,753	77,284
Total firms (non-missing export status)	299,362	26,064	66,096	56,605	73,347	77,250
- Exporter (ESS_t=1)	52,234	6,051	11,086	9,672	12,706	12,719
% of total firms(non-missing export status)	17%	23%	17%	17%	17%	16%
POEs (% of all POEs)	11%	5%	11%	8%	11%	10%
SOEs(% of all SOEs)	43%	27%	46%	42%	46%	45%
FOEs(% of all FOEs)	80%	67%	79%	82%	81%	82%

Note: ESS is export status, take value of 1 if export in year t, 0 otherwise; POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers

Table 2 shows the transitions in and out of exporting for firms in the sample with non-missing export status for any two consecutive years. We classify firms according to their export status for a cohort of two years. When a firm did not export in the preceding year, it either starts exporting in the current year and is labelled a “new-exporter”, or remains a “non-exporter”. When a firm exported in the preceding year, it either keeps exporting and is labelled a “continuous-exporter” or stops exporting and is labelled an “exiting-exporter”. Each column describes the transition proportion of export status from one year the next year. For instance, the first column for 2010-2011 indicates that 83.9% of firms that did not export in the year 2010 also do not export in the year 2011, while 16.1% of those begin exporting in the year 2011. Although there are firms switch on and off export status, there is a substantial degree of export persistence over time. There is 85.2% of firms that exported in the year 2010 that keep doing so in the year 2011, while 14.8% of those stops exporting in the year 2011. On average 83% of exporters keep exporting in the following years. This suggests that it is more likely to export next year for the current exporters than for the non-exporters.

Table 2: Export status transition rate

		2010-2011	2011-2012	2012-2013	2013-2014	Avg.
Non-exporter in year t-1	-Non-exporter in year t	83.9%	96.5%	96.5%	95.8%	93.1%
	-New exporter in year t	16.1%	3.5%	3.5%	4.2%	6.9%
Exporter in year t-1	-Continuous exporter in year t	85.2%	84.4%	84.8%	77.5%	83.0%
	-Exiting exporter in year t	14.8%	15.6%	15.2%	22.5%	17.0%

Table 3: Descriptive statistics

Panel A: All manufacturers and by ownership

	All			POEs			SOEs			FOEs		
	ESS=0	ESS=1	t-test	ESS=0	ESS=1	t-test	ESS=0	ESS=1	t-test	ESS=0	ESS=1	t-test
Leverage ratio	49.54	55.25	-45.85	49.70	59.40	-62.56	51.40	57.10	-6.61	43.50	48.80	-12.21
	(24.41)	(23.91)	(0.00)	(24.34)	(22.23)	(0.00)	(25.19)	(22.52)	(0.00)	(26.85)	(25.05)	(0.00)
Tangible asset ratio	19.56	25.97	-71.47	19.20	21.20	-18.04	28.50	25.90	3.90	30.20	32.40	-6.37
	(16.75)	(18.68)	(0.00)	(16.51)	(16.66)	(0.00)	(19.98)	(18.55)	(0.00)	(20.99)	(19.35)	(0.00)
Productivity	489.5	964.2	-96.9	484.4	959.3	-78.8	648.7	1,333.7	-15.9	656.3	944.8	-14.0
	(899)	(1328)	(0.00)	(894)	(1316)	(0.00)	(929)	(1562)	(0.00)	(1069)	(1322)	(0.00)
Capital intensity	154.2	227.2	-55.4	151.0	190.0	-25.6	252.0	307.0	-3.9	270.0	281.0	-1.6
	(210)	(314)	(0.00)	(203)	(268)	(0.00)	(343)	(379)	(0.00)	(372)	(363)	(0)
Assets	12,505	84,733	-238	11,230	66,223	-184	105,324	216,771	-18	46,972	107,084	-29
	(36,313)	(120,962)	(0.00)	(32,114)	(107,353)	(0.00)	(127,733)	(173,921)	(0.00)	(83,150)	(129,383)	(0.00)
Age	5.54	7.87	-110.04	5.50	7.90	-92.86	10.70	12.20	-5.17	6.70	7.60	-11.70
	(4.07)	(4.92)	(0.00)	(4.01)	(4.92)	(0.00)	(6.67)	(7.34)	(0.00)	(4.54)	(4.68)	(0.00)
Value added/labour	0.44	0.81	-14.15	0.44	0.65	-7.88	0.58	0.98	-3.69	0.41	1.06	-3.21
	(5.01)	(2.20)	(0.00)	(3.98)	(1.55)	(0.00)	(2.74)	(1.74)	(0.00)	(23.39)	(2.95)	(0.00)

Panel B: By type of exporter

	Newexp	Nonexp	Conexp	Exiexp
Leverage ratio	56.30	51.40	55.30	55.90

	(23.50)	(22.96)	(23.90)	(23.26)
Tangible asset ratio	24.00	18.70	26.90	22.30
	(18.51)	(15.76)	(18.46)	(18.19)
Productivity	926.3	512.6	1,036.0	811.9
	(1279)	(908)	(1366)	(1210)
Capital intensity	219.0	160.0	247.0	199.0
	(301)	(205)	(331)	(289)
Assets	60,540	12,104	104,614	48,903
	(97,212)	(32,655)	(131,722)	(86,705)
Age	7.30	5.90	8.60	7.80
	(4.72)	(4.05)	(4.96)	(4.75)
Value added/labour	0.67	0.46	0.91	0.56
	(3.12)	(5.59)	(1.82)	(2.55)

Note: ESS is export status, take value of 1 if export in year t, 0 otherwise; POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Newexp are new exportes; Nonexp are non-exporters; Conexp are continuous exporters; Exiexp are exiting exporters. Mean values of firm characteristics are reported by export status and the t-statistics of the mean equality test. Standard deviations in parentheses under mean values, p-value in parentheses under t-value. Leverage is Total debt/Total assets, in percentage. Tangible asset ratio is Net tangible assets/Total assets, in percentage. Productivity is Net sales/labour, in million dongs per labour. Capital intensity is Net fixed assets/labour, in millions dong per labour. Assets are Total assets, in million dongs. Age is number of operating years since establishment. Value added/labour is value added /labour.

Table 3 contains descriptive statistics for various ownership type in panel A and exporting type in panel B, regarding leverage, tangible asset ratio, productivity, capital intensity, assets, age, and value added per labour. It also reports t-test statistics and p-values (in parentheses) for differences in the means of the variables of interest between exporters and non-exporters. The null hypothesis that there is no difference on average between exporters and non-exporters is always rejected at the 1 percent level. In line with the stylized facts in literature on heterogeneity firms in international trade, exporters in our sample are considerably more productive, larger, more capital intensive, and older than non-exporters[e]. In particular, the productivity of exporters is almost double, and size is seven times larger than non-exporters. We highlight the new stylized facts on the differences across ownership groups. From Table 3, we see that the differences between exporters and non-exporters are greater for POEs than for SOEs and FOEs. For example, on average, for POE exporters the debt ratio is 9.7% higher than for non-exporters, while the difference in debt ratio between SOEs exporters and non-exporters is smaller (5.7%), and that for FOEs is the smallest (4.5%). A similar pattern is found in assets size: POE exporters are almost six times larger than POEs non-exporters, whereas SOE and FOE exporters are only two times larger than their non-exporting counterparts. Nonetheless, SOEs and FOEs firms have more favourable characteristics of being exporters than POEs. They are more productive, more capital intensive, and bigger than their POE counterparts. Contrary to the traditional views that SOEs are less efficient than POEs, the SOEs in our samples are more productive than their POE counterparts, possibly owing to the privatization process starting from the early 1990s which may have filtered out the less efficient SOEs. Note that the distributions of most of our main variables are highly skewed to the right. Possible reasons for such right-skewed distributions include the fact that the majority of Vietnamese manufacturers in the sample are privately owned, small and young and have low capital intensity and productivity.

Regarding the type of exporters, there is not much difference with respect to the financial constraints indicators. New-exporters have the debt to total assets ratio of 1% higher and tangible asset ratio of 2.9% lower than that of continuous exporters. In addition, they are less productive, less capital intensive, smaller, and younger than continuous exporters.

[e]Bernard and Jensen, 1999, Greenaway and Yu, 2004, and a considerable literature on firm heterogeneity in trade have argued that exporters are more productive, larger, older, and more capital intensive than non-exporters.

In summary, these preliminary descriptive statistics provide a general picture of Vietnamese exporters vs. non-exporters. First, most of FOEs and SOEs are exporters, while only a small portion of POEs becomes exporters. Second, there is persistence in exporting. That is, the current exporters are more likely to export next year in comparison to the non-exporters. Similarly, there is strong persistence in non-exporting. Third, we observe the differences between exporters and non-exporters not only on productivity but also on borrowing constraints and other firm's characteristics. Last, these differences between exporters and non-exporters are more pronounced in POEs than in other types of ownership. To formalize these findings and control for industry and year fixed effects, we empirically model export activities and present the results in the next sections.

5. Empirical approach and estimation methodology

In this section, we present the regression framework that we will use to empirically analyze the extensive margin of exports, that is, the probability of a firm deciding to export, conditional on a number of firm characteristics. In addition, we briefly discuss the estimation methodology.

As is shown at first in the descriptive statistics presented in Table 3, exporters are different from non-exporters not only in terms of productivity but also with respect to borrowing constraints and other firm characteristics including ownership and type of exporters. In our analysis, we use three different specifications. We begin with the base-line specification with borrowing constraints and productivity, classifying firms into three groups based on ownership types. In the second specification, we account for the observed pattern in the descriptive statistics that current exporters are more likely to export next year more than non-exporters. For this reason, we further classify firms into two groups of new exporters and continuous exporters respectively and investigate how borrowing constraints differently affect the two groups. Last, since the positive impact of productivity may be altered by the presence of borrowing constraints, we allow the interaction between these two factors in the third specification.

