



DETERMINANTS OF FINANCIAL CONSTRAINTS: THE EFFECT OF FINANCIAL CRISIS AND HETEROGENEITY ACROSS INDUSTRIES

Nina Ponikvar^a, Katja Zajc Kejžar^b, Barbara Mörec^c

^a Assistant Professor, Ph.D, University of Ljubljana, Faculty of Economics, Academic Unit for Economics, Kardeljeva ploščad 17, SI-1000 Ljubljana, Slovenia, nina.ponikvar@ef.uni-lj.si.

^b Associate Professor, Ph.D, University of Ljubljana, Faculty of Economics, Academic Unit for International Economics and Business, Kardeljeva ploščad 17, SI-1000 Ljubljana, Slovenia, katja.zajc@ef.uni-lj.si.

^c Teaching Assistant, Ph.D, University of Ljubljana, Faculty of Economics, Academic Unit for Accounting and Auditing, Kardeljeva ploščad 17, SI-1000 Ljubljana, Slovenia, barbara.morec@ef.uni-lj.si.

ARTICLE INFO

Keywords:

- financial constraints
- industry factors
- firm characteristics
- economic crisis

ABSTRACT

Based on the population of Slovenian firms we analyse the impact of the 2008 financial crisis on the firms' financial constraints. In line with the theoretical predictions firm size, ownership, productivity, and export orientation all impact firm's financial situation. With the full onset of the crisis in 2009, financial health of the foreign firms worsened more compared to domestic firms, while the availability of financial resources deteriorated less for more productive firms and for exporters. Even though firm's size has a significant impact on firm's financial constraint, crisis didn't have an additional significant negative effect on firms' financial distress for all but small firms.

Reference to this paper should be made as follows: Ponikvar N, Kejžar Zajc K, Morec B. 2013. Determinants of financial constraints: The effect of financial crisis and heterogeneity across industries, *Ekonom-ska istraživanja – Economic Research Special Issue 2013*

I. INTRODUCTION

In the recent decades it has been recognized in the empirical literature that firm finance carry important implications for firm performance either in terms of firm growth, profitability or even firm survival. During the recent financial crisis, firms in general have been reporting acute problems of access to finance. On the one hand, the deteriorated profitability of firms resulting from the economic crisis has led to decrease in availability of the internal financial sources while tightened credit standards on loans to non-financial corporations reduce accessibility of external funds. Because access to finance is widely perceived as a crucial factor for firms to maintain their day-to-day business as well to achieve growth in the long run, the worsened accessibility of financial sources may pose a major threat to the economy as a whole.

Based on the data from the financial statements for the population of Slovenian firms in the period 2006-2011 this paper analyses how the financial crisis affected the financial constraints of the manufacturing and service firms. More specifically, we investigate (i) the firm characteristics that affect financial constraints of Slovenian manufacturing and service sector firms, (ii) industries in which the financial constraints are most severe, and (iii) how the recent financial crisis changed the average financial constraints of Slovenian firms. Namely, theoretical and empirical literature shows a strong link between financial constraints and firms age and size (Kumar and Francisco, 2005; Artola and Genre, 2011; Hutchinson and Xavier, 2006), its presence on foreign markets (Silva, 2011 and Wagner, 2012) and industrial environment (Arteta and Hale, 2008).

Slovenia, according to the World Economic Forum an innovation-driven EU economy and a member of European monetary unit, provides an ideal research setting for an analysis of an impact of firm-specific and industry-specific effects on firm's financial constraints. Namely, Slovenia owes its relatively modest overall global competitiveness ranking - according to most recent Global competitiveness report prepared by World Economic Forum, 2012-2013, Slovenia is on 56th place out of 144 compared countries - to the fact that companies experience extremely limited access to loans, where Slovenia ranks 118th out of 144 compared countries. Additionally, in Slovenia other external sources of funding like venture capital and financing through local equity market are severely limited, too. Although high scarcity of external financial resources is characteristic not only for Slovenia, but actually for Eastern Europe in general (Marer, 2010), Slovenia has been hit even worse by the liquidity aspect of the current crisis due to high instability of the Slovenian banking system.

We measure Slovenian firms' financial health according to the methodology first proposed by Musso and Schiavo (2008) and extended by Bellone et al (2010). We construct a synthetic index from seven different variables that carry important information relative to the existence of financial constraints to the firm. They are (i) firm size, (ii) profitability, (iii) liquidity, (iv) cash-flow generating ability (v) firm solvency, (vi) trade credit over total assets, and (vii) debt repaying ability. Such a measure of firm's financial health is time-varying and continuous; it acknowledges the multiple features of financial constraints and captures different degrees of financial constraints (Silva, 2011). In order to identify the factors determining the financial health of firms from the manufacturing and service sector in Slovenia, we estimate the firm-level financial constraints model using a panel data econometric model which is applied to the dataset that covers the whole population of firms registered in Slovenia. We apply the panel data fixed effects estimator as well as ordered probit model.

