Firm size, financial constraints and intensive export margin[*]

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Abstract

The paper studies the causal relationship between the extent of external debt financing and the intensive margin of exports for firms of different size. We use detailed balance sheet data with information on sources of financing for a set of Slovenian firms for the period 2001-2008. We apply the continuous matching technique to control for the key variables and consider three modes of financing, firm own cash flow, bank loans and borrowing in internal credit markets. We find clear evidence that taking on any additional finance help firms to expand exports. Even when considering the most restrictive mode of access to external finance, i.e. the bank loans, we still find that variation in debt-to-assets ratio explains export expansion. This suggests that firms (managers/owners) that are more willing to take risk, can manage to expand effectively firm's exports. We also demonstrate a monotonic and higher responsiveness of export share to debt-to-asset ratio for small firms than for medium and large firms, which suggests that small firms benefit more from taking additional bank loans. However, this relationship for small firms becomes monotonic only after controlling for firms' survival in the export markets, which suggests that many small firms with high debt-to-asset ratio are likely to fail in foreign markets.

Keywords: exports, financial constraints, intensive margin, firm heterogeneity, continous matching

JEL Classification: D24, F12, F14

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1 Introduction

A large body of literature suggests that access to financing is important determinant of firm investments (Stiglitz and Weiss, 1981; Fazzari and Hubbard, 1988; Evans and Jovanovic, 1989; Bond, 1994; Dixit and Pindyck, 1994; Hubbard, 1998). Cabral and Mata (2003) argue that expansion of small firms is hampered by firms' financial constraints resulting in observed right-skewed firm size distribution. Financial factors are also shown to be important in explaining the patterns of international trade. Chaney (2005) has shown theoretically that in the presence of large fixed cost of exporting access to financing may explain part of the variation in the foreign market participation. Greenaway, Guariglia and Kneller (2007) confirm this prediction for a set of UK manufacturing firms. Further, Zia (2008) reports that removal of subsidized credit causes a significant decline in the exports of privately owned Pakistani firms, while the exports of large, publicly listed, and group network firms remain unaffected. In a similar vein, Bellone, Musso, Nesta and Schiavo (2000) demonstrate that less financially constrained Italian firms are more likely to start exporting earlier, but that exporting per se does not improve financial health of exporters. They also find, taking export intensity as a proxy for serving a large number of destinations, a negative relationship between access to financing and export intensity. The reasoning for the latter is straightforward. Further expansion of exporters to new foreign markets as well as the introduction of new products to the existing markets is associated with significant sunk cost. Financial constraints will therefore provide an important barrier not only to the entry into export markets, but also to new exporters' expansion dynamics in foreign markets. Damijan, Kostevc and Polanec (2010) show that Slovenian firms with higher debt-to-asset ratio tend to export greater number of products to greater number of markets. In both cases, firm size is shown to be positively correlated with the expansion dynamics of new exporters.

These findings suggest that expansion of exports may take different patterns for exporters of different size. While for large firms export expansion is likely to be monotonic due to their larger internal funds and better access to external finance, this pattern might be non-monotonic for small exporters. First reason is that small exporters may have weaker access to external finance or have to pay a higher finance premia. The speed of foreign market expansion is therefore constrained by the internal funds available to them. Another important issue, however, relates to a famous remark by Knight (1921) who argues that bearing risk is one of the essential characteristics of entrepreneurship. As noted by Bond, Tybout and Utar (2008), the households with lower relative risk tolerence shy away from business ventures during the periods of excessive macro volatility. Similarly, due to fixed costs associated with exporting, small firms bear higher risk of failure and are therefore less prone to take risks related to exporting. Hence self-restraint may play an important role in foreign market participation, particularly for small firms.

This means that, for the same levels of external financing, small firms will export a smaller share of their total sales. Furthermore, small firms may expand to a lesser extent than large firms even if they are not liquidity constrained. Smaller size of internal funds and the risk of failure will make smaller exporters to be more cautious in terms of taking additional risks associated with increased export intensity. On the other hand, small firms willing to risk by taking external finance may well use the additional funds more efficiently. Bond, Tybout and Utar (2008) show that households with promising business opportunities and modest wealth would be the main beneficiaries of better-functioning credit markets. However, there is a limit in terms of export expansion also for risk loving small exporting firms. Eaton, Eslava, Kugler and Tybout (2007), Bernard, Jensen, Redding and Schott (2007, 2009) and Damijan, Kostevc and Polanec (2010), report that small firms typically serve only one or two foreign markets with a handful of products. This, in turn, makes them relatively more vulnerable to the potential failure in the export markets. Large firms can take on the extensive geographic dispersion of export markets and a large variety of products exported as a significant insurance against the risk of failure in a single foreign market or in a single product exported. Small firms do not enjoy a similar comfort. A failure in any of the export projects can be terminal for a small firm leading to its exit from the export market, and consequently, due to the excessive indebtedness, also driving it out of the business altogether.

Drawing a correlation between the level of external debt and export intensity, a monotonic relationship is likely to be found for large firms, while for small firms a relationship in the form of an inverted U-shape is more likely to be found. The right tail will consist of firms that have taken on the excessive debt, but have failed in their endeavour in the export markets. As a consequence, export share diminishes and the debt-to-asset ratio rises significantly.