5.1. Empirical approach

We start from the standard specification, similar to Minetti and Zhu (2011). Let us denote π_{it} as the difference in expected operating profits between exporting and not exporting for firm i at time

t, whereπ_{it} depends on firms' financial constraints FC_{it-1}, productivity $Prod_{it-1}$, and other firm's characteristics X_{it-1}. $\lambda_{si}$and $\lambda_t$are industry and year fixed effects, respectively.According to the models developed by Chaney (2005) and Manova (2013), financial constraints come into play in the firm export decision due to the existence of sunk cost.

$$\pi_{it} = FC_{it-1}\beta + \theta Prod_{it-1} + X_{it-1}\gamma + \lambda_{si} + \lambda_t + \varepsilon_{it} \quad (1)$$

We assume that the firm decides to export when it expects its operating profits to be higher when it exports than when it does not. Therefore, we specify the model that explains the export decision of the firm i at time t as follows:

$$y_{it} = \begin{cases} 1, & \pi_{it} > 0 \\ 0, & \pi_{it} \leq 0 \end{cases} \quad (2)$$

Where $y_{it}$is the export status of firm i in period t, which takes the value of 1 if firm i exports in period t and 0 otherwise.Our target is to identify and quantify the role of financial constraints on the export entry decision. We estimate these effects using a binary choice approach

$$y_{it} = \begin{cases} 1 & if FC_{it-1}\beta + \theta Prod_{it-1} + X_{it-1}\gamma + \lambda_{si} + \lambda_t + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases} \quad (3)$$

In our specification, FC_{it-1}representseither leverage (and its squared term) or the tangible asset ratio. The firm characteristics such as age, size, and capital intensity are included in vector of control variable$s$ X_{it-1}. Other unobserved firm attributes are captured byε_{it},ε_{it}~N(0,1).

Next, we focus on the difference between new exporters and existing exporters.The literature argues that the role of financial constraints on the export decision is based on the existence of (one-time?) sunk cost. It virtually ignores the role of financial constraints on maintained export activities. Once a firm has started exporting, that is, once the sunk cost has been paid, financial constraints may play an even more important role in financing working capital and trade-related costs. In other words, financial constraints may matter in maintaining the export status as well. Bearing this in mind, we hypothesize that financial constraints may have a different impact on the probability of being a new or a continuous exporter. To verify this argument, we estimate equation(3) for the two sub-samples. The first sub-sample includes new exporters and non-

exporters. The second sub-sample includes the continuous exporters and stopped exporters. The result from the former sub-sample reveals the effects of financial constraints on the probability of being a new exporter, while those from the later sub-sample reveal the impact of financial constraints on the probability of being a continuous exporter. Because we have a dataset with an average of 4 years observations per firm, we define new exporters as those who did not export in year t-1 and export in year t; continuous exporters are those who exported in year t-1 and continue doing so in year t. This is similar to the approach taken by Berman and Hericourt (2010) who have a dataset with an average of 3 years of observations per firm.[f]

Finally, we look into the interaction between borrowing constraints and productivity. According to the prediction in Chaney's model, the role of financial constraint on the export entry decision is different at the different level of productivity. The highest and lowest productive firms do not depend on borrowing constraints. The former group is productive enough to generate sufficient liquidity from domestic sales, while the later one has too low productivity to export, regardless of borrowing constraints. Only the mid-level productivity firms are productive enough to export profitably but may not generate enough internal liquidity to finance the sunk cost. This group may need external finance and may be sensitive to financial constraints.Therefore,it is necessary to examine how the presence of borrowing constraints has different impact on firms at various productivity levels. To do so, we allow for the interaction betweenborrowing constraints and productivity.

$$y_{it} = \begin{cases} 1 & if\ FC_{it-1}\beta + (FC_{it-1} \times Prod_{it-1})\varphi + \theta Prod_{it-1} + X_{it-1}\gamma + \lambda_{si} + \lambda_t + \varepsilon_{it} > 0 \\ 0 & otherwise \end{cases} \quad (4)$$

5.2. Methodology

Since our dependent variable is a binary variable that takes the value one for an exporter and zero for a non-exporter, a probit model is a suitable choice for estimating the probability of exporting.

[f]The definition of new, continuous, and stopped exporters differs in the literature, mostly for reasons of data availability. Greenaway et al. (2007) for example use a UK manufacturing dataset with an average of 7 observations per firm. They look at three continuous years and define new exporters as those who did not export in year t-2, either exported or not in year t-1, and always export in year t; continuous exporters are those who always export in three years.

Therefore we estimate equations (3) and (4) by aprobit model. Industry and year dummies are included in all estimations to capture systematic differences across industries as well as systematic changes in the business environment faced by all firms. Industry dummies are at the 2-digit level as defined under Vietnam Standard Industrial Classification (VSIC) version 2007. This broad set of fixed effects allows us to reduce the possibility of omitted variable bias. To minimize endogeneity problems, we lag all firm characteristics by one year. The logarithm transformation of non-financial variables helps to mitigate the potential multicollinearity. All standard error are White-adjusted for possible heteroskedasticity.

Different from itsOLS counterpart, the estimated coefficientsobtained through a probit estimation are not directly interpretable as the predicted change in the dependent variable as a result of one unit change in the independent variable. The estimated coefficients from probit models display the change in the z-score of the dependent variable upon a one unit change in the independent variable.

To assess the size and significance of the impact of an independent variable on the dependent one in a probit model, the literature typically uses marginal effectscalculated at the means of all covariates or calculated as the average marginal effects across all observed values (AME). The later has the advantage of taking the observed distribution into account. Nevertheless, the AME only gives a point estimate of the average elasticity, while we are particularly interested in the question to what extent the impact of for instance leverage on the export decision varies across a plausible range of values. For this reason, we calculate the marginal effect across a range of representative values (MER) of the variable of interest and present these graphically. Our choice for the range ofrepresentative values of one variable iswithin the observed rangeof values of that variable in our sample.

6. Estimation results

In this section, we present the estimation results using the approach presented in Section 5. Our analysis is threefold. First, we analyze the impact of borrowing constraints and productivity on the export decision and present in Section 6.1. Second, to gain greater insight into the relationship between borrowing constraints, productivity, and export decision, we graphically analyze the

results in Section 6.1 by figures in Section 6.2. Next, we examine the role of borrowing constraints in maintaining export status and starting to export. The results are presented in Section 6.3. In addition, we investigate how the export decision of firms at various level of productivity depends on the borrowing constraints and present the results in Section 6.4. Last, in Section 6.5 we test the robustness of our results by using the non-interpolate export status and using the value added per labour as an alternative measure of productivity.

6.1. To export or not to export

Table 4 reports the baselineestimation results of Eq.(3) on the impact of borrowing constraints on a firm's export decision. Columns (1) and (2) present the estimates of Eq.(3) for leverage and tangible asset ratio for all manufacturers in the sample. In columns (3) through (8), we estimate the same models as in columns (1) and (2) for the different groups of POEs, SOEs, and FOEs, respectively.In the discussion, we mostly focus on the results for the POEs. Note that the group of POEs has by far the largest number of year-observations. Therefore, the results for POEs dominate the results for all firms. In addition, we consider the POEs to be the most interesting group in our sample to investigate the role of borrowing constraints in the export decision, as both FOEs and SOEs may face "softer" borrowing constraints.[g] The baseline predicted probability shows that POEs have a much smaller likelihood of exporting than SOEs and FOEs.

A number of findings stand out. First, we find that leverage and its quadratic term both are highly significant for POEs with a positive coefficient for the level and a negative one for the quadratic term. It suggests a concave a concave relationship between leverage and export probability for POEs. Both the F-test and the Sasabuchi-Lind-Mehlum (SML) test statistics in the lower section of Table 4 provide support for the inverse U-shape of the leverage effect for POEs.[h] Economically, it implies that a small amount of debt – possibly indicating access to external funding and room for higher borrowing – increases the likelihood of exporting, while a high debt level indicates less borrowing room, making it harder to raise additional funds to finance the export-related costs. The

[g] Moreover, for SOEs it is unclear to what extent the decision to export is primarily driven by economic arguments such as expected profitability. National strategic motives may play a role too.

[h] The F-test has the null hypothesis that the quadratic term has a zero coefficient while the SML test has the null hypothesis that the relation between the leverage terms and the export decision is either monotonous or U-shaped. Both hypotheses are strongly rejected for POEs, but not for FOEs and SOEs.

estimated coefficients suggest that the threshold where leverage starts yielding a negative marginal effect on the likelihood of being an exporter equals about 0.47 (=0.853/2*0.904).

For SOEs and FOEs little evidence on leverage is found. One possible explanation is that SOEs may subject to the soft leverage constraints from the bank or enjoy privileged access to bank credit (Kokko and Sjoholm, 2007;Thai, 2008). This may also be the case for FOEs who may be able to fund themselves through foreign "mother companies" or international resources (Beck et al, 2006; Poncet et al., 2010).

Note that the literature so far yields mixed results on this issue. Berman and Hericourt (2008), Egger and Kesina (2013), and Stiebale (2011) report a negative relationship between leverage and the decision to export, while Fauceglia (2015) and Minetti and Zhu (2011) document a positive one.[i] Tang and Zhang (2012) distinguish exporter groups based on ownership similar to our analysis and find a more pronounced impact of leverage for SOEs and FOEs than for POEs. This is opposite to our results. All of these studies hypothesize a linear – monotonous – relation between leverage and the export decision.

