Access to finance and a non-monotonic firm expansion *

Jože P. Damijan† Črt Kostevc‡ Sašo Polanec§

Abstract

The paper studies the relationship between firms’ access to capital and their domestic- and foreign-market expansion in relation to their size. We make use of a very detailed firm balance sheets with a detailed information on different sources of firms’ liquidity for a population of Slovenian firms for the period 2001-2008. By utilising the continuous matching technique we demonstrate that improving access to external finance affects the turnover of smaller firms in a more profound way than that of their medium and large-sized counterparts. In terms of export expansion, small firms are shown to benefit the most of all groups from taking on additional bank loans. The relationship, however, is non-monotonic implying an optimal level of debt for small firms above which additional borrowing may even have a negative impact on turnover. Medium-sized and large firms can afford to rely more on internal financing.

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

JEL Classification: D24, F12, F14

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1 Introduction

Firm growth theory suggest that financial constraints are important obstacle to firms’ 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 growth dynamics of small firms are hampered by firms’ financial constraints resulting in a typically right skewed firms’ size distributions. Liquidity constraints are also a key determinant of the export behavior of firms. If there are fixed costs associated with exporting, then financial constraints at the firm level will become increasingly important. Chaney (2005) builds a trade model, which shows that with liquidity constraints only few firms will be able to start exporting. Greenaway, Guariglia and Kneller (2007) find that financially constrained UK manufacturing firms are less likely to export. Zia (2008) reports for Pakistani firms that removal of subsidized credit causes a significant decline in the exports of privately owned firms, while the exports of large, publicly listed, and group network firms are unaffected. Bellone, Musso, Nesta and Schiavo (2000) demonstrate for Italian manufacturing firms that financially less constrained firms are likelier to start exporting, but that exporting does not improve financial health of exporters. Furthermore, taking export intensity as a proxy for serving a larger number of destinations they find a negative relationship between financial constraints 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, which can only be borne by firms with a stable access to funds.

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. Using the sample of Slovenian manufacturing firms, Damijan, Kostevc and Polanec (2010) explicitly confirm that liquidity constraints significantly hamper expansion of new exporters in foreign markets both in terms of the number of products exported and the number of destinations served. In both cases, firm size is shown to be positively correlated with the new exporters’ expansion dynamics.

These findings suggest that the dynamics of sales expansion both in the extensive and intensive margin may take a different pattern for firms of different size. While for large firms expansion is likely to be monotonic due to their larger internal funds and better access to external finance, this pattern might be well non-monotonic for small exporters. First reason is that small exporting firms have difficulties getting access to external finance or have to pay a higher finance premia. The pattern of their export expansion will therefore be 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), due to credit constraints the households with relatively less tolerance for risk shy away.
from business ventures during periods of macro volatility. Similarly, due to fixed costs associated with exporting, small firms bear a relatively higher risk of failure and will therefore be less prone to take excessive risks in foreign markets.

In terms of export intensity, small firms will therefore export a smaller share of their total sales for the same levels of external financing. Furthermore, small firms may not expand to the export intensity dimensions we observe at 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 potential failure in export markets. Large firms can take on the extensive geographic dispersion of export markets and a huge 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 have that luxury. 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 completely.

In this paper, we analyze this relationship between access to liquidity and the subsequent output expansion of firms. We make use of very detailed firm balance sheets for a population of Slovenian firms in the period 2001-2008. With complete information on a firm’s financial standing (balance sheets), we estimate its potential for acquiring external debt by employing the usual determinants of debt ratios that a creditor would likely consider. Comparing predicted debt-to-asset ratios with actual ones also provides information on overall willingness of firms to take on debt. On the other hand, we take firm’s own cash flow as its main internal source of liquidity, while only a minority of firms can depend on lending from associated firms (i.e. firms within the same group). Our primary goal is to show whether, for the same levels of liquidity constraints, small firms experience different patterns of export and domestic expansion than their medium and large-sized counterparts. We show that improved access to funds, controlling for current levels of indebtedness, affects the expansion dynamics of smaller firms in a significant different way that of either mid-sized or larger firms. We use continuous matching technique based on the generalised propensity score as our primary econometric tool and map the relevant dose response functions (Imbens 2000, Hirano, Imbens 2004). As a robustness
check we also use standard regression methods. In our empirical exercises, several alternative measures of liquidity constraints are taken, but the main findings remain robust. In terms of export intensity expansion, small firms are shown to benefit the most of all groups from taking additional 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, like other activities of the firm, is costly as a firm considering selling in a particular foreign market has to engage in the foreign market analysis, in building the distribution, sales and aftersale network, paying sales personnel, modifying the products according to the local requirements, financing the production expansion, etc. It therefore represents a sunk cost, which requires significant investment. Recent empirical literature demonstrates that 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).