In this paper, we analyze this relationship between the extent of liquidity constraints and the intensive margin of exports for firms of different size. We use firm-level balance sheet data with detailed information on financing for a set of Slovenian firms for the period 2001-2008. We take firm's own cash flow as its main internal source of liquidity. Among the external sources of finance, we make use of the information on short- and long-term borrowing from the banking sector and information on borrowing in the internal credit market for firms in the network group. Our main goal is to test whether, for the firms with the same expected debt-to-assets ratio, small exporting firms experience different pattern of export expansion than their medium and large-sized counterparts. We aim to show that firms with higher debt-to-assets ratio increase export intensity and that this response varies between firms of different size. Our main econometric tool employed is continuous matching technique based on the generalised propensity score and the relevant dose response functions (Imbens 2000, Hirano, Imbens 2004). As a robustness check we also use standard regressions. In our empirical excersises, several alternative measures of

liquidity constraints are used, although the key findings remain the same. In terms of export intensity expansion, small firms are shown to benefit the most of all groups from taking additional bank loans, while medium-sized firms do rely more on financing in the internal credit markets. Large firms increase their export intensity monotonically with the increase in both sources of external financing.

The paper is organized as follows. Section 2 discusses the conceptual framework of the paper. Section 3 presents the datasets used and some basic descriptive statistics. Section 4 discusses the empirical methodology

employed in the paper. Section 5 presents main empirical results of the paper and the last Section concludes.

2   The conceptual framework

Exporting is just like any other activity of firms. It is costly as a firm considering selling in a particular foreign market has to engage in the foreign market analysis, in building the distribution, sale and aftersale network, paying the sales people, modifying the products according to the local requirements, financing the production expansion, etc. Exports is a sunk cost, which requires significant investment. Recent empirical literature demonstrates this clearly - only firms that have sufficient liquidity will be able to export (Chaney, 2005; Greenaway, Guariglia and Kneller, 2007; Bellone, Musso, Nesta and Schiavo, 2008, Zia, 2008).

To finance the investment, a firm has to hold either to its internal funds or to to raise external finance (debt or new equity) or borrow from the associated firms in the network group. Here, firm size is crucial. First, the level of investment is constrained by firm's own cash flow (Glichrist and Himmelberg, 1995). Bond (1994) notes that investment spending may be constrained by cash flow even though the firm has access to finance from debt or new share issues. Evidence of financial constraints on investment spending does not necessarily indicate the presence of credit rationing or of 'gaps' in the capital market. All that is required is a significant cost differential between external and internal finance. Second, the amount of the investment rises with the number of foreign markets (and products) a firm decides to serve. Without borrowing, small firms can afford to finance only few investments abroad. In order to finance extensive export dynamics, however, borrowing outside the firms is necessary (Damijan, Kostevc and Polanec, 2010). Again, availability of internally generated finance (cash flow) provides a non-negligible constraint on the ability of these firms to raise external finance. In general, cost of borrowing will depend on the firm size and firm history.

Hence, firm size plays a crucial role in firm's export evolution. Ceteris paribus, small firm will face more severe (internal and external) financial constraints and will be therefore more likely to start exporting at a later point than a large firm and will serve less foreign

markets (and with less products) than a large firm. This is why the empirical literature typically finds that the intensive and extensive export margins of small firms is lower than that of the medium-sized or large firms (e.g. Eaton, Eslava, Kugler and Tybout, 2007; Bernard, Jensen, Redding and Schott, 2009; and Damijan, Kostevc and Polanec, 2010).

Another complication comes from the fact that small firms are more risk averse and will shy away both from taking the excessive risks in foreign markets as well as from taking the excessive external debt to finance export ventures. Studying financial constraints affecting new French firms, Bonnet, Cieply and Dejardin (2005) find that there is a non-negligible share of firms, which do not ask for a bank loan although they declare facing financial constraints. This self-imposed constraint then translates into even lower intensive and extensive export margins of small firms than it would normally appear from the smaller size.

Lower intensive and extensive export margins of small firms in combination with their necessary larger exposure to external debt, however, affects also their survival in the export markets. Small firms are poorly insured against the risk of failure in export markets. While large firms can use the extensive geographic dispersion of export markets and a variety of products exported as insurance against the risk of failure in a single foreign market or in a single product exported, any failure in export projects of a small firm can be terminal. Any failure can lead to a small firm exiting the export market and, potentially, also driving it out of the business completely due to the excessive indebtedness.

To see this point, assume a small exporting firm that is constrained by its own cash flow potential and is taking additional debt in order to finance either an expansion to a new export market or to introduce a new product. When successful, then additional debt will result in the desired increase of firm's export intensity as the firm's total sales and exports increase by the same amount. In case of a failure, however, both firm's relative cash flow and export intensity will decrease when compared to the firm's domestic sales increased by unsold stocks. This in turn diminishes the value of firm's assets and increases its debt-to-asset ratio.

Three implications stem from the above reasoning. First, with liquidity constraints relaxed by the access to external credit and capital markets, small firms are benefitting more relative to large firms. This finding is confirmed by Forbes (2007) for Chilean plants showing that during the period of increased taxes on capital inflows, smaller traded firms in Chile experienced significant financial constraints and these constraints decreased as firm size increased. Zia (2008) shows that removal of subsidized credit causes a significant decline in the exports of small firms, while the exports of large firms and of group network firms are unaffected. This implies that, after removing the constraint on external finance, small firms are likely to expand faster than large firms. We will document this below.