Second, the tangible assets ratio enters positively and highly statistically significant at 1% level for POEs as well as for the other ownership types. Overall, it provides strong evidence that firms with a higher amount of tangible assets relative to their balance sheet size have a greater probability to be exporters. This result is consistent with literature such as Manova and Yu (2016), Berman and Hericourt (2010), and Feenstra et al. (2014). It provides support for the hypothesis that a high tangible asset ratio can be interpreted as a high capacity to provide loan collateral in the form of pledgeable assets, hence relaxing borrowing constraints and enabling a firm to borrow to finance the exporting cost. Moreover, the highly significant estimated coefficients also reflect the prevalent traditional lending practice in developing countries. According to the report by Simavi and Wohlers (2007) on Vietnam's current lending environment, the existence of tangible collateral is a sufficient condition to grand a loan to all types of firms. As the consequence, collateral constrained firms are less likely to export.

[i] Note that the operationalization of leverage varies across studies.

Table 4: Borrowing constraints, productivity, and export decision

	All	All	POEs	POEs	SOEs	SOEs	FOEs	FOEs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage ratio	-0.00432		0.853***		1.492*		0.0733	
	(0.08)		(0.10)		(0.79)		(0.23)	
Leverage ratio square	-0.378***		-0.904***		-1.004		-0.11	
	(0.08)		(0.09)		(0.76)		(0.23)	
Tangible asset ratio		1.642***		1.188***		1.411***		0.988***
		(0.03)		(0.04)		(0.34)		(0.10)
Productivity	0.127***	0.162***	0.131***	0.157***	0.180***	0.309***	0.0725***	0.131***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.05)	(0.05)	(0.02)	(0.02)
Capital intensity	-0.152***	-0.267***	-0.182***	-0.255***	-0.141***	-0.317***	-0.0648***	-0.152***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.04)	(0.06)	(0.01)	(0.02)
Assets	0.560***	0.567***	0.487***	0.503***	0.378***	0.449***	0.376***	0.353***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.04)	(0.05)	(0.02)	(0.01)
Age	0.0643***	0.0534***	0.120***	0.0998***	0.0213	0.0725	-0.0440**	0.00164
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.06)	(0.02)	(0.02)
Constant	-7.010***	-6.852***	-6.419***	-6.170***	-6.372***	-7.112***	-5.124***	-3.765***
	(0.26)	(0.22)	(0.32)	(0.24)	(0.59)	(0.60)	(0.51)	(0.50)
No.Obs	155608	160432	142186	145421	1234	1302	12060	13570
Baseline predicted probability (on average)	0.185	0.190	0.129	0.129	0.392	0.380	0.818	0.821
F test of the quadratic term	23.87		98.66		1.76		0.23	
	(0.00)		(0.00)		(0.18)		(0.63)	
SML tests for an inverse U-shape	na		9.02		0.6		0.32	
	na		0.00		(0.28)		(0.37)	
Pseudo-R-squared	0.321	0.339	0.258	0.268	0.255	0.261	0.149	0.147

Notes: POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Leverage ratio is Total debt/Total assets. Leverage ratio square is the square of Total debt/Total assets. Tangible asset ratio is Tangible assets/Total assets. Productivity is the logarithm of Net sales/Labour. Capital intensity is the logarithm of Net fixed asset/Labour. Assets is the logarithm of total assets. Age is the logarithm of firm's age. All estimations include year and industry dummies. Robust standard errors are into parentheses. All regressors, besides fixed effects, are one year lagged. Significance levels: *10%,**5%,***1%.

Third, productivity always enters highly significantly and positively in all estimations, confirming the self-selection hypothesis that the more efficient firms can enter the export market. This result is strongly in line with literature (Greenaway et al. 2007; Berman and Hericourt , 2010; Bernard et al. 2007; Minetti and Zhu, 2011).

Last, the control variables generally have plausible signs and are highly significant. The logarithm of size always has a positive effect on export probability. The magnitude of the coefficient for size is higher in POEs, suggesting that size is relatively more important for POEs than for other groups in entering export market. The coefficients of the log of age are also positive and significant (with the exception of the state-owned and foreign-owned manufacturer sub-samples, in which some coefficients are non-significant), suggesting that exporting is more likely the older a firm is. The effect of capital intensity, as measured by the logarithm of the ratio between net fixed assets and total labour, is always negative, which is the opposite of what is commonly found in the literature (see Minetti and Zhu, 2011 and Fauceglia, 2015). Possibly, multicollinearity plays a role here. In this respect, we note that the descriptive statistics show that exporters in our sample on average are more capital intensive than non-exporters, which is opposite to our estimation result.

To sum up, for POEs higher leverage – beyond a threshold – and lower tangible assets significantly reduce the likelihood of becoming an exporting firm. This is consistent with the hypothesis that borrowing constraints can be an important impediment for firms to become exporters. For SOEs and FOEs leverage does not play a significant role, probably due to softer financing constraints, but tangible assets remain important. Furthermore, larger, older, more productive and less capital intensive firms have a higher probability to be exporters. POEs are less likely to export than SOEs which in turn are less likely to export than FOEs.

6.2. Marginal effects

Due to the Probit estimation, the marginal effect of a change in one of the dependent variables on the export decision varies with the level of the dependent. The non-linear leverage effect reinforces the impact variation of leverage. To shed more light on the pattern of marginal effects at plausible, representative values (MER), we provide a graphical presentation and discussion, using the Table 4 estimates. We present the MER estimates together with lines indicating the 95 percent

confidence interval. The histogram of the frequency distribution is plotted in the back of the figure to provide information on the distribution of dependent variable that is on the horizontal axis.[10]

Figure 1: Average marginal effects of Leverage ratio on export probability with 95% CIs

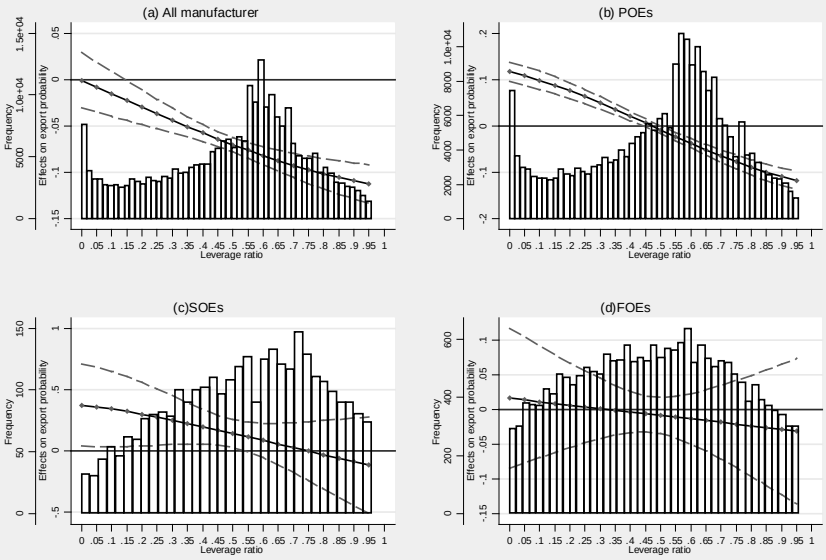
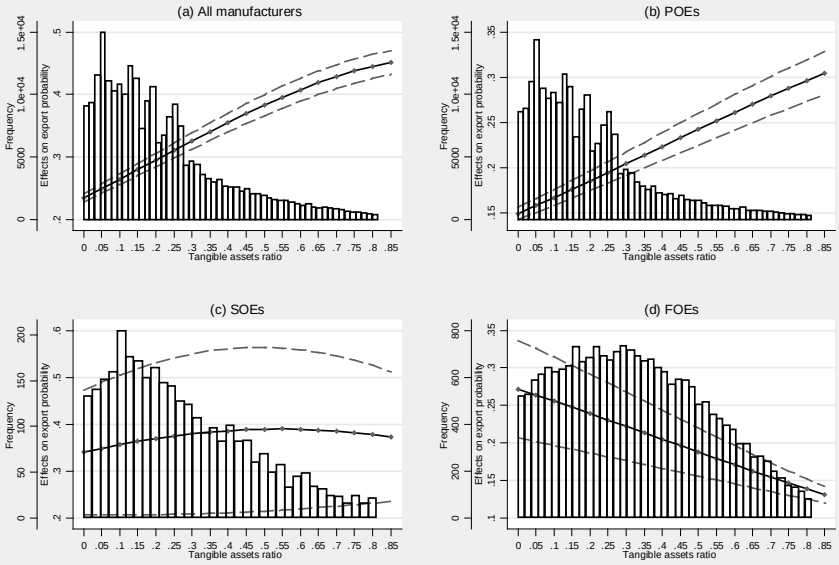


Figure 2: Average Marginal Effects of Tangible assets ratio with 95% CIs



[10]The marginal effect of a continuous variable x is interpreted as the instantaneous rate of change of the export probability given a small change of the continuous variable x. The marginal effect of a continuous variable x at a representative value x=x1 is interpreted as the instantaneous rate of change of the export probability given a small change of x with an assumption that all firms in the sample have the value x=x1.