Parallely, a much longer tradition of studies in the financial literature supports the hypothesized negative impact of financial constraints on firm growth (Cooley and Quadrini, 2001; Cabral and Mata, 2003; Desai et al., 2003). Furtermore, Campello et al. (2009) survey 1050 CFOs from 39 countries from North America, Europe and Asia. They find that firms that declared themselves to be financially constrained, on average, plan to reduce employment (by 11%), technology spending (by 22%), capital investment (by 9%), marketing expenditure (by 33%), dividend payments (by 14%) and 86% of constrained firms claimed to have bypassed attractive investment due to difficulties in raising external funds (compared to 44% unconstrained firms). In contrast to the overwhelming evidence in support of the negative impact of financial constraints, the magnitude of that impact is questionable as Angelini and Generale (2008) find only a 1 to 2% difference in growth rates between financially constrained and unconstrained firms for Italian enterprises. This indicates that financial constraints can only explain a modest fraction of the differences in firm size.

To finance any investment, a firm has to either draw on its internal funds, borrow from the associated firms in the network group or succeed in raising external finance (debt or new equity).\footnote{The latter is made more difficult by the "funding gap" (see Hall, Lerner 2010 for innovation financing)} Firm size plays a crucial role in this process. Smaller firms are restricted in
terms of their internal funds, the size of collateralizable assets as well as their future cash
flow, allowing them a more limited scope of investment opportunities. 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, the cost of borrowing will depend on the firm size and firm history.
With firm size playing an important role in output expansion small firms will face more
severe (internal and external) financial constraints and will also be 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 are smaller than those 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
issue arises from the fact that small firms might be more risk averse and will avoid taking
the risks in unknown markets as well as from taking excessive external debt to finance
export ventures. Studying financial constraints affecting new French firms, Bonnet, Cieply
and Dejardin (2005) report that there is a non-negligible share of firms, which do not ask
for a bank loan although they declare facing financial constraints.

The immediate implications stemming from the above are: first, with liquidity con-
straints relaxed by access to external credit and capital markets, smaller firms would ben-
efit more relative to larger 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 signif-
icant decline in the exports of small firms, while the exports of large firms and of group
network firms are unaffected. Second, even if they are not liquidity constrained, small
firms are less likely to expand at the rate observed for large firms. The most likely ex-
planations for this relates to the firms’ smaller scale. Any expansion requires significant
investments, whereby small firms’ own assets, their foreseeable future earnings as well as
their self imposed restraints provide important barriers to such plans. Finally, the smaller
the firm the more prone it is to suffering terminal shocks as unsuccessful attempts at
expansion may force them to exit the market altogether. The risk involved with expan-
sionary policy of small firms are larger than those for medium or large firms, given that
they will likely have more vested on one successful investment and be less diversified in
terms of markets served or products supplied. Firm size may, hence, also be related to
risk aversion.

that could be present in financing export ventures as opposed to domestic expansion. Effectively, due to
the "lemons problem", investment in exports may be underfinanced.
3 Data and sample characteristics