Second, however, even if they are not liquidity constrained, small firms are less likely to expand to the dimensions of the intensive and extensive export margins we observe in

large firms. The most likely explanations for this relates to the firms' small scale. Any expansion requires significant investments, whereby small firms' own assets and their self imposed limits provide important barriers to such plans. On the one side, borrowing is more costly for small firms, while on the other side small firms will hesitate to take on excessive external debt.

And third, for small exporting firms taking excessive risks in terms of additional bank loans for financing new export projects, any failure in exporting markets may become terminal. After a failure cash flow will decrease and, subsequently, export intensity measured against domestic sales increased by unsold stocks will decrease, while debt-to-asset ratio will rise even further. Hence, a non-monotonic relationship between firms' liquidity and export intensity taking the form of an inverted U shape may be a likely outcome for small-sized exporters. On the one hand, any additional own cash flow or external debt increase will positively affect the pace of firm export intensity, but at a diminishing rate with the respect to the actual debt-to-asset ratio. On the other hand, however, a number of small firms will fail in recent export projects, which may well drive them out of the export markets.

Hence, the left tail of the firm distribution according to debt-to-assets ratio and export intensity will consist of firms which are more conservative in terms of borrowing but which also perform lower export shares. On the other edge, the right tail will consist of firms that have taken on the excessive debt, but have failed in their endeavour in the export markets. As a consequence, their export shares diminish and the debt-to-asset ratio rise significantly. We demonstrate this relationship in the next Sections using the detailed microdata for Slovenia.

3   Data and sample characteristics

We employ balance-sheet data for a set of Slovenian firms for the period 2001-2008. The reporting to Slovenian Agency for Public Legal Records and Related Services (AJPES) is mandatory for all firms and large sole proprietors with more than 30 employees. On an annual basis AJPES gathers data on approximately 40,000 enterprises (as well as some 60,000 independent entrepreneurs). Our primary focus will be on the subset of about 5,000 manufacturing firms with at least 1 full-time employee yielding about 55,000 year-firm observations. Since we are mainly interested in the role of financing for firm behavior, we drop the data for 2008 from most of our regressions in order to avoid the impact of the global financial crisis.[1] This further reduces the size of the sample to approximately 47,000 observations for the period 2001-2007. AJPES database contains detailed information on financing and some information on the cross-border activities of these firms. The structure

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[1] We perform a robustness check by including data for year 2008 in the analysis and find that it does not alter the basic findings.

of sales allow us to use export share as a measure of export intensity. Table 1 reflects some of the basic characteristics of the sample, with respect to the number of firms, their export participation, average export intensity and median debt to asset ratio.

Table 1: Some characteristics of Slovene manufacturing firms in the period 2001-2007

year	all firms	share of exp.	av. exp. share (all)	med. exp. share (exp)	med. debt/assets
2001	4,808	48.2%	0.186	0.299	0.575
2002	4,931	50.9%	0.189	0.274	0.587
2003	4,964	51.1%	0.187	0.257	0.586
2004	5,062	52.7%	0.185	0.221	0.599
2005	5,147	53.1%	0.184	0.208	0.603
2006	5,202	54.7%	0.194	0.229	0.622
2007	5,395	54.3%	0.191	0.227	0.629

Source: AJPES

In addition to an increase in the number of firms, Table 1 reveals that the share of exporters increased throughout the sample period. After an initial decline, a gradual upward shift in the average share of exports in total sales for all firms (median export shares are close to zero) with a similar evolution for the cohort of exporting firms whose median export share reaches minimum in 2005 only to recover somewhat in 2006 and 2007. The share of external financing as measured by the median debt-to-asset ratio, on the other hand, has been increasing markably throughout the period of observation. This is consistent with prior evidence for other countries and suggests that financing constraints affect small firms to a greater extent.

Table 2 reveals some crucial differences between firms of different size in terms of the intensive export market and the shares of various sources of external finance. The ranking order is expected. Small firms are shown to export the lowest shares of their total sales and to rely most intensively on borrowing in the credit markets, followed by medium and large firms. The surprising fact, however, is the evidence that small firms pay on average the lowest interest rates. This is quite counter-intuitive and contrary to the evidence for other countries. An ad hoc explanation for this surprising fact would be that small firms in Slovenia are not facing external financial constraints at all, which is reflected in their larger debt-to-asset ratios.

Table 2: Median export share and share of financing of Slovenian manufacturing firms in the period 2001-2007, by size classes

year	size	export share	debt-to-asset ratio	share of bank debt	share of debt to assoc. firms	median interest rate
2001	$1 < emp \leq 50$	0	0.613	0	0	0.042
	$50 < emp \leq 200$	0.039	0.485	0.198	0	0.058
	$emp > 200$	0.312	0.411	0.318	0.011	0.066
2007	$1 < emp \leq 50$	0	0.646	0	0	0.005
	$50 < emp \leq 200$	0.048	0.636	0.217	0	0.015
	$emp > 200$	0.344	0.526	0.382	0.030	0.022

Note: All median values."share of bank liabilitites" represents the share of bank liabilities in total financial liabilities, while "share of liab. to assoc. firms" represents the share of liabilities to firms in the same group or associated firms in total financial liabilities.

Source: AJPES

Differences in the access to finance are clearly depicted in figures 1a and 1b showing distributions of three size groups of firms with respect to own cash flow and to debt generated by bank loans. Figure 1 demonstrates similar distributions for small and medium-size firms as opposed to large firms. Consequently, small and medium firms rely more on bank loans than large firms, whereby there is visible a significant difference between small and medium firms. For small firms bank loans are important mode to gather finance. Medium firms are, to a greater extent, part of large network groups and are granted access to internal credit markets.