Figure 3: Average marginal effects of Productivity with 95% CIs

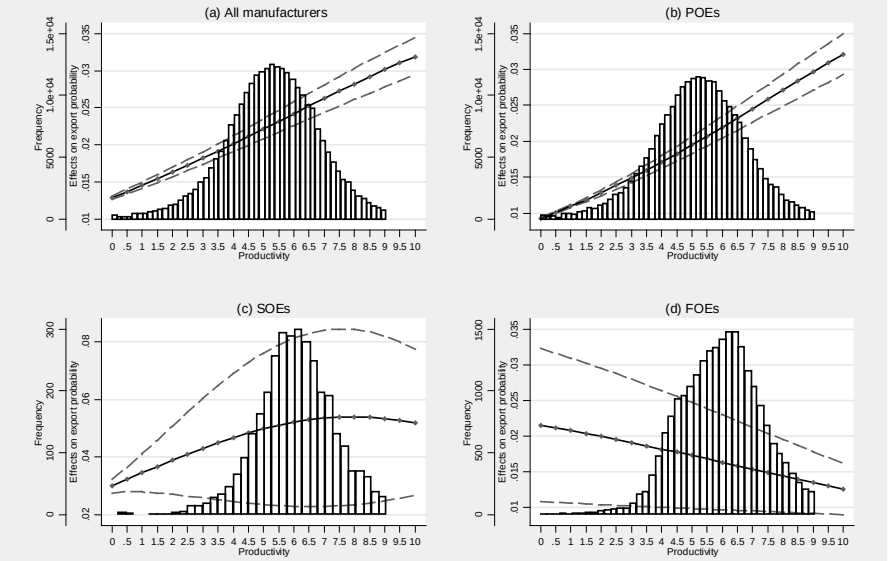


Figure 1 presents the MER of leverage changes across its observed range of values, based on columns 1,3,5, and 7in Table 4for the respective ownership types.For the leverage ratio, we choose values between zero and one with step size 0.05. This grid choice allows for a good view on the variation in marginal effects while maintaining readability.

Consistent with findings in section 6.1, we observe that the marginal effect of leverage on the export probability for POEs is positive but decreasing up till a leverage ratio of 47 percent. Beyond that, higher leverage increasingly impacts negatively on export probability. It is consistent with the idea that low leverage indicates access to external finance with room to expand funding, while high leverage become a burden and limits the scope for additional external funding. The histogram in figure 1b shows that the majority of observations (63.8% of the total firm-years observations of private manufacturer) are above this 47% threshold.[11]For SOEs, the pattern is similar to that of POEs, though only the positive effect at low leverage values is significant. For SOEs, the MER is substantially higher than for POEs at low debt levels. The threshold value is close to 75 percent, which is substantially higher than that of POEs. For FOEs no significant effects are found. Overall,

[11]Our evidence corresponds to the finance-growth literature (Arcand et al. 2011, Reinhart and Rogoff, 2010) that debt finance beyond a threshold may harm growth. At the micro level, Coricelli et al. (2012) argue that the relationship between leverage and productivity growth is non-monotonic.

it supports the hypothesis that POEs with high debt ratios face financial constraints which reduce their probability to export. SOEs and FOEs face softer finance constraints and are hampered less by high leverage in their export decision.

Figure 2 presents MERs for the tangible asset ratio as indicator of borrowing constraints. The design is does similar to Figure 1 but is based on columns 2, 4, 6, and 8 in Table 4.We choose a range from zero to 0.85 with 0.05 steps for the tangible asset ratio. First, the MER in figure 2 is significantly positive for all ownership types, indicating that a higher level of assets than can serve as collateral increases the likelihood of exporting. Second, the marginal effect is strongly increasing for POEs, roughly constant for SOEs, and marginally decreasing for FOEs. Especially for POEs, the majority of which has a relatively low tangible asset ratio, an increase in this ratio can substantially improve the firm's probability to export. For example, given the POEs sample standard deviation of tangible asset ratio of 0.165, and average marginal effect at tangible asset ratio of 20% is 0.185, the effect of a one standard deviation increase in the tangible asset ratio is 0.03, which is substantial when compared to the baseline export probability of 0.129.[12]

Figure 3 displays the MERs for productivity, with a layout similar to the previous figures. We choose a range of value from 0 to 10 with steps of 0.5 and use the estimated coefficients of the leverage equations (1), (3), (5) and (7).[13]For all ownership types, the MER of productivity is positive. Marginal effects are increasing in productivity for POEs and SOEs and marginally decreasing for FOEs. The decreasing MER for FOEs may be because FOEs have a high baseline export probability. Hence, an additional increase in productivity does not much increase the number of firms to export.

Overall, the graphs confirm the non-monotonic relationship between leverage and export probability for POEs. That is, leverage has a positive impact on the export decision when it is low, and becomes a constraint when it is higher than a threshold. Analysis of firms of different

[12] For SOEs and FOEs, similar evaluation at tangible asset ratio of 20% with the sample standard deviation for SOEs of 0.194 (for FOEs is 0.197), and average marginal effect of 0.376 (for FOEs is 0.229), one sd increase in tangible asset ratio amounts to a 7% and 4.5% increase in export probability for SOEs and FOEs, respectively.

[13] For ease of exposition, we only graph the MER estimates for productivity based on the estimation of the leverage equation. The results based on the estimation of the tangible asset ratio are qualitatively similar and are presented in Appendix 4.

ownership reveals that SOEs and FOEs face a softer leverage constraint. Both the tangible asset ratio and productivityhave significantly positive effects on the export decision for all ownership types.

6.3. New exporters vs. Continuous exporters

We now turn to the difference between deciding to start exporting – from a starting situation of non-exporting – and deciding to maintain exporting – from a starting situation of exporting. Theoretical models implicitly stress the point that financial constraints specifically matter at entry due to the existence of sunk entry cost. We argue that financial constraints may also matter when a firm already is exporting. To investigate this issue we divide each sample into two sub-samples of non-exporters that may or may not start exporting on the one hand and exporters that may or may not keep exporting on the other. Table 5 contains the results in a similar format as Table 4.

Overall, the estimation results in Table 5 are quite similar to those in Table 4. We mainly find a non-monotonic – inverse U-shaped – relationship between leverage and the export decision for POEs, both for new exporters and continuous exporters. For almost all ownership types and specifications, the tangible asset ratio and productivity have significantly positive coefficients. Also, the pattern of estimated coefficients for the control variables is qualitatively similar in sign, size and significance to that of Table 4. Obviously, the baseline predicted probability to export is much higher – and the estimated intercept less negative – for the continuous exporters than for the new exporters. This is consistent with Table 2 which showed strong persistence: non-exporters have a high probability of not entering the export market, while exporters have a high probability of maintaining their presence in export markets. For a more detailed look of the effect of borrowing constraints and productivity on the export decision, we present MERs in Figures 4-5 whereby we focus on POEs.[14]

[14]For the sake of exposition, we only graph the MER estimates for POEs new exporters and continuous exporters based on the estimation in columns 5,6,7, and 8 of Table 5. The results for all manufacturers, SOEs, and FOEs are presented in Appendix 4, 5, and 6, respectively.For SOEs and FOEs, the MERs are generally insignificant across the whole range of leverage values.

Table 5: Borrowing constraints, productivity, and export decision for new exporters and continuous exporters

	New	New	Continuous	Continuous	New	New	Continuous	Continuous
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: All manufacturers and POEs							
	All	All	All	All	POE	POE	POE	POE
Leverage ratio	0.433***		-0.282		0.821***		0.440*	
	(0.14)		(0.20)		(0.16)		(0.25)	
Leverage ratio square	-0.684***		-0.109		-0.898***		-0.564**	
	(0.14)		(0.19)		(0.15)		(0.23)	
Tangible asset ratio		1.141***		1.078***		1.053***		0.662***
		(0.06)		(0.09)		(0.06)		(0.10)
Productivity	0.104***	0.132***	0.0915***	0.132***	0.0995***	0.127***	0.103***	0.129***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Capital intensity	-0.106***	-0.188***	-0.108***	-0.177***	-0.126***	-0.195***	-0.139***	-0.176***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.446***	0.460***	0.317***	0.303***	0.428***	0.447***	0.272***	0.270***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.0383***	0.0337***	0.00482	0.0246	0.0751***	0.0675***	0.0801***	0.0813***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)
Constant	-6.029***	-5.588***	-2.972***	-3.018***	-5.839***	-5.383***	-2.789***	-3.029***
	(0.36)	(0.29)	(0.62)	(0.64)	(0.44)	(0.31)	(1.03)	(0.83)
Baseline predicted probability (on average)	0.05	0.06	0.81	0.81	0.04	0.04	0.73	0.73
F test of the quadratic term	24.99		0.34		35.09		5.95	
	(0.00)		(0.56)		(0.00)		(0.01)	
SML tests for an inverse U-shape	3.14		na		5.26		1.74	
	(0 .00)		na		(0.00)		(0.04)	
No.Obs	94,403	96,667	19,712	20,882	92,013	94,051	12,159	12,378
Pseudo-R-squared	0.264	0.273	0.115	0.117	0.238	0.245	0.0923	0.0922
	Panel B: SOEs and FOEs							
	SOE	SOE	SOE	SOE	FOE	FOE	FOE	FOE

Leverage ratio	0.808		3.609**		0.606		-0.00637	
	(1.57)		(1.77)		(0.48)		(0.39)	
Leverage ratio square	-1.281		-2.812*		-0.822		-0.107	
	(1.48)		(1.66)		(0.50)		(0.39)	
Tangible asset ratio		1.709***		1.697**		0.303		0.894***
		(0.62)		(0.83)		(0.23)		(0.18)
Productivity	0.196**	0.381***	0.0606	0.224*	0.158***	0.181***	0.0913***	0.142***
	(0.10)	(0.09)	(0.14)	(0.13)	(0.03)	(0.03)	(0.03)	(0.03)
Capital intensity	-0.214***	-0.405***	-0.223**	-0.357***	-0.0144	-0.0581**	-0.0680***	-0.132***
	(0.08)	(0.10)	(0.10)	(0.12)	(0.03)	(0.03)	(0.02)	(0.03)
Assets	0.457***	0.500***	0.313***	0.299***	0.317***	0.304***	0.251***	0.224***
	(0.10)	(0.11)	(0.11)	(0.11)	(0.03)	(0.03)	(0.03)	(0.02)
Age	-0.0686	-0.0608	-0.089	0.0331	-0.0921**	-0.0644	-0.0042	0.0299
	(0.11)	(0.11)	(0.15)	(0.14)	(0.05)	(0.04)	(0.04)	(0.04)
Constant	-4.129***	-4.764***	-2.807**	-2.785**	-3.995***	-2.900***	-2.090***	-2.091***
	(1.05)	(1.02)	(1.41)	(1.37)	(0.55)	(0.65)	(0.78)	(0.78)
Baseline predicted probability (on average)	0.14	0.14	0.87	0.85	0.55	0.55	0.94	0.94
F test of the quadratic term	0.75		2.88		2.69		0.08	
	(0.39)		(0.09)		(0.10)		(0.80)	
SML tests for an inverse U-shape	0.51		1.14		1.27		na	
	(0.30)		(0.13)		(0.10)		na	
No.Obs	511	543	330	344	1,759	1,945	7,177	8,114
Pseudo-R-squared	0.279	0.291	0.173	0.156	0.162	0.156	0.0697	0.0694

Notes: New are new exporters; Continuous is continuous exporters. POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Leverage ratio is Total debt/Total assets. Leverage ratio square is the square of Total debt/Total assets. Tangible asset ratio is Tangible assets/Total assets. Productivity is the logarithm of Net sales/Labour. Capital intensity is the logarithm of Net fixed asset/Labour. Assets is the logarithm of total assets. Age is the logarithm of firm's age. All estimations include year and industry dummies. Robust standard errors are into parentheses. All regressors, besides fixed effects, are one year lagged. Significance levels: *10%,**5%,***1%.