The remainder of this paper is structured as follows. Chapter II gives a brief overview of the theoretical framework of firm's financial constraints existence, its determinants, and measurement

methods. Paper proceeds with research model-, and sample data description. Results are presented in Chapter IV. Paper concludes with discussion on possible economic measures to reduce firms' financial constraints.

II. FINANCIAL CONSTRAINTS AND ITS DETERMINANTS

A. Theoretical framework

In the neoclassical financial theoretical framework, complete information is available to all participants in the perfect capital markets, all firms have equal access to capital markets, any desired investment project can be financed and the firms' responses to changes in the cost of capital or tax-based investment incentives differ only due to differences in investment demand. In such circumstances, a firm's ability to obtain financial funds, firm's growth and its investment decisions are independent of its current financial condition such as internal liquidity, indebtedness or dividend payments (Hall and Jorgenson, 1967; Modigliani and Miller, 1958). In the real world, however, the access to financial markets is not the universal and equal for all firms, since firms face uncertain prospects and operate in imperfect or incomplete capital markets, where internal funds bring a cost advantage over external funds, with the latter also being called a 'financing hierarchy' (Fazzari, Hubbard and Petersen, 1988). The body of literature investigating the existence and the determinants of financing constraints is already very large and based on different theoretical considerations: transaction costs, the asymmetry of information, the agency problem, the cost of financial distress, the tax effects, and the pecking order theory.

One of the oldest and perhaps most obvious explanations of the financing hierarchy is based on the transaction costs of issuing debt and/or equity. These costs include compensation for the dealer placing the issue, registration fees, legal, accounting printing costs, taxes (Oliner and Rudebusch, 1992). Additionally, the accessibility of external funds is conditioned on revealing firm's strategic orientation by proposing investment projects to external financial sources (Sawyer, 1981). However, empirical tests show that transaction costs in their narrow meaning, including only dealer provisions, fees, physical costs and taxes, usually do not explain the hierarchy of finance (Oliner and Rudebusch, 1992).

The most popular explanation of financing hierarchy stresses the information problems in capital markets. The fundamental insight comes from Akerlof's (1970) analysis of the 'lemons' problem. The focus is on the potential asymmetry of information between the firm's managers and outside suppliers of finance about the quality of the firm's investment project and the behaviour of its managers. When the management has information about a project's returns but the investors do not have relevant knowledge about the competence of the managerial team and the true project's profitability, the investors (debt or/and equity providers) cannot distinguish between good and bad projects (adverse selection). They evaluate every project by some average project outcome (Oliner and Rudebusch, 1992). The cost of financing such projects with external funds exceeds that of financing with internal funds because of this asymmetry of information. The difference in the costs of internal and external financing, caused by such asymmetric information, represents the 'lemons premium' (Akerlof, 1970). Empirical studies give strong evidence of information asymmetries being an important source of the financing hierarchy (e.g. Athey and Reeser, 2000; Oliner and Rudebusch, 1992).

With asymmetric information, the firm's owners, represented by managers also have some scope to pursue their own interests at the expense of the firm's other stakeholders, especially

debt holders. As shown in Jensen and Meckling (1976), the agency problems that arise from these conflicts of interest can boost the cost of obtaining external finance. The greater the debt-equity ratio, the more managers' incentives may diverge from the interests of the creditors. To protect themselves, creditors usually demand covenants that restrict management behaviour in various ways. These restrictions and the monitoring required for enforcement constitute the agency costs of debt. Keynes (1936) analysed a similar phenomenon, which he called the 'lender's risk'. As investments increase, holding the firm's internal financial resources fixed, the debt leverage will rise and lenders will require a higher interest rate to compensate for the increasing risk of default. As a result, the cost of new debt and equity may differ substantially from the opportunity (implicit) cost of internal finance generated through the cash flow and retained earnings (Fazzari, Hubbard and Petersen, 1988). The rationing of lending caused by informational asymmetry is also confirmed in empirical studies such as those by Bond and Meghir (1994), Levine (1997) and Van Ees et al. (1997).

In the trade-off model between potential bankruptcy costs and agency costs Fama and French (2002) incorporated tax effect on debt-equity ratio, first introduced by Miller (1977) and later upgraded by De Angelo and Masulis (1980). They concluded taxes can have offsetting effects on capital structure decisions. On one hand unlike dividend payments interest payments are tax deductible and consequently corporate income tax encourages debt financing. At the same time various tax allowances and loss carry forwards reduces the advantage of indebtedness. If investors (equity or debt holders) are simultaneously subject to personal income tax, which frequently taxes interest more heavily than capital gains, firms would be more inclined towards capital issue. Firm's optimal capital structure is therefore dependent on firm-specific circumstances and tax provisions applicable to the investors.