Figure 1: a) Kernel density distribution for EBITDA (cash flow) to sales ratio for the three class sizes b) Kernel density function of debt to assett ratio for the three class sizes
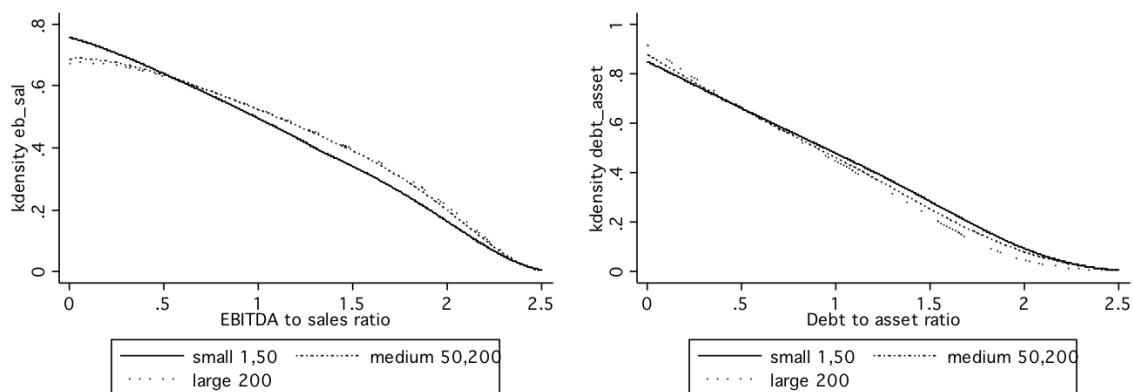
Note: Cash flow measured by earnings before interest, taxes, depreciation, and amortization (EBITDA)

Source: AJPES, own calculations

4 Econometric approach

In order to test the impact of financial constraints on the intensity of exports across the whole spectrum of firms, we utilise the generalised propensity score (GPS). The relatively novel method (Imbens, 2000; Hirano and Imbens, 2004) represents a generalisation of the more commonly used binary treatment propensity score methodology (Rosenbaum and Rubin 1983, 1984). Namely, in many cases the treatment variables take on more than two values and the actual "dose" of the treatment variable becomes crucial. The key difference in effect becomes that for estimating average causal effects it is no longer necessary to divide the population into subpopulations within which causal comparisons are valid, as is the case with binary-treatment propensity score, but it is sufficient to divide the population into subpopulations where average potential outcomes can be estimated (Imbens 2000).

The basic framework (following Hirano, Imbens, 2004) assumes a random sample of, say, firms indexed $i = 1, ..., N$. Each firm can be associated with a set of potential outcomes, $Y_i(t)$, for $t \; \epsilon \; \tau$, which is referred to as the unit-level dose-response function. In contrast to the binary-treatment case, τ is allowed to be an interval $[t_0, t_1]$. We are interested in the average dose-response function, $\mu(t) = E[Y_i(t)]$. In addition, each observed unit is also associated with a vector of covariates X_i and the level of the treatment received, $T_i \; \epsilon \; [t_0, t_1]$. Finally, in addition to observing the vector of covariates and treatment received, we also have information on the outcome correspodning to the level of treatment received, $Y_i = Y_i(T_i)$.

Where the key assumption in the binary-treatment propensity score estimation was strong unconfoundedness (Rosenbaum, Rubin 1983), Imbens (2000) proposes a generalisation of this approach for the generalised propensity score by assuming that the treatment variable is only weakly unconfounded given the set of pretreatment covariates

$$Y(t) \perp T \mid X \text{ for all } t \; \epsilon \; \tau \tag{1}$$

Instead of requiring joint independence of all potential outcomes only conditional independece needs to hold for each value of the treatment (Hirano, Imbens, 2004). As was the case with the binary variable case, conditioning on the entire set of pre-treatment variables may prove difficult in cases where the dimension of X is large, therefore the original proposition of Rosenbaum and Rubin (1983) of conditioning on the propensity score instead is generalised by Imbens (2000) and Hirano, Imbens (2004) into gonditioning on the "generalised propensity score". Letting $r(t, x)$ be the conditional density of the treatment given the covariates:

$$r(t.x) = f_{T|X}(t \mid x) \tag{2}$$

the generalised propensity score is $R = r(T, X)$. Assuming that, as above, the assignement to treatment is only weakly unconfounded, Hirano and Imbens (2004) show that adjusting for the generalised propensity score eliminates the possible bias stemming from the inherent differences in pre-treatment variables. In order to test the impact of financing constraints on the intensity of exports, we estimate the following generalised propensity score of treatment variable (financing)

$$fin_t = f(fin_{t-1}, va\_emp_{t-1}, size_{t-1}, credit\_deter_{t-1}, time, industry) \qquad (3)$$

where fin_t represents various measures of financing employed at time t, such as debt-to-assets ratio and EBITDA-to-sales, va_emp_{t-1} stands for labor productivity at time $t-1$ as measured by value added per employee, $size_{t-1}$ measures firm size in terms of sales at $t-1$, $credit\_deter$ represent a set of variables commonly used to determine credit size, such as implicit interest rate, share of collateral and variance of sales relative to long-term trend (all lagged). Finally, $time$ and $industry$ are the respective year and NACE 2-digit industry dummies.[2]