Figure 5: Average marginal effects of productivity with 95% CIs

based on the estimations of columns 5, 6,7, and 8 in Panel A of Table 6

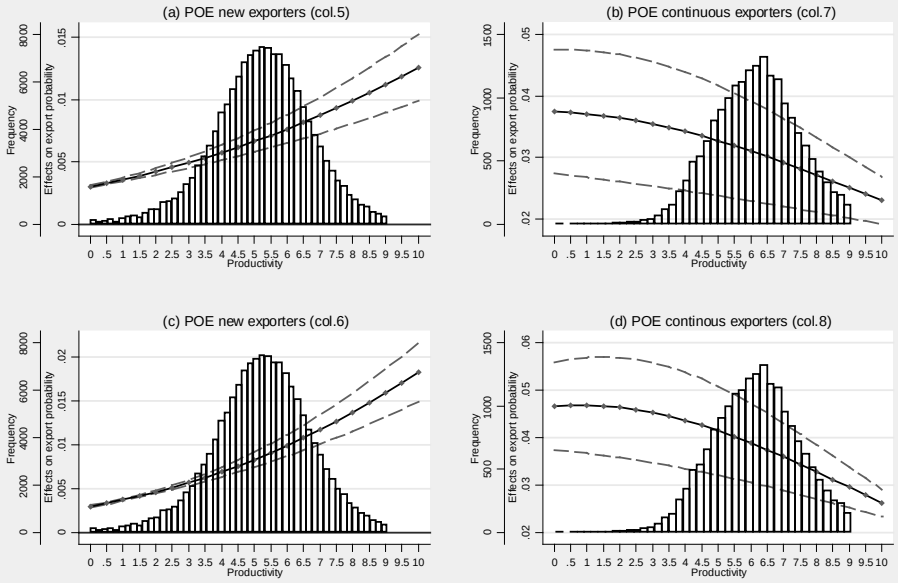
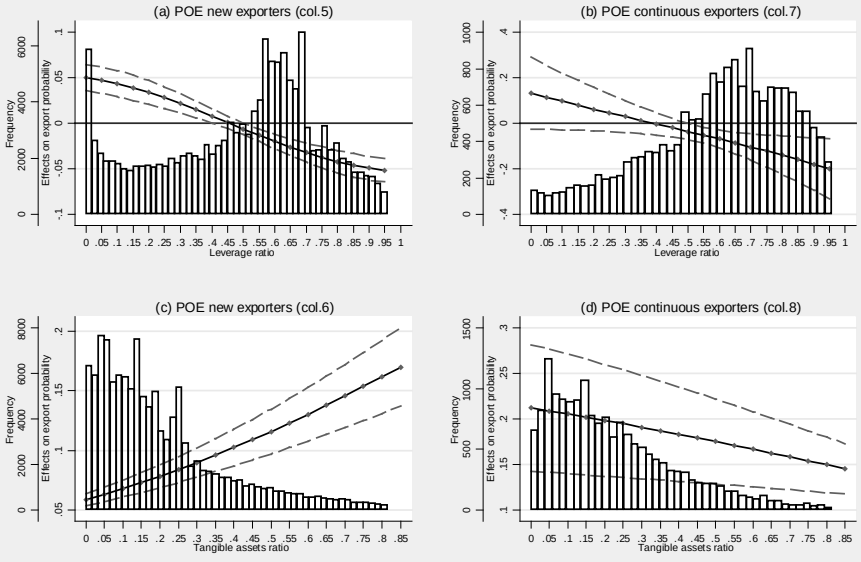


Figure 4: Average marginal effects of Leverage and Tangible asset ratio with 95% CIs

based on the estimations of columns 5, 6, 7, and 8 in Panel A of Table 6



First, we graph the MERs of leverage and the tangible asset ratio on export decision in Figure 4.The pattern of the marginal effect of leverage is quite similar for new and continuous exporters. In both cases, the MER is positive at low leverage and negative at high leverage, with the turning point close to 40 percent. However, at low levels only for new exporters higher leverage significantly increases the probability to export, for continuous exporters the effect is insignificant. At high levels, the effect is significantly negative for both new and continuous exporters. The latter provides suggestive evidence that too high debt not only reduces a firm's chance to enter export markets but also makes it more likely to exit when it is already exporting. This supports the idea that borrowing constraints may play a role after a firm has started to export. At high leverage ratios, the sensitivity of the export decision is higher for continuous exporters than for new exporters. That is, a further increase in leverage increases the probability for exporters to quit more than it decreases the probability for non-exporters to enter. In this respect, also note that continuous (POEs) exporters typically have higher leverage, and are larger and more productive than new exporters.[o]

We next examine the marginal effect (MER) of the tangible asset ratio on the export decision in Figure 4(c) and (d).The graphs show that the MER is positively significant in all cases. However, for new exporters, the MER increases, while for continuous exporters it decreases. Put differently, it is more important for non-exporters that consider entering the export markets to increase their tangible assets than it is for exporters that want to maintain active in exporting.

Figure 5 depicts the MER of productivity on the export decision. MER is always positive and. Comparisons of MER between POEs new exporters and POEs continuous exporters show that the MER of the later is decreasing while that of the former is increasing when productivity increases.

To sum up, first there is a strong persistence in export status. Non-exporters are more likely to not enter the export market, while exporters have more chance to remain exporting. Next, at high debt ratios, an increase in leverage reduces the chance to remain exporting more than the probability of joining the export market. In addition to that, increasing tangibility and productivity is more important for new exporters to increase their likelihood of exporting.

[o]Literature that explores the difference between new exporters and continuous exporters generally confirms the superiority of continuous exporters (Alvarez, 2007; Greenaway et al. 2007).

6.4. Interaction between borrowing constraints and productivity

So far, we have documented patterns of borrowing constraints and productivity for firms of different type of ownership. Overall, the observed patterns are consistent with the theoretical prediction of Chaney's model. That is, productivity is not the sole factor determine firm's export decision. Borrowing constraints as another source of firm's heterogeneity restrict firms from being exporters as well. According to Chaney (2005), only a subset of firms is subject to borrowing constraints. Those are firms with productivity that is not too low to be able to export but not too high to generate enough liquidity from domestic sales. In this section, we would like to examine to what extent the export decision of firms at various level of productivity is subject to borrowing constraints. To do so, we allow for the interaction between borrowing constraints and productivity in Eq.4 and examine this relationship using the probit model. Obviously Eq.3 is nested in Eq.4. We use the likelihood-ratio test procedure to examine whether the extended model (Eq.4) is a statistical improvement of the baseline one (Eq.3).

Table 6 presents the estimation results of Eq.4 both for leverage and the tangible asset ratio. The likelihood ratio test results imply rejections of the null hypothesisthat interaction terms have no explanatory power for the sample of all manufacturers, POEs. For FOEs, the null hypothesis is not rejected, while for SOEs the relevance of interaction effects is rejected for leveragebut not for the tangible asset ratio. In the subsequent analysis we focus on POEs as they are the dominant group in the total sample and consistently show relevant interaction effects. The results for POEs suggest thatthe impact of borrowing constraints on export probability depends on a firm's position on the productivity distribution.

Due to the various non-linear specifications and interaction effects, interpretation of the sign and size of individual coefficients is infeasible.Instead, we graph the marginal effect of leverage and tangibility on export probability at various levels of productivity in Figure 6[p]. We choose values plus and minus one standard deviation away from the mean for leverage and the tangible asset ratio respectively. This allows us to examine the joint impact of borrowing constraints and productivity on export probability.

[p]We do not report the graphs of MER of leverage at representative values of leverage because they are almost identical to Figure 1 (based on Table 4). The MER of the tangible asset ratio and productivity at their own representative values are also not reported for the same reason. They are available upon request.