We employ balance-sheet data on the population of Slovenian enterprises in the period between 2001 and 2008. The data is collected by the Slovenian Agency for Public Legal Records and Related Services (AJPES) and reporting is mandatory for all business subjects. 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. Given that we are primarily interested in the financial aspects of firm performance, we chose to drop year 2008 from most of our regressions in order to avoid the onset of the global financial crisis and its possibly distorting impact on the relationship between financial constraints and firm decisions. This further reduces the effective size of the sample to approximately 47,000 observations in the period between 2001 and 2007. AJPES database includes detailed financial statements included in the firm balance sheets as well as information required in the construction of income statements. Importantly, we have some information on the cross-border activities of these firms, namely their exporting revenues allowing us to use export share as a measure of exporting 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>
<thead>
<tr>
<th>Year</th>
<th>All firms</th>
<th>Share of exporters</th>
<th>Median export share (export.)</th>
<th>Median debt/assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>4,808</td>
<td>48.2%</td>
<td>0.294</td>
<td>0.575</td>
</tr>
<tr>
<td>2002</td>
<td>4,931</td>
<td>50.9%</td>
<td>0.279</td>
<td>0.587</td>
</tr>
<tr>
<td>2003</td>
<td>4,964</td>
<td>51.1%</td>
<td>0.256</td>
<td>0.586</td>
</tr>
<tr>
<td>2004</td>
<td>5,062</td>
<td>52.7%</td>
<td>0.228</td>
<td>0.599</td>
</tr>
<tr>
<td>2005</td>
<td>5,147</td>
<td>53.1%</td>
<td>0.214</td>
<td>0.603</td>
</tr>
<tr>
<td>2006</td>
<td>5,202</td>
<td>54.7%</td>
<td>0.233</td>
<td>0.622</td>
</tr>
<tr>
<td>2007</td>
<td>5,395</td>
<td>54.3%</td>
<td>0.232</td>
<td>0.629</td>
</tr>
<tr>
<td>2008</td>
<td>4,559</td>
<td>56.9%</td>
<td>0.258</td>
<td>0.623</td>
</tr>
</tbody>
</table>

Source: AJPES

In addition to the increase in the size of the sample, Table 1 reveals that the share of firms exporting has been increasing throughout the sample period. After an initial decline, with a minimum in 2005 the median share of exports in total turnover recovers.

Note that the drop in the number of firms observed in 2008 is primarily attributable to changes introduced with NACE revision 2 classification.

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

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until the end of the observed period. 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 tends to suggest that any relationship between export intensity and financing constraints, if it exists at all, is non linear.

Table 2: Characteristics of Slovene manufacturing firms in the period 2001-2007 by size class

<table>
<thead>
<tr>
<th>year</th>
<th>size</th>
<th>export share</th>
<th>debt to asset ratio</th>
<th>share of bank. liabilities</th>
<th>share of liab. to assoc. firms</th>
<th>interest rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>1 &lt; emp ≤ 50</td>
<td>0</td>
<td>0.613</td>
<td>0</td>
<td>0</td>
<td>0.042</td>
</tr>
<tr>
<td></td>
<td>50 &lt; emp ≤ 200</td>
<td>0.039</td>
<td>0.485</td>
<td>0.198</td>
<td>0</td>
<td>0.058</td>
</tr>
<tr>
<td></td>
<td>emp &gt; 200</td>
<td>0.312</td>
<td>0.411</td>
<td>0.318</td>
<td>0.011</td>
<td>0.066</td>
</tr>
<tr>
<td>2007</td>
<td>1 &lt; emp ≤ 50</td>
<td>0</td>
<td>0.646</td>
<td>0</td>
<td>0</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td>50 &lt; emp ≤ 200</td>
<td>0.048</td>
<td>0.636</td>
<td>0.217</td>
<td>0</td>
<td>0.015</td>
</tr>
<tr>
<td></td>
<td>emp &gt; 200</td>
<td>0.344</td>
<td>0.526</td>
<td>0.382</td>
<td>0.030</td>
<td>0.022</td>
</tr>
</tbody>
</table>

Note: All median values. "share of bank liabilities" 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 that small and medium firms are similarly constrained in terms of own finance when compared to large firms. Consequently, small and medium firms rely more on bank loans than large firms, whereby there is visible a significant difference also between small and medium firms. For small firms in Slovenia bank loans provide the only way to gather finance for planned investments. Medium firms are in great extent part of large network groups and are granted access to internal credit markets.