Based on the generalised propensity score one can generate a dose-response function depicting the average potential outcomes at any level of the treatment variable. In our example, we generate dose-response functions of the response of export intensity to various levels of treatment, i.e. financing. Namely, in order to perform continuous matching estimation, the treatment variable has to be bounded (above and below), which is why we employ measures of financial constraints relative to the maximum in the respective size class, year and NACE 3-digit industry.[3]

5 Results

5.1 Preliminary regressions

In order to obtain benchmark results on the relationship between financial constraints and export intensity, we estimate the relationship between export intensity (value of foreign sales relative to domestic and foreign sales) and the ratio of total debt-to-assets applying the OLS estimator. The covariates in regression are measures of firm size (total sales), firm labor productivity (value added per employee), the implicit interest rate, collateral,

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[2]In order not to loose to many observations, we look at the contemporaneous impact of financing constraints on export intensity. We do, however, also test the robustness of this approach by lagging both sides of 3 by one period and henceforth testing the effect of lagged financing constraints on current export intensity. Results based on this approach exhibit no qualitative nor quantitative differences compared with our baseline model.

[3]Some industries in given years can include firms that exhibit extreme values in terms of the financial constraints variable. In order to mitigate the issue of such outliers, we also provide results of dose-response functions where the relevant treatment variables are calculated relative to 99th (98th) percentile of the distribution within a given year, size class and industry.

measured as the value of all realestate and machinery in total assets, share of loans from associated firms, variance of sales relative to trend and, finally, the full set time and NACE 3-digit industry interaction dummies. All the regressors are lagged one period relative to the dependent variable. We distinguish between three size classes. Small firms employ between 1 and at most 49 employees, medium-sized firms employ between 50 and 200 employees, while large firms employ more than 200 employees. In order to explore the effect of firm-own internal sources of financing, we show estimates of the effects of cash-flow-to-sales ratio (EBITDA to sales) on the export share in the columns (7)-(9). We include only firms that exported at least a part of their existence and exclude firms being allways non-exporters.

Table 3: The estimates of export intensity equation (dependent variable: export share)

	(1)	(2)	(3)	(7)	(8)	(9)
	small firms	Medium-sized firms	large firms	small firms	medium-sized firms	large firms
r_D/A_1	0.054***	-0.0032	0.142***			
	(0.020)	(0.035)	(0.039)			
r_EBITDA/sal_1				0.046**	-0.128**	-0.115
				(0.019)	(0.057)	(0.081)
va_emp_1	-6.794e-07*	9.785e-06***	6.557e-06**	-5.877e-07	8.731e-06***	-8.449e-07
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
sales_1	9.12e-08***	3.14e-08***	4.21e-09***	9.62e-08***	3.29e-08***	5.40e-09***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
int_rate_1	0.014	0.511***	0.273**	0.014	0.503***	0.552***
	(0.011)	(0.156)	(0.118)	(0.010)	(0.157)	(0.200)
collat_1	-0.026	-0.006	-0.077	-0.028	0.007	-0.092
	(0.016)	(0.040)	(0.071)	(0.016)	(0.040)	(0.073)
sh_assoc_1	0.066**	-0.021	-0.033	0.070**	-0.023	-0.007
	(0.032)	(0.038)	(0.047)	(0.033)	(0.038)	(0.048)
var_1	4.96e-16***	-1.28e-16***	-1.79e-18***	4.37e-16**	-1.30e-16***	-2.27e-18**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	8399	2113	1060	8170	2096	1051
R-squared	0.162	0.383	0.662	0.164	0.386	0.660

Note: Significance based on heteroscedasticity robust standard errors, *, **, *** indicate statistical significance at 10, 5 and 1 per cent, respectively

Table 3 reveals a positive correlation between lagged debt-to-asset ratio and export intensity for both small and large firms implying that access to external finance improves the scope of firm exposure in foreign markets. The impact for mid-sized firms is ambiguous as it is not significantly different from zero. After controlling for firm size and productivity, higher lagged interest rates and lower variation in sales are shown to positively impact the export share for medium and large firms, while the share of collateral and share of loans from associated firms do not have a significant impact on the share of exports. Results with respect to the cash-flow-to-sales ratio offer more intriguing as EBITDA-to-sales ratio positively impacts the share of exports for small firms only, while it has an unexpected significantly negative impact on the export share for mid-sized firms. In order to see which part of the distribution with respect to financial constraints generates these results, we now turn to continuous matching and dose-response results.

5.2   Dose response for bank loans

Benchmark analysis is based on estimation of the effects of the relative bank-loan-generated debt to asset ratio on the exporting intensity. Given that the continuous matching technique requires that the treatment variable is continuous on the relevant interval, we choose to construct a measure of a relative debt to asset ratio on an interval between 0 and 1. For that purpose we calculate relative values of the debt to asset ratio by relating absolute values to the year-industry-size class specific maximum debt-to-asset ratios. The maximum ratio of outstanding debt to firm assets is calculated for each year, each NACE 2-digit manufacturing industry and each size class of firms, where size classes are micro firms (less than 10 employees), small firms (more than 10 and at most 50 employees), medium-sized firms (from 51 to 200 employees) and large firms with more than 200 employees. The resulting relative debt to asset ratios therefore span the interval between 0, which implies no debt, and 1, which is the highest debt to asset ratio achieved by a firm of that size class in the relevant year and industry. We only consider those firms whose debt-to-asset ratio was smaller than unity[4]. Finally, in order to test for the robustness of results, we also tried calculating relative values with respect to the 99th percentile rather than the maximum values, but that had no significant impact on the results shown bellow.