Figure 6: Average Marginal Effects of (a) Leverage and (b) Tangible assets ratio with 95% CIs - POEs

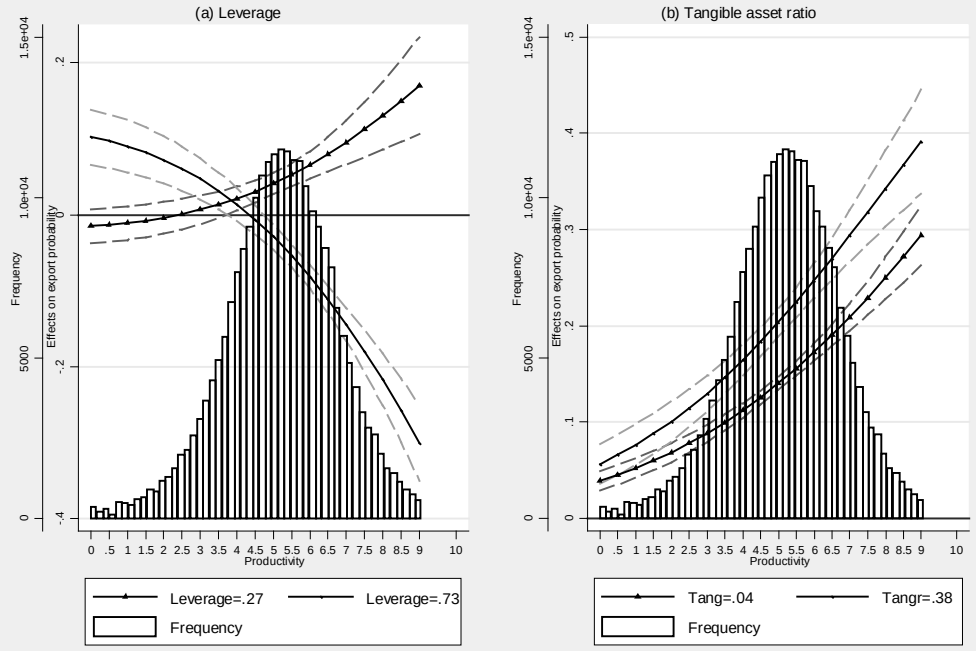


Figure 6a displays the MER of leverage on export probability. For the medium and high productive firms (those firms on the right hand side of the histogram), borrowing constraints clearly matter: when leverage is low the MER is significantly positive and rises with productivity contributing to a higher export probability. When leverage is high on the other hand, the MER is increasingly negative and decreases the firm's probability of exporting. For the low productive firms – who typically have a small probability to export anyway – the MER for low leverage is insignificant. It shows that access to borrowing does not significantly raise the firm's export probability, consistent with our expectations. For firms with low productivity and high leverage, the MER is significantly positive, which appears anomalous.

The MER of the tangible asset ratio is presented in Figure 6b. The MER pattern for firms with a high versus low tangible assetratio is similar. The MER is always significantly positive and rising with productivity. The higher a firm's productivity the higher the marginal effect of increasing tangibles on export probability is. But this effect is stronger for firms with high tangibles than for firms with low tangibles. This supports the idea of credit constraints – indicated by low tangibles - hurting a productive firm's export probability.

To sum up, the impact of borrowing constraints on export probability is subject to the level of productivity. Medium and high productive firms are more likely to export when leverage is low and tangible asset ratio is high.

6.5. Sensitivity analysis

We test for the robustness of the results of our main analysis in Table 4, 5, and 6 with respect to two factors. First, we eliminate the year-observations that were obtained through interpolation. Second, we use total value added per unit of labour as an alternative indicator of productivity. We present the robustness test results. Tables 7, 8, 9, and 10, corresponding to the sample of all manufacturers, POEs, SOEs, and FOEs, respectively. Overall, our results appear to be relatively insensitive to the interpolation of the export status or the use of an alternative measure of productivity.

Table 6: Borrowing constraints, productivity, interaction effects, and export decision

	All	All	POEs	POEs	SOEs	SOEs	FOEs	FOEs
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Leverage ratio	-1.403***		-1.173***		0.265		1.07	
	(0.33)		(0.37)		(3.94)		(1.02)	
Leverage ratio square	1.924***		1.689***		0.247		-0.993	
	(0.33)		(0.37)		(3.78)		(1.07)	
Lev*Prod	0.223***		0.346***		0.205		-0.183	
	(0.06)		(0.07)		(0.66)		(0.18)	
Lev*Lev*Prod	-0.378***		-0.441***		-0.208		0.161	
	(0.06)		(0.07)		(0.62)		(0.19)	
Tangible asset ratio		1.135***		0.804***		3.987***		1.070***
		(0.11)		(0.13)		(1.12)		(0.32)
Tang*Prod		0.0946***		0.0714***		-0.451**		-0.0153
		(0.02)		(0.02)		(0.19)		(0.06)
Productivity	0.139***	0.144***	0.0978***	0.144***	0.142	0.424***	0.112***	0.135***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.17)	(0.07)	(0.04)	(0.02)
Capital intensity	-0.152***	-0.268***	-0.182***	-0.256***	-0.142***	-0.312***	-0.0644***	-0.152***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.04)	(0.06)	(0.01)	(0.02)
Assets	0.559***	0.566***	0.488***	0.502***	0.377***	0.458***	0.376***	0.353***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.04)	(0.05)	(0.02)	(0.01)
Age	0.0630***	0.0546***	0.119***	0.101***	0.0226	0.0757	-0.0447**	0.00129
	(0.01)	(0.01)	(0.01)	(0.01)	(0.06)	(0.06)	(0.02)	(0.02)
Constant	-7.043***	-6.734***	-6.226***	-6.088***	-6.141***	-7.921***	-5.312***	-3.788***
	(0.27)	(0.22)	(0.33)	(0.24)	(1.10)	(0.67)	(0.54)	(0.51)
LR test Chi-square	134.82	24.08	75.25	10.06	0.11	5.68	1.35	0.08
LR test p-value	0.00	0.00	0.00	0.00	0.94	0.02	0.51	0.78
Degree of freedom	2	1	2	1	2	1	2	1
No.Obs	155608	160432	142186	145421	1234	1302	12060	13570
Pseudo-R-squared	0.322	0.339	0.259	0.268	0.255	0.264	0.149	0.147

Notes: POEs are private-owned manufacturers; SOEs are state-owned manufacturers; FOEs are foreign-owned manufacturers. Leverage ratio is Total debt/Total assets. Leverage ratio square is the square of Total debt/Total assets. Tangible asset ratio is Tangible assets/Total assets. Productivity is the logarithm of Net sales/Labour. Capital intensity is the logarithm of Net fixed asset/Labour. Assets is the logarithm of total assets. Age is the logarithm of firm's age. All estimations include year and industry dummies. Robust standard errors are into parentheses. All regressors, besides fixed effects, are one year lagged. Significance levels: *10%,**5%,***1%.

Table 7: Robustness check for all manufacturers

					Panel A: Export status before interpolation			
					New	Continuous	New	Continuous
Leverage ratio	-0.268***	-1.471***			0.238*	-0.282		
	(0.08)	(0.34)			(0.14)	(0.20)		
Leverage ratio square	-0.139*	1.951***			-0.508***	-0.109		
	(0.08)	(0.35)			(0.14)	(0.19)		
Lev*Prod		0.189***						
		(0.06)						
Lev2*Prod		-0.342***						
		(0.06)						
Tangible asset ratio			1.577***	1.175***			1.032***	1.078***
			(0.03)	(0.11)			(0.06)	(0.09)
Tang* prod				0.0751***				
				(0.02)				
Productivity	0.140***	0.159***	0.174***	0.159***	0.120***	0.0915***	0.146***	0.132***
	(0.00)	(0.02)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Capital intensity	-0.164***	-0.164***	-0.275***	-0.277***	-0.113***	-0.108***	-0.189***	-0.177***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.541***	0.541***	0.547***	0.547***	0.428***	0.317***	0.439***	0.303***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.0533***	0.0520***	0.0434***	0.0444***	0.0250**	0.00482	0.0206*	0.0246
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Constant	-6.781***	-6.845***	-6.658***	-6.565***	-5.861***	-2.972***	-5.430***	-3.018***
	(0.25)	(0.27)	(0.22)	(0.22)	(0.35)	(0.62)	(0.28)	(0.64)
Psuedo R2	0.315	0.316	0.331	0.331	0.257	0.115	0.264	0.117
No.Obs	143546	143546	147121	147121	82436	19712	83464	20882

	Panel B: Using value added as productivity							
Leverage ratio	0.240**	-0.101			0.410**	-0.251		
	(0.10)	(0.16)			(0.18)	(0.24)		
Leverage ratio square	-0.455***	-0.306**			-0.530***	-0.00704		
	(0.10)	(0.15)			(0.17)	(0.23)		
Lev*Prod		-0.371**						
		(0.15)						
Lev2*Prod		0.133						
		(0.15)						
Tangible asset ratio			1.716***	1.761***			1.393***	0.879***
			(0.04)	(0.06)			(0.08)	(0.10)
Tang* prod				0.0565				
				(0.05)				
Productivity	0.196***	0.349***	0.228***	0.216***	0.118***	0.171***	0.144***	0.180***
	(0.01)	(0.04)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Capital intensity	-0.170***	-0.170***	-0.281***	-0.281***	-0.127***	-0.130***	-0.219***	-0.177***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.558***	0.556***	0.576***	0.576***	0.437***	0.309***	0.462***	0.310***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.120***	0.118***	0.114***	0.115***	0.0874***	0.0294	0.0853***	0.0444**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Constant	-6.823***	-6.667***	-6.048***	-6.058***	-4.620***	-2.418**	-4.541***	-3.750***
	(0.60)	(0.60)	(0.38)	(0.38)	(0.35)	(1.04)	(0.43)	(0.72)
Psuedo R2	0.294	0.295	0.313	0.313	0.228	0.109	0.241	0.112
No.Obs	112166	112166	113879	113879	74151	13436	75232	13956