Figure 1: a) Kernel density function of 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 Imbens 2004) represents a generalisation of the more commonly used binary treatment propensity score methodology (Rosenbaum and Rubin 1983, 1984). Namely, in many cases 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 with units indexed \( i = 1, \ldots, N \). Each unit can be associated with a set of potential outcomes, \( Y_i(t) \), for \( t \in \tau \), which is referred to as the unit-level dose-response function. In contrast to the binary-treatment case, \( \tau \) 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, \( T_i \in [t_0, t_1] \). Finally, in addition to observing the vector of covariates and treatment received, we also have information on the outcome corresponding 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

\[
Y(t) \perp T \mid X \text{ for all } t \in \tau
\]  \hspace{1cm} (1)

Instead of requiring joint independence of all potential outcomes only conditional independence 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 conditioning on the "generalised propensity score". Letting \( r(t, x) \) be the conditional density of the
treatment given the covariates:

\[ r(t,x) = f_{T,X}(t \mid x) \]

the generalised propensity score is \( R = r(T,X) \). Assuming that, as above, the assignment 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 access to finance on the domestic versus export sales dynamics, we estimate the following generalised propensity score of treatment variable (access to finance)

\[
access\_fin_t = f(access\_fin_{t-1}, va\_emp_{t-1}, size_{t-1}, credit\_deter_{t-1}, legal\_status, time, industry)
\]

where \( access\_fin_t \) represents varying measures of availability of funds employed below at time \( t \), \( va\_emp_{t-1} \) 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 collateralizable assets in total assets, profitability (share of profits in total sales) and variance of sales relative to long-term trend (all lagged). \( legal\_status, time \) and \( industry \) are the respective legal status, year and NACE 3-digit industry dummies.\(^4\)

Finally, 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 turnover to assets to changes in access to finance. Specifically, we individually look at the effects of access to finance on total turnover relative to total assets, domestic sales to total assets and exports to total assets for the three size classes of firms.

## 5 Results

### 5.1 Preliminary regressions

In order to obtain benchmark results on the relationship between financial constraints and expansion of firm turnover, we estimate the relationship between the changes in the sales to assets ratio (value of \( a \)) total sales to assets \( b \) exports to assets and \( c \) domestic sales to assets \( ) \) and changes in debt to assets ratio with fixed effects tobit. As covariates, which

\(^4\)In order not to lose too 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.
We include growth of the debt to assets ratio as a direct measure of whether additional funds are used to increase turnover, debt to assets ratio and debt to asset ratio squared give help determine the effect of indebtedness (i.e. cumulative borrowing history) on sales expansion, profitability as measured by the profits to sales ratio in order to control for internal financing and the level of assets as a measure of firm size. In addition we introduce legal status dummy, NACE 3-digit industry dummies, year dummies and a full set of NACE-year interaction dummies into the specification in order to control for the set factors. We distinguish between three size classes of firms with respect to employment. Small firms include those with at least 2 and at most 50 employees, medium-sized firms employ between 50 and 200 employees, while large firms employ more than 200 employees. In order to see the effects of firm size on the relationship between output expansion and changes in external debt, we employ interaction terms between the key variables of interest and indicator variables for small and large firms, respectively. Our base estimates therefore refer to medium-sized firms. We include only firms that exported, excluding non-exporters.

Table 3: The impact of changes and levels of debt-to-asset ratio on output expansion (dependent variables are total sales to assets (column 1), exports to assets (2) and domestic sales to assets (3))