Figure 2 presents the dose response function with the 95% confidence interval of the impact of the treatment variable (relative debt to asset ratio) on the share of exports in total sales for all manufacturing firms in the period between 2002 and 2007. The upper and lower bounds of the 95% confidence interval were generated using bootstrapping with 500 replications. Figure 3 presents these results separately for each of the three size classes.

Figure 2: The impact of relative debt to asset ratio from bank loans on export intensity for all manufacturing firms (2001-2007)
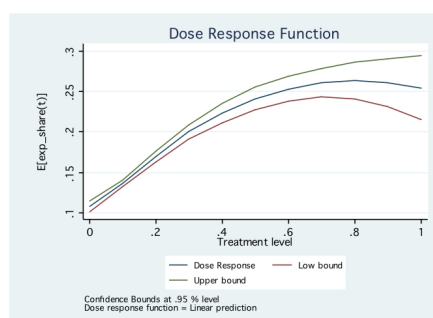
Source: AJPES, own calculations

Figure 3: The impact of relative debt to asset ratio on export intensity (2001-2007) a) small manufacturing firms, b) medium-sized manufacturing firms, and c) large manufacturing firms

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[4]Some firms in the dataset exhibit higher debt to asset ratio, but obviously have no equity anymore and have likely filled for bancrupcy or liquidation.
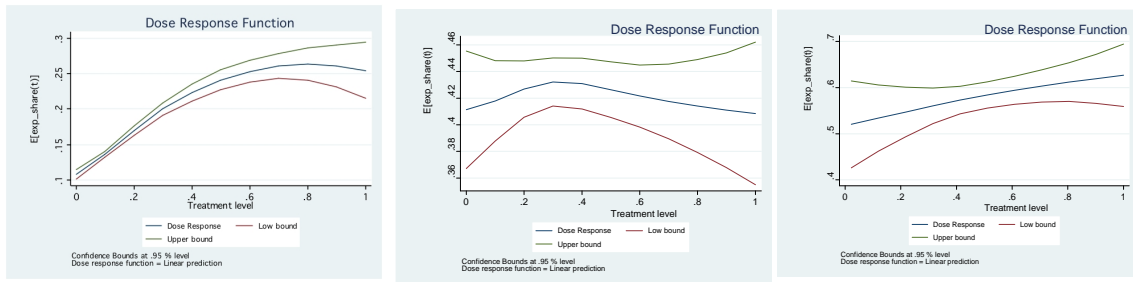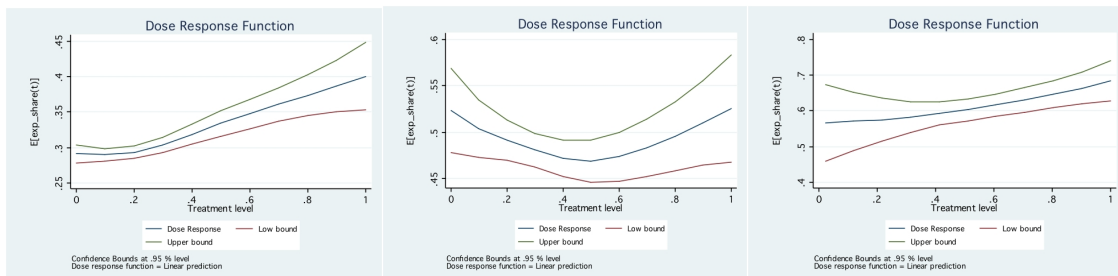
Note: Small firms are those with between 2 and 50 employees, medium-sized firms are those with more than 50 and at most 200 employees, and large firms are those with more than 200 employees

Source: AJPES, own calculations

The graphs indicate three important characteristics of the impact of firm indebtedness on export intensity. First, the response of export intensity to relative indebtedness is not linear. This is particularly evident for micro and medium-sized firms, while for small and large firms a linear response of export intensity to relative financial constraints seems to be in place. Second, firm size crucially impacts the dose response function, which gradually becomes flatter as firm size increases. This is particularly evident with large firms where the dose response function appears linear, but not as markable with medium-sized firms that still exhibit a more concave response.

It turns out that the observed concavity of the dose response function for small firms can be explained by the existence of a large number of highly indebted non-exporters, which were matched at the upper end of the relative debt-to-asset ratio spectrum and subsequently caused the observed down turn of the dose-response function in case of small firms. This fact becomes evident once only exporting firms are considered as is the case in Figure 4.