Table 8: Robustness check for POEs manufacturers

	Panel A: Export status before interpolation							
					New	Continuous	New	Continuous
Leverage ratio	0.637***	-1.111***			0.644***	0.440*		
	(0.10)	(0.39)			(0.16)	(0.25)		
Leverage ratio square	-0.709***	1.607***			-0.737***	-0.564**		
	(0.09)	(0.39)			(0.16)	(0.23)		
Lev*Prod		0.296***						
		(0.07)						
Lev2*Prod		-0.392***						
		(0.07)						
Tangible asset ratio			1.105***	0.827***			0.932***	0.662***
			(0.04)	(0.13)			(0.07)	(0.10)
Tang* prod				0.0517**				
				(0.02)				
Productivity	0.144***	0.121***	0.167***	0.158***	0.116***	0.103***	0.141***	0.129***
	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Capital intensity	-0.195***	-0.195***	-0.264***	-0.264***	-0.135***	-0.139***	-0.198***	-0.176***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Assets	0.470***	0.471***	0.484***	0.484***	0.410***	0.272***	0.426***	0.270***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.110***	0.109***	0.0902***	0.0908***	0.0620***	0.0801***	0.0545***	0.0813***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Constant	-6.224***	-6.086***	-6.000***	-5.941***	-5.693***	-2.789***	-5.236***	-3.029***
	(0.32)	(0.33)	(0.24)	(0.24)	(0.45)	(1.03)	(0.31)	(0.83)

Psuedo R2	0.253	0.254	0.261	0.261	0.232	0.0923	0.237	0.0922
No.Obs	130134	130134	132123	132123	80060	12159	80865	12378
				Panel B: Using value added as productivity				
Leverage ratio	0.846***	0.645***			0.626***	0.332		
	(0.12)	(0.19)			(0.19)	(0.30)		
Leverage ratio square	-0.781***	-0.707***			-0.648***	-0.354		
	(0.11)	(0.18)			(0.18)	(0.27)		
Lev*Prod		-0.187						
		(0.16)						
Lev2*Prod		0.0409						
		(0.16)						
Tangible asset ratio			1.367***	1.346***			1.291***	0.457***
			(0.05)	(0.06)			(0.08)	(0.12)
Tang* prod				-0.0246				
				(0.05)				
Productivity	0.163***	0.254***	0.190***	0.195***	0.0976***	0.183***	0.117***	0.184***
	(0.01)	(0.04)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Capital intensity	-0.184***	-0.184***	-0.263***	-0.263***	-0.131***	-0.149***	-0.211***	-0.168***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Assets	0.503***	0.501***	0.528***	0.528***	0.426***	0.266***	0.455***	0.275***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	0.152***	0.151***	0.137***	0.137***	0.101***	0.0980***	0.0940***	0.0979***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Constant	-6.024***	-5.928***	-5.390***	-5.387***	-4.619***	-3.257***	-4.316***	-3.517***
	(0.53)	(0.53)	(0.33)	(0.33)	(0.35)	(0.82)	(0.40)	(0.72)
Psuedo R2	0.243	0.243	0.253	0.253	0.213	0.0914	0.223	0.0925
No.Obs	106240	106240	107347	107347	72793	9253	73772	9314

Table 9: Robustness check for SOEs manufacturers

	Panel A: Export status before interpolation							
					New	Continuous	New	Continuous
Leverage ratio	1.520*	0.461			0.825	3.609**		
	(0.79)	(3.95)			(1.58)	(1.77)		
Leverage ratio square	-1.025	0.111			-1.295	-2.812*		
	(0.76)	(3.78)			(1.48)	(1.66)		
Lev*Prod		0.176						
		(0.66)						
Lev2*Prod		-0.188						
		(0.62)						
Tangible asset ratio			1.407***	3.930***			1.708***	1.697**
			(0.34)	(1.12)			(0.62)	(0.83)
Tang* prod				-0.442**				
				(0.19)				
Productivity	0.174***	0.145	0.305***	0.418***	0.192**	0.0606	0.378***	0.224*
	(0.05)	(0.17)	(0.05)	(0.07)	(0.10)	(0.14)	(0.09)	(0.13)
	-	-	-	-	-		-	
Capital intensity	0.141***	0.142***	0.315***	0.310***	0.214***	-0.223**	0.401***	-0.357***
	(0.04)	(0.04)	(0.06)	(0.06)	(0.08)	(0.10)	(0.10)	(0.12)
Assets	0.381***	0.380***	0.449***	0.458***	0.458***	0.313***	0.498***	0.299***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.10)	(0.11)	(0.11)	(0.11)
Age	0.0218	0.0227	0.0738	0.0767	-0.0681	-0.089	-0.0591	0.0331
	(0.06)	(0.06)	(0.06)	(0.06)	(0.11)	(0.15)	(0.11)	(0.14)
	-	-	-	-	-		-	
Constant	6.383***	6.204***	7.107***	7.899***	4.126***	-2.807**	4.760***	-2.785**
	(0.59)	(1.11)	(0.60)	(0.66)	(1.05)	(1.41)	(1.02)	(1.37)
Psuedo R2	0.256	0.256	0.261	0.264	0.279	0.173	0.291	0.156
No.Obs	1233	1233	1299	1299	510	330	540	344

	Panel B: Using value added as productivity							
Leverage ratio	2.958**	4.430**			2.247	7.677***		
	(1.32)	(1.73)			(3.14)	(2.47)		
Leverage ratio square	-1.897	-3.375**			-2.901	-6.290**		
	(1.23)	(1.62)			(2.82)	(2.45)		
Lev*Prod		2.772*						
		(1.52)						
Lev2*Prod		-2.695**						
		(1.35)						
Tangible asset ratio			0.967	1.138*			3.641***	2.201*
			(0.60)	(0.66)			(1.33)	(1.17)
Tang* prod				0.335				
				(0.45)				
Productivity	0.0139	-0.55	0.0523	-0.0391	-0.239	-0.212	-0.0177	-0.147
	(0.09)	(0.41)	(0.08)	(0.14)	(0.16)	(0.25)	(0.14)	(0.18)
Capital intensity	-0.0322	-0.0333	-0.132	-0.129	-0.0965	-0.275**	-0.458**	-0.510**
	(0.06)	(0.07)	(0.09)	(0.09)	(0.13)	(0.14)	(0.19)	(0.21)
Assets	0.393***	0.397***	0.449***	0.449***	0.573***	0.039	0.742***	0.203
	(0.07)	(0.07)	(0.08)	(0.08)	(0.15)	(0.19)	(0.19)	(0.22)
Age	-0.0763	-0.0714	-0.00139	-0.00765	-0.121	-0.201	-0.119	-0.232
	(0.09)	(0.10)	(0.09)	(0.09)	(0.23)	(0.22)	(0.19)	(0.25)
	-	-	-	-	-		-	
Constant	5.203***	5.530***	4.789***	4.842***	5.221***	1.292	6.951***	1.741
	(0.85)	(0.92)	(0.93)	(0.93)	(1.61)	(2.21)	(1.69)	(2.27)
Psuedo R2	0.231	0.236	0.206	0.207	0.331	0.215	0.337	0.195
No.Obs	495	495	506	506	192	154	206	156

Table 10: Robustness check for FOEs manufacturers

					Panel A: Export status before interpolation			
					New	Continuous	New	Continuous
Leverage ratio	0.0718	1.108			0.592	-0.00637		
	(0.23)	(1.02)			(0.48)	(0.39)		
Leverage ratio square	-0.106	-1.048			-0.795	-0.107		
	(0.23)	(1.07)			(0.50)	(0.39)		
Lev*Prod		-0.189						
		(0.18)						
Lev2*Prod		0.172						
		(0.19)						
Tangible asset ratio			0.985***	1.056***			0.295	0.894***
			(0.10)	(0.32)			(0.23)	(0.18)
Tang* prod				-0.0133				
				(0.06)				
Productivity	0.0731***	0.113***	0.130***	0.134***	0.160***	0.0913***	0.183***	0.142***
	(0.02)	(0.04)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Capital intensity	-0.0652***	-0.0648***	-0.152***	-0.152***	-0.0146	-0.0680***	-0.0580*	-0.132***
	(0.01)	(0.01)	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
Assets	0.375***	0.375***	0.352***	0.352***	0.314***	0.251***	0.303***	0.224***
	(0.02)	(0.02)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.02)
Age	-0.0445**	-0.0451**	0.000915	0.000618	-0.0928**	-0.0042	-0.0654	0.0299
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.04)	(0.04)
Constant	-5.118***	-5.308***	-3.756***	-3.777***	3.981***	-2.090***	-2.889***	-2.091***
	(0.51)	(0.54)	(0.50)	(0.51)	(0.55)	(0.78)	(0.65)	(0.78)
Psuedo R2	0.149	0.149	0.147	0.147	0.162	0.0697	0.155	0.0694

No.Obs	12055	12055	13564	13564	1754	7177	1939	8114
Panel B: Using value added as productivity								
Leverage ratio	0.611*	0.672*			1.304*	0.00968		
	(0.34)	(0.39)			(0.67)	(0.50)		
Leverage ratio square	-0.676**	-0.797**			-1.302*	0.0269		
	(0.34)	(0.40)			(0.71)	(0.51)		
Lev*Prod		0.0954						
		(0.34)						
Lev2*Prod		-0.204						
		(0.37)						
Tangible asset ratio			0.567***	0.518***			0.161	0.424*
			(0.16)	(0.18)			(0.34)	(0.23)
Tang* prod				-0.0774				
				(0.12)				
Productivity	0.0470*	0.0588	0.0720***	0.0931**	0.118*	0.0459	0.166***	0.0554
	(0.03)	(0.07)	(0.03)	(0.04)	(0.06)	(0.04)	(0.06)	(0.04)
Capital intensity	-0.0322*	-0.0314*	-0.0761***	-0.0763***	0.0196	-0.0673**	-0.0269	-0.0769**
	(0.02)	(0.02)	(0.02)	(0.02)	(0.04)	(0.03)	(0.04)	(0.03)
Assets	0.386***	0.386***	0.367***	0.367***	0.292***	0.288***	0.295***	0.256***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.05)	(0.04)	(0.05)	(0.03)
Age	-0.0173	-0.0172	0.027	0.0264	-0.0303	-0.0304	0.00961	-0.008
	(0.03)	(0.03)	(0.03)	(0.03)	(0.07)	(0.05)	(0.07)	(0.05)
Constant	-4.473***	-4.476***	-4.144***	-4.129***	3.097***	-1.606**	2.897***	-1.346**
	(0.94)	(0.93)	(0.93)	(0.93)	(0.80)	(0.65)	(0.79)	(0.64)
Psuedo R2	0.15	0.15	0.145	0.145	0.116	0.0821	0.114	0.0737
No.Obs	5352	5352	5948	5948	800	3942	883	4394

7. Conclusion

In this paper, we focus on the impact of financial constraints and productivity on export probability for a large sample of Vietnamese firms. To this purpose, we use survey data to build a database for a sample of 103,425 manufacturers in Vietnam over the period 2009-2014. Most of the manufacturers are private-owned (POEs). In addition, there are some state-owned (SOEs) and foreign-owned (FOEs) manufacturers. Overall, the data show there is strong persistence in export status: in any given year, non-exporting firms only have a small unconditional probability to start exporting. Similarly, exporting firms only have a small unconditional probability to stop exporting. Stylized facts show that exporters in our sample are considerably more productive, larger, more capital intensive, and older than non-exporters, which is consistent with the literature. SOEs and particularly FOEs are – unsurprisingly more likely to export than privately owned manufacturers.