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Δ(total sales/assets)</th>
<th>Δ(exports/assets)</th>
<th>Δ(dom. sales/assets)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(tot.sales/assets)_1</td>
<td>-0.0380*** (0.00386)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(exports/assets)_1</td>
<td></td>
<td>0.0602*** (0.00516)</td>
<td></td>
</tr>
<tr>
<td>(dom.sal/assets)_1</td>
<td></td>
<td></td>
<td>-0.0157*** (0.00355)</td>
</tr>
<tr>
<td>Δ(debt/assets)_1</td>
<td>0.344*** (0.0778)</td>
<td>0.255*** (0.0529)</td>
<td>0.0851 (0.0734)</td>
</tr>
<tr>
<td>(profit/assets)_1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(profits/sales)_1</td>
<td>-0.0058 (0.0031)</td>
<td>-0.0037 (0.00089)</td>
<td>-0.0102 (-0.0082)</td>
</tr>
<tr>
<td>sm*(Δ(debt/assets))_1</td>
<td>-0.345*** (0.0778)</td>
<td>-0.222*** (0.0556)</td>
<td>-0.0866 (0.0734)</td>
</tr>
<tr>
<td>la*(Δ(debt/assets))_1</td>
<td>0.0114 (0.175)</td>
<td>0.0177 (0.118)</td>
<td>0.0363 (0.163)</td>
</tr>
<tr>
<td>sm*(debt/assets)_1</td>
<td>-0.115 (0.139)</td>
<td>-0.0544 (0.109)</td>
<td>-0.0700 (0.122)</td>
</tr>
<tr>
<td>la*(debt/assets)_1</td>
<td>-0.563 (0.282)</td>
<td>-0.476 (0.214)</td>
<td>-0.458 (0.256)</td>
</tr>
<tr>
<td>sm*(debt/assets)^2_1</td>
<td>0.201* (0.121)</td>
<td>0.133 (0.0945)</td>
<td>0.136 (0.105)</td>
</tr>
<tr>
<td>la*(debt/assets)^2_1</td>
<td>0.635** (0.265)</td>
<td>0.380 (0.201)</td>
<td>0.481** (0.243)</td>
</tr>
<tr>
<td>small firms dummy</td>
<td>0.00488 (0.0388)</td>
<td>-0.0882*** (0.0307)</td>
<td>0.0514 (0.0349)</td>
</tr>
<tr>
<td>Time dummies</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Industry dummies</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Legal status dum.</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Time*Industry dum</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Observations</td>
<td>18,592</td>
<td>18,592</td>
<td>18,592</td>
</tr>
<tr>
<td>Number of maticna</td>
<td>4,948</td>
<td>4,948</td>
<td>4,948</td>
</tr>
<tr>
<td>Chi-square test</td>
<td>-</td>
<td>-1.1066</td>
<td>-6544</td>
</tr>
<tr>
<td>Rho</td>
<td>8.83e-07</td>
<td>0.123</td>
<td>1.12e-06</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-11066</td>
<td>-6544</td>
<td>-10424</td>
</tr>
</tbody>
</table>

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

Expectedly, Table 3 reveals a positive correlation between changes in debt to asset ratio debt-to-asset ratio and both total sales and exports (to assets) for all firm sizes, although
the effect is substantially smaller for small firms. This implies that access to external financing improves the scope of firm exposure in foreign markets, but the effect is greater for mid-sized and larger firms contrary to expectations. The impact for domestic sales does not significantly differ from zero regardless of the size class implying that investments financed by external funds primarily benefit the exporting expansion of mid-sized and large firms. Significantly, more indebted firms, those with arguably greater access to external liquidity have experienced greater growth of both domestic and export sales, while the statistical significance of its squared value indicates the presence of non-linearity with respect to the levels of debt-to-asset ratio. Large firms, on the other hand, have a significantly negative sales trajectory with respect to debt-to-asset levels, which would indicate that they tend to finance growth primarily from internal sources of funding. Finally, profitability does not seem to have any impact on sales growth, while smaller firms tend to have slower export growth and larger faster export growth compared with medium-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 functions

Benchmark analysis is based on estimation of the effects of the bank-loan-generated debt to asset ratio on firm turnover-to-assets ratio, which is split further into exports to assets and domestic sales to assets. The continuous matching technique requires that the treatment variable is continuous on the relevant interval, which is why we limit our analysis to only those firms with debt-to-asset ratios smaller than 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. Figure 2 presents the dose response function with the 95\% confidence interval of the impact of the treatment variable (debt to asset ratio) on the ratio of exports to assets, domestic sales to assets and export share for small manufacturing firms, with between 2 and 50 employees, in the period between 2002 and 2007. The upper and lower bounds of the 95\% confidence interval were generated using bootstrapping with 500 replications.