Figure 4: The impact of relative debt-to-asset ratio on export intensity (2001-2007) for exporting firms only a) small firms, b) medium-sized firms, and c) large firms

Note: Small firms are those with between 2 and 50 employees, medium-sized firms are those with more than 50 and at most 200 employees, and large firms are those with more than 200 employees. Confidence interval obtained using bootstrapped standard errors (500 replications)
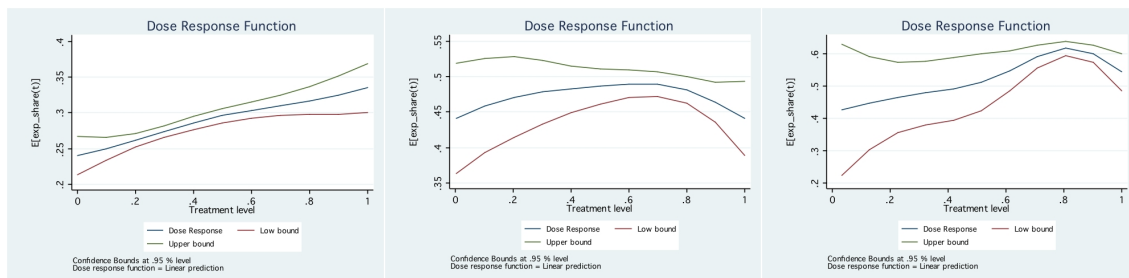
Source: AJPES, own calculations

Figure 4 draws only on firms that remain exporters at least for 2 years after taking on the excessive debt. This means that we exclude all firms, which failed in the export markets after taking on excessive bank loans. It is evident that the dose response function has flattened out for small firms, implying that additional bank loans benefitted firms that had solid export projects or those firms which at least remained exporting.

Exploring further, we decompose the effect of bank financing on the export share by looking separately at volumes of exports and domestic sales.[5] As evident from the results presented in the Appendix, small firms use almost exclusively additional bank loans for expanding their sales abroad, while actually reducing their domestic sales. Alternatively, mid-sized firms exhibit growth both in terms of exports and domestic sales, which allows for the ambiguity of the relationship between access to external finances and the share of exports. Finally, large firms use the access to external finance to stimulate exports without having to canibalise their own domestic sales. Presumably having exhausted the potential of the domestic market, where sales can no longer grow, they exploit new sources of bank loans to further their foreign sales.

5.3 Dose response for loans from associated firms

Table 2 revealed that there are marked differences between the three size classes in terms of the access to credit from firms in the same group or other type of affiliated firms. Not surprisingly, larger firms are revealed to have more access to such internal credit markets compared to medium and small firms. Importantly, shares of loans from affiliated firms are very low for all three groups of firms, with the share for the median large firm reaching only 3 percent in 2007 and shares for median small and mid-sized firms no greater than zero. In order to test whether there is any impact of access to internal credit markets on the share of exports, we reproduce the above results using relative shares of "internal credit" as the treatment variable.

Figure 5: The impact of relative debt-to-asset ratio of loans from associated firms on export intensity for manufacturing firms (2001-2007) a) small firms, b) medium-sized firms, and c) large firms

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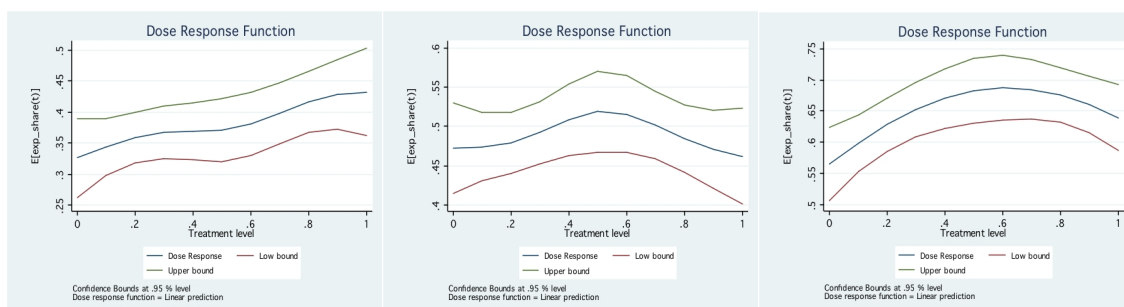
[5]We normalize both exports and domestic sales by dividing them with assets. This allows some control for size differences between otherwise similar firms.

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Only firms with positive shares of loans from affiliated firms were considered for these regressions. With very small sample sizes ranging from 595 observations for small firms to 827 observations for medium-sized firms, this results are at least in part driven by sample specificities. In spite of this, non-linear response functions prevail indicating that for mid-sized and large firms after some share of internal loans, further reliance on such financing actually reduces the average export share. Small firms, however, benefit monotonically from borrowing in the internal credit markets throughout the share of these internal debts.

5.4 Dose response for own cash flow

As a robustness test of the observed nonlinear relationship between financial constraints and export intensity, we employ an additional measure of financial constraints by using information on the firm's own generated cash flow-to-sales ratio. For that purpose we use the ratio earnings before interest, taxes, depreciation, and depreciation (EBITDA) to sales of an individual firm, relative to the maximuum in the given year, industry and class size. As before, we test the response of export intensity to changes in the relative cash flow-to-sales ratio.

Figure 8: The impact of relative cash flow to asset ratio on export intensity for small manufacturing firms (2001-2007) a) small firms, b) medium-sized firms, and c) large firms

As was the case with the effects of external financing, measured by debt-to-asset ratio, export share also does not display a linear response to changes in relative cash-flow-to-sales ratio. For medium and large firms the effect is decidedly non-monotonic. For initial

levels of EBITDA to sales ratio relative to the benchmark firm[6] the increased share of firm-own financing positively impacts the export share, while above the treshold the impact is negative. These results are in line with the initial OLS estimates for both debt-to-asset as well as cash-flow-to-sales ratios. There we found a significant positive impact of the share of cash flows in sales for small firms only, while the negative effect dominated for mid-sized firms and no conclusive results where evident for large firms. Similarly, in case of debt-to-asset ratios, we observed the predominantly positive effects of access to credit for small and large firms, whereby the estimates for mid-sized firms were not signifiantly different from zero.