To more precisely analyse the role of financial constraints, productivity and their interaction in the decision to export, we use a probit model. In the analysis, we control for size, age, and capital intensity. To capture other unobserved determinants we also include industry and year fixed effects. We find strong results for POEs and relatively weak ones for the other two groups.

Our results suggest that borrowing constraints significantly affect export decision for POEs. Different from other literature, we find that manufacturers face a non-constant effect of borrowing constraints on export decision.That is, the relationship between leverage and export probability for POEs manufacturers is concave. At low leverage levels, more borrowing increases a firm's exporting probability. At high leverage, more borrowing decreases this probability. Furthermore, the results indicate that borrowing constraints matter both for the decision to start exporting and for the decision to continue exporting, and more so for the latter. Finally, when we include the interaction between productivity and borrowing constraints, the results show that medium and high productive POEs depend more on borrowing constraints than the low productive ones. Our results are robust to sensitivity checks.

One limitation of our research is that the studied period is the aftermath of the 2008 global financial crisis. As the international financial crisis affects the cost and availability of external finance (Foley and Manova, 2014) future research should account for the impact of the crisis on the relationship between borrowing constraints and export to gauge more robust picture on this nexus.

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Appendix

Table 1: How private manufacturers are selected into the survey over years

	2009				2010				2011			
Labours	C. 1	C. 2	C.3	C.4	C. 1	C. 2	C.3	C.4	C. 1	C. 2	C.3	C.4
<10	15%	15%	100%	15%	10%	20%	100%	20%	100%	100%	100%	100%
20-Oct	15%	100%	100%	100%	10%	20%	100%	20%	100%	100%	100%	100%
20-30	15%	100%	100%	100%	20%	20%	100%	100%	100%	100%	100%	100%
30-50	100%	100%	100%	100%	20%	100%	100%	100%	100%	100%	100%	100%
50-100	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
>100	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	2012				2013				2014			
Labours	C. 1	C. 2	C.3	C.4	C. 1	C. 2	C.3	C.4	C. 1	C.2	C.3	C.4
<10	10%	20%	100%	20%	10%	20%	100%	20%	10%	20%	100%	20%
20-Oct	10%	20%	100%	20%	10%	20%	100%	20%	10%	20%	100%	20%
20-30	20%	20%	100%	100%	10%	20%	100%	100%	10%	20%	100%	100%
30-50	20%	100%	100%	100%	10%	20%	100%	100%	10%	20%	100%	100%
50-100	100%	100%	100%	100%	20%	100%	100%	100%	20%	100%	100%	100%
>100	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Note:

- C: category
  - + C.1 : firms in Ho Chi Minh, Ha Noi;
  - + C.2: Da Nang, Binh Duong, Dong Nai, Hai Phong;
  - + C.3: firms in small provinces with total firms<1000: Ha Giang, Cao Bang, Bac Kan, Tuyen Quang, Lao Cai, Dien Bien, Lai Chau, Son La, Yen Bai, Hoa Binh, Lang Son, Phu Yen, Ninh Thuan, Kon Tum, Đak Nong, Tra Vinh, Hau Giang, Bac Lieu;
  - + C.4: firms in the rest of provinces; within each industry, firms are chosen randomly.
- %: percentage of manufacturers are selected into the survey.

Appendix 2

Before and after fill in missing export status for firms with $ESS_{t-1}=ESSt_{+1}=0$ and ESS_t is missing

	Before		After	
ESS	0	1	0	1
2010	20,013	6,051	20,013	6,051
2011	54,977	11,086	55,010	11,086
2012	21,626	9,672	46,933	9,672
2013	60,621	12,706	60,641	12,706
2014	64,530	12,719	64,531	12,719
Total	221,767	52,234	247,128	52,234

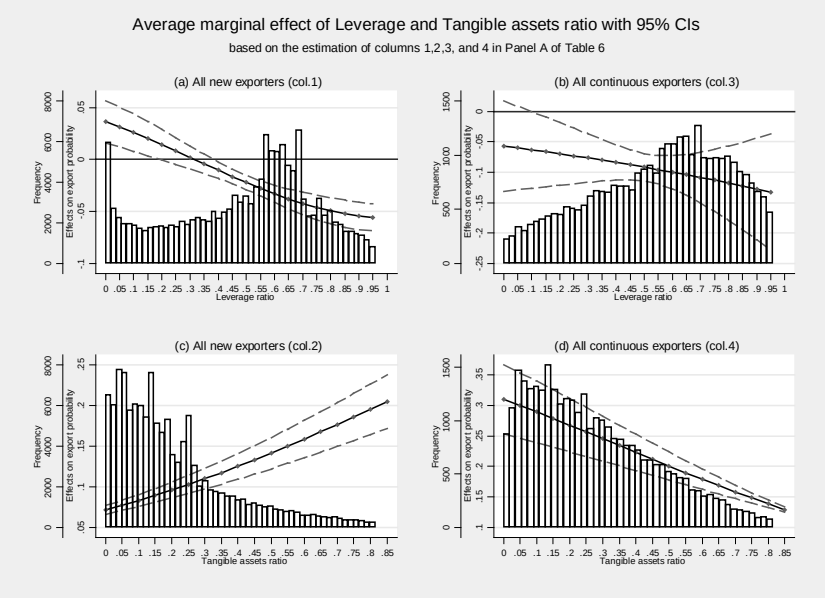
Appendix 3

Variable definition

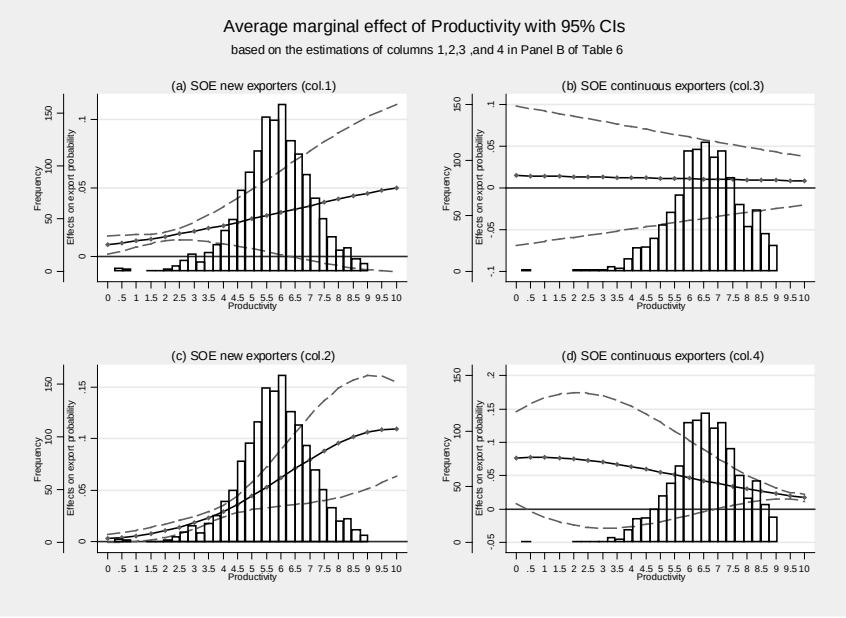
Variable		Definition
Export decision		Export status, equal to 1 if firm export in that year, 0 otherwise
Leverage ratio	Total debt/total assets	Total debt over total assets. Calculated as average of year.
Tangible asset ratio	Tangible asset/total assets	Net tangible assets over total assets. Calculated as average of year.
Productivity	Net sales/labour	Net salesover total labours, expressed in logarithmic form in the regressions. Net sales is calculated at end-of-year, labour is calculated as average of year.
Capital intensity	Net fixed assets/labour	Net fixed assets over total labours, expressed in logarithmic form in regressions. Calculated as average of year.
Age	Log of age	Firm's age is defined as number of year since the starting business date, expressed in logarithmic form in regressions.
Assets	Log of total assets	Total assets, expressed in logarithmic form in regressions. Calculated as average of year.
Value added/labour	Value added/labour	Value added over total labours, value added is equal to net sales minus materials, expressed in logarithmic form in regressions.

Appendix 4

a. Average marginal effect of leverage with 95% CIs- for all manufacturers based on the estimation of Table 5



b. Average marginal effect of productivity with 95% CIs- for SOEs based on the estimation of Table 5



c. **Average marginal effect of productivity with 95% CIs- for FOEs based on the estimation of Table 5**