\footnote{Some firms in the dataset exhibit higher debt to asset ratio, but obviously have no equity anymore and have likely filed for bankruptcy or liquidation.}
Figure 2: The impact of debt to asset ratio from bank loans on a) the exports to assets ratio, b) domestic sales to assets ratio, and c) export share for small manufacturing firms (2001-2007)

Note: Small firms are those with between 2 and 50 employees, number of observations 4.787
Source: AJPES, own calculations

The graphs indicate three important characteristics of the impact of firm indebtedness on sales. Firstly, the response of turnover to indebtedness is not linear. This is feature of the dose-response functions for small firms, implying that the effect of additional external funds changes in relation to the overall debt levels. Perhaps surprisingly, the effect of added debt in a matched pair of firms even appears to have a negative impact on domestic sales for small firms, which results in an increased share of exports. 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 firms that barely export, which were matched at the upper end of the debt-to-asset ratio spectrum and subsequently caused the observed down turn of the dose-response function in case of small firms. Assuming that our specification of propensity score fully captures the determinants of credit used by the financial markets, than the firms matched by the continuous matching method have equal access to external funds. The primary differences between them would therefore be a result of differences in risk aversion or other factors impacting the actual amount of debt they take on. Evidently, firms that end up taking on greater debt achieve better results in terms of export or domestic sales, other firms appear to be self-constrained against taking on more external financing and associated risk.

Figure 3: The impact of debt to asset ratio from bank loans on a) the exports to assets ratio, b) domestic sales to assets ratio, and c) export share for medium-sized manufacturing firms (2001-2007)
Note: Medium-sized firms are those with more than 50 and at most 200 employees, number of observations 2.506
Source: AJPES, own calculations

Figure 4: The impact of debt to asset ratio from bank loans on a) the exports to assets ratio, b) domestic sales to assets ratio, and c) export share for medium-sized manufacturing firms (2001-2007)

Note: Large firms are those with more 200 employees, number of observations 1.263
Source: AJPES, own calculations

A more predictable storyline emerges when we consider larger firms. Mid-sized firms exhibit almost linear 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. Crucially, the pronounced concavity with respect to changes in domestic sales that is evident for small firms almost completely disappears as firm size increases. Finally, large firms use the access to finance to stimulate exports without having to cannibalise their own domestic sales. Presumably having exhausted the potential of the domestic market, where sales can no longer grow, they exploit new sources of finance to further their foreign sales. As above, it appears that factors other than actual financial constraints play an important role in the expansion of sales (both international and domestic) for medium-sized and large firms.

5.3 Robustness check

Another possible reason that some firms expand their sales seemingly in response to new external sources of liquidity may be that they have higher skilled employees. More specifically, some managers may be more capable of creating opportunities for expansion than others and that may be at least in part independent of the firm’s propensity for debt. In order to test whether high-skill firms perform at all differently than their lower skilled counterparts, we compare the dos-response function for the bottom and top wage quintile (in a given year-NACE 3-digit industry pair). For the sake of brevity, we only present the two sets of results for small firms, while those for medium-sized and large firms are available upon request. The estimates for low-skilled firms are presented in Figure 5 and those for high-skilled firms in Figure 6.
Figure 5: The impact of debt to asset ratio from bank loans on a) the exports to assets ratio, b) domestic sales to assets ratio, and c) export share for small-sized low-skill manufacturing firms (2001-2007)

Note: Small firms are those with between 2 and 50 employees
Source: AJPES, own calculations

Figure 6: The impact of debt to asset ratio from bank loans on a) the exports to assets ratio, b) domestic sales to assets ratio, and c) export share for small-sized high-skill manufacturing firms (2001-2007)

Note: Small firms are those with between 2 and 50 employees
Source: AJPES, own calculations

Although there are notable quantitative differences between the two sets of estimates, the basic shapes of the dose response functions do not differ at all qualitatively. Namely, the underlying features of those functions are their non-linearities with respect to the lagged debt-to-asset ratio (measured on the horizontal axis). As in the broader sample, small firms above some debt-to-asset threshold increase their export-to-assets ratio at a faster rate, while actually decreasing their domestic sales-to-assets ratio.

5.4 Possible methodological issues

There are several possible methodological issues that may affect the results and their interpretation. First of all, the investment cycles of the matched firms are very likely not synchronised, meaning that we may observe "naturally" occurring higher indebtedness levels for a subset of firms at the onset of the investment cycle, while other firms may have already paid off some of the debt from a previous investment and are still some time away
from the start of the subsequent investment cycle. Both of these firms could possibly exhibit similar propensities of debt to asset ratios, but one of the could simply choose not to increase this ratio at this point in time. These effects are partially mitigated by inclusion of the lagged level of debt to asset ratio as a predictor of the current debt-to-asset ratio. The same outcome could occur if a given firm simply had no viable investment opportunity in a given year, but would otherwise be a suitable candidate for additional bank loans. Again, controlling for years, industries and legal status, these factors are less likely to be important but could still matter. These factors introduce a possible bias into our results but the sign of the bias is undeterminable.