Finally, pecking order theory (established by Myers and Majluf, 1984) integrates transaction costs theory and the asymmetry of information model to explain the firms' financing hierarchy. Namely, firms rank various financing sources by their cost, generated for various reasons already described by both theories. Commonly, firms' capital structure follow pecking order theory if they rather use internal than external financing and – in case they use external financing – they rather use debt than equity financing. However, there is an alternative definition of pecking order theory which builds on behavior finance theory. So Petersen and Schulman (1987, in Hussain, Millman & Matlay, 2006) claim owners of small firms, who are at the same time managers, would rather omit profitable investment than to release the control of the firm.

Thus in the circumstances of imperfect information and uncertainty the importance of the internal earnings for financing investments derives not only from the limited attainability or high costs of the external finance due to the lender's risk, but also from the alleviation of the possible negative outcome of investing and thus a smaller borrower's risk and – in case of SMEs – the propensity of owners/managers towards creditors. Because investing is connected to risk, internal financial sources can alleviate the consequences of unexpected unfavorable results of investment activity.

B. Determinants of financial constraints

Since the late 1980s, a large number of empirical studies have addressed the issue of financial constraints, mainly in order to study the relation between firm investment and the availability of internal funds. Indeed, large and convincing evidence exists showing that, when a standard investment equation is augmented with cash flow availability, the fit of the equation improves (Musso and Schiavo, 2008). Theory and empirical evidence suggest that credit constraints are tighter for those

firms expected to face relatively severe asymmetries of information. These firms are also the ones that depend more on the availability of internal funds. Firms which suffer less from asymmetric information and are thus more creditworthy rely less on internal funds to finance their investments (Fazzari, Hubbard and Petersen, 1988; Oliner and Rudebusch, 1992; Natke, 1999).

In practice, the asymmetry of information is a consequence of the behavior of banks and financial institutions which are much more reluctant to finance firms for which they do not have sufficient information on their disposal. These firms are usually developing, young and small firms that are almost without performance history. On the other hand, well-established larger firms have already demonstrated their ability to run successful projects and to make a profit. It is therefore easier and cheaper for large firms than for small firms to raise external funds, thus lowering the need for retained earnings to finance investment (Scherer and Ross, 1990). Further, very large, well-known firms are often considered to be less influenced by asymmetric information effect because they typically have greater experience in the capital market, can credibly enter long-term relationships and offer a lower average cost of obtaining required information (Athey and Reeser, 2000). The importance of size and age as a determinant of financial constraints is established also in Bougheas et al. (2006), using UK manufacturing firms from 1989 to 1999, Colluzi et al. (2009) and Canton et al. (2010) for EU firms in 2006. These authors all found that being young or small increases significantly the probability of facing financing obstacles and older firms perceive external financing as being less difficult. Based on the data collected during the recent economic crisis, Artola and Genre (2011) find that in the EU, firms who really experienced a credit crunch tended to be small and young, confirming the fact that SMEs tend to suffer more when credit standards are tightened.

Furthermore, financial constraint could be influenced by firm's ownership structure. There is no unanimous view whether ownership structure improve or hinder firm's ability to obtain external financing. Artola and Genre (2011) claim that state ownership reduces firm's value due to repeated politicians' interference and consequently imposes additional costs to external financing. On the other hand Blanchard and Shleifer (2000) claim state ownership reduce financial constraints due to preferential treatment by other market participants, e.g. banks.

The importance of internal financial funds also differs across industries. Worthington (1995) reported that the importance of internal financial funds for investment spending is greater for durable goods industries than for non-durable goods industries and, second, that the cash flow's effect is significantly larger in industries with high sunk costs than in those with low sunk costs. The latter could suggest that the availability of external finance is less important when the assets being financed are highly specific or are sunk and are thus less likely to be financed by a source external to the firm.

Exporting status is another firm characteristic that is arguably related to financial health of a firm. While there is strong empirical support for positive relationship observed between firms' financial health and their export status (e.g. Campa and Shaver, 2002; Guariglia and Mateut, 2010), the direction of causality is not that a clear-cut. On one hand, Greenaway, Guariglia and Kneller (2007) find that export participation improves firm's ex-post financial health; at least in case of continuous exporters while fail to confirm, similarly as Stiebale (2011) that firms enjoying better ex-ante financial health are more likely to start exporting. Several reasons for lower financial constraints of exporters are listed in the literature (e.g. in Campa and Shaver, 2002; Greenaway, et.al, 2007). Firstly, exporters are in a superior position to diversify their sources of financing and the associated risks since they have access to both internal and international financial markets. Secondly, the fact that a firm is an exporter also provides a signal that the firm is sufficiently

productive to generate enough profits in foreign markets to recover the sunk costs, which in turn increases the likelihood that the firm will be able to service its external debt, and further relaxes the liquidity constraints that it faces. Finally, exporting firms are less tied to the domestic cycles, and less subject to those financial constraints induced by tight monetary policy and recessions in their home country.