6 Conclusions

This paper studies the relationship between financing and the intensive margin of exports for firms of different size in Slovenia. In terms of the export expansion along the intensive margin, preliminary estimates indicates that larger firms seem to benefit more from access to additional credit than smaller or mid-sized firms. On the other hand, ordinary least squares estimates also reveal that share of internal resources (EBITDA to sales) positively impacts the export intensity of small firms, while having a negative (no) impact in case of mid-sized and large firms.

By employing a novel approach and using the continuous matching technique we demonstrate that improving the access to external finance affects the export intensity of smaller firms in a more significant way than that of their medium and large-sized counterparts. Dose-response estimates for the cohort of small firms indicate that they have unambiguous benefits from having access to either internal or external sources of finance. Results for mid-sized and large firms are ambiguous on the other hand. Large firms clearly benefit from a higher bank debt to asset ratio, while results for the share of cash flow in sales are ambiguous with some benefits occuring initially at low debt, but negative after a certain threshold. Similarly, medium-sized firms also experience clear benefits at initial levels of debt to asset ratio and own cash flow to sales ratio, but these effects are overturned by a negative impact at higher levels for both treatment variables. A further decomposition into exports and domestic sales reveals the story behind the observed changes in export intensity. It is evident that smaller firms disproportionately commit to the foreign markets using additional sources to finance the export expansion, while effectively "canibalising" their domestic sales. Medium-sized firms tend to addopt a more even-handed approach as they manage to increase both their domestic sales as well as improve the sales revenue in the domestic market. Large firms, on the other hand, focus on the export markets similarly as smaller firms, but not at the cost of domestic

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[6]99th percentile of the EBITDA to sales ratio within the same year, NACE 3/digit industry and size class.

sales.

To summarize the findings, after controlling for the key variables and considering three modes of financing, it is evident that taking on any additional finance help firms to expand exports. Even when considering the most restrictive mode of access to external finance, i.e. the bank loans, we still find that variation in debt-to-assets ratio explains export expansion. This suggests that firms (managers/owners) that are more willing to take risk, can manage to expand effectively firm's exports. However, one should bear in mind that this monotonic and positive relationship between additional finance and export expansion for small firms becomes monotonic only after controlling for firms' survival in the export markets. This again suggests that many small firms with high debt-to-asset ratio are likely to fail in foreign markets. Hence, it may be too early to draw strong policy implications in the sense that policies aiming at reducing credit rationing will uniformly benefit the exporters. There is a lot of risk out there waiting, in particular for small exporters.

Hence, policies aiming at reducing the credit rationing may have beneficial effects for expanding exports.

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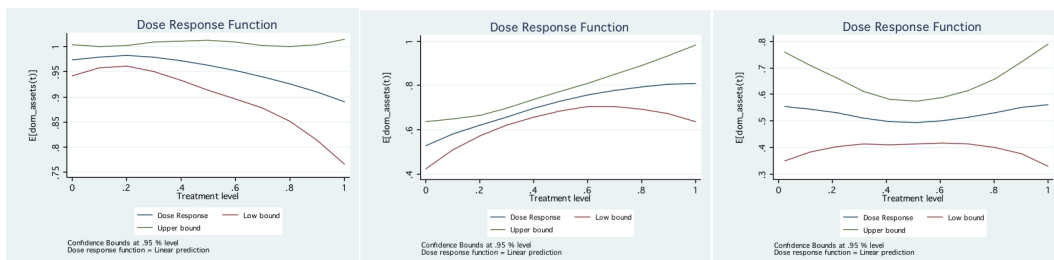
6.1 Appendix

Figure A1: The impact of relative debt to asset ratio on exports to assets ratio (2001-2007) for exporting firms only a) small firms, b) medium-sized firms, and c) large firms
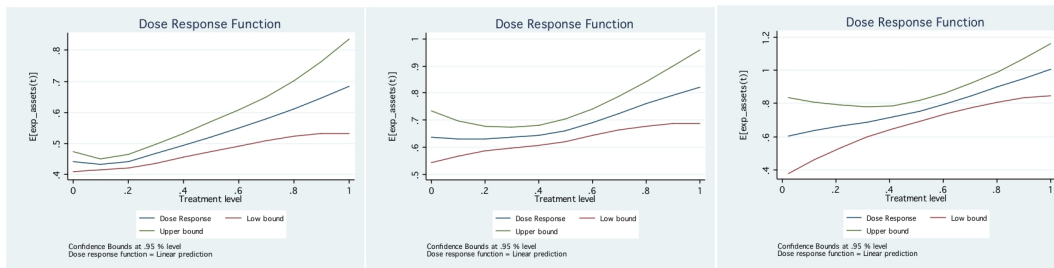
Note: Small firms are those with between 2 and 50 employees, medium-sized firms are those with more than 50 and at most 200 employees, and large firms are those with more than 200 employees. Confidence interval obtained using bootstrapped standard errors (500 replications)

Source: AJPES, own calculations

Figure A2: The impact of relative debt to asset ratio on domestic sales to assets ratio (2001-2007) for exporting firms only a) small firms, b) medium-sized firms, and c) large firms

Note: Small firms are those with between 2 and 50 employees, medium-sized firms are those with more than 50 and at most 200 employees, and large firms are those with more than 200 employees. Confidence interval obtained using bootstrapped standard errors (500 replications)

Source: AJPES, own calculations