Secondly, our specification of the generalised propensity score may not be capturing the full set of information available to the bank. This may significantly impact the interpretation of the results and/or introduce additional bias into the estimated dose-response functions. To see this, notice that the difference between debt predicted by econometrician ($D_{\text{econ}}$) and actual debt ($D$) can be rewritten as follows:

$$D_{\text{econ}} - D = (D_{\text{econ}} - D^*) + (D^* - D) + (D - D_{\text{bank}})$$

(4)

The difference between the predicted debt and the actual one can be deconstructed into three parts. Firstly, there is an econometric bias between what is actually predicted by the generalised propensity score specification and the actual "optimal" debt-to-asset ratio of a given firm. These difference is, at least in part, due to unobserved variables or missing variables that were left out of the GPS specification such as information on the details of actual investment opportunities that were financed. Secondly, there could also be a part of these difference that we could term the "true financing constraint" and it would be the difference between a firm's own optimal debt rate and the one being afforded to it by the financial markets. Firms receiving less than their optimal amount of external funding would therefore be financially constrained, while the possibility of banks overfinancing some firms is also likely, making the determination of the direction of this bias difficult. On the other hand, variables omitted from the GPS specification may create a downward bias on the variance of GPS predictions with respect to the true variance.

Finally, presenting aggregate (legal status, years and industries) treatment effects in the dose-response functions may be hiding important composition effects. Namely, there may be marked differences primarily between industries in terms of the effects added external financing may have on changes in primarily exports as well as domestic sales. The difficulty in dealing with the issue of aggregating across industries is that the sample sized in some industries would simply not support any kind of regressions as they are far too small. As far as aggregation issues related to time and legal status, we perform
several robustness checks, by either shortening (down to only 5 years) or lengthening the sample period to include 2008 but this reveals no markable difference in the estimates. We also do separate regressions for different legal formats assumed by the firms and find that, again, no qualitative differences between them emerge.

6 Conclusions

The paper studies the relationship between the extent of liquidity constraints and the output expansion for Slovenian manufacturing firms. In terms of the expansion along export and domestic sales, the preliminary estimates indicate that larger firms seem to benefit more from their access to additional credit than smaller or mid-sized firms. On the other hand,

By employing a novel approach and using the continuous matching technique we demonstrate that improving 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 new external sources of finance. Given our specification of the generalised propensity score, we find that in addition to firms benefiting from access to external liquidity, some firms actually self-restrain from taking on additional debt. As is evident from the dose-response functions, firms that ended up taking on added debt managed to expand their turnover faster than firms that did not assume additional debt. This effect is by no means independent of the level of debt accumulated beforehand by these firms. Especially small firms (with less than 50 employees) are revealed to be able to improve their domestic sales only up to a certain limit, beyond which additional debt actually begins to decrease domestic sales. At the same time, additional debt speeds up the expansion in exporting markets, making it seem like that smaller firms disproportionately commit to the foreign markets using additional sources to finance the export expansion effectively "canibalising" their domestic sales. Mid-sized firms tend to adopt 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 sales. Presumably having exhausted the potential of the domestic market, they are not able to exploit it for further growth instead having to rely exclusively on exports.

Provisioning on the fact that our specification of the generalised propensity score captures the determinants used by the banks in determining the correct debt-to-asset ratio, or at least does not introduce a systematic bias in that respect, the dose-response functions actually capture the self-constraint of firms rather than external financial constraints. Firms, wither through risk aversion or lack of growth opportunities compared with other firms in the same industry choose not to take on more debt and that has the effect of
smaller future sales primarily in the exporting markets. This could have important policy implications as financial constraints may not be the sole determinant of growth specifically in the export markets. Policy makers would, rather than making access to external finance easier, have to focus on tackling the underlying causes of firm self-restraint.

References