On the contrary, Bellone et.al (2011) provide evidence in favor of self-selecting of financially healthier firms into exporting. They find that firms starting to export display a significant ex-ante financial advantage compared to their non-exporting counterparts. Such result is in line with Chaney's (2005) theoretical prediction that limited access to external financial funds may prevent some firms that could otherwise profitably enter foreign markets from selling their products abroad. As stressed by Greenaway, et.al (2007) since starting of exporting involves an initial fixed investment, export market participation decisions are likely to be affected by financial variables in the same manner as investment in fixed capital. However, credit constraints seem to be more important in determining the extensive margin of trade in terms of number of newly served destinations than for intensive margin of trade (Muûls, 2008; Askenazy et.al, 2011).

C. Measurement of financial constraints

Although theory is relatively straightforward when it comes to their definition, financial constraints are not directly observable in practice. Consequently different measures are applied as proxies. On the one hand, several microeconomic studies use survey data, where firms and individuals provide their perception on financial constraints (e.g. Artola and Genre, 2011, Kumar and Francisco, 2005, overview in Musso and Schiavo, 2008) and are thus based on self-assessment together with all its disadvantages. The other empirical approach to detect financial constraints is based on segmentation of firms into groups based on one or more different criteria, such as dividend policy, size, age, and membership in a group of conglomerate, existence of bond rating or concentration of ownership (see Musso and Schiavo, 2008, for a comprehensive review of these studies). One of the main weaknesses of these studies is first its time invariance, second, when dividend policy is concerned, the analysis is restricted to quoted firms, which are usually also larger and more mature.

In defining financial constraints we follow the methodology first proposed by Musso and Schiavo (2008) and extended by Bellone et.al (2010), who constructed a synthetic index from seven dimensions of financial status of the firm, i.e. firm size, its profitability, liquidity, cash flow generating ability, firm's solvency, share of trade credit, and ability of repaying debt. Such a measure of firm's financial health acknowledges multiple features of financial constraints and captures different degrees of financial constraints (Silva, 2011).

III. DATA AND METHODOLOGY

A. Data and descriptive statistics

Our data source is the database of Slovenian firms' financial statements collected by the Agency of the Republic of Slovenia for Public Legal Records and Related Services (APLR). The database covers the whole population of firms registered in Slovenia since reporting financial statements' data is obligatory for all business entities registered in Slovenia. Our analysis is based on the financial statements of Slovenian firms in the 2006-2011 period and includes 313,537 observations for 71,771 different firms.

Table 1 shows the structure of the analyzed dataset according to the NACE classification of industries. In the 2008-2011 period, the number of firms in Slovenia increased by 11 percent. Economic sectors, in which the number of firms increased by more, include activities related to energy, water and waste management, transport, tourism, information and communication services, financial, insurance and real estate activities, professional, scientific, technical, administrative and support service activities.

TABLE 1: FIRMS BY ECONOMIC SECTORS IN SLOVENIA IN THE 2008-2011 PERIOD

NACE	Economic sector	2008		2011		Index 11/08
		No.	%	No.	%	
A	Agriculture, forestry and fishing	356	0.68	372	0.64	104.5
B	Mining and quarrying	66	0.13	72	0.12	109.1
C	Manufacturing	6,676	12.84	7,033	12.17	105.3
D	Electricity, gas, steam etc.	206	0.40	531	0.92	257.8
E	Water supply, sewerage, waste management etc.	260	0.50	314	0.54	120.8
F	Construction	6,746	12.97	6,943	12.01	102.9
G	Wholesale and retail trade	13,456	25.88	14,263	24.68	106.0
H	Transportation and storage	2,253	4.33	2,643	4.57	117.3
I	Accommodation and food service activities	2,318	4.46	2,641	4.57	113.9
J	Information and communication	2,571	4.94	3,157	5.46	122.8
K	Financial and insurance activities	1,044	2.01	1,182	2.05	113.2
L	Real estate activities	1,725	3.32	1,891	3.27	109.6
M	Professional, scientific and technical activities	10,183	19.58	11,866	20.53	116.5
N	Administrative and support service activities	1,456	2.80	1,756	3.04	120.6
O-U	Other sectors	2,681	5.16	3,134	5.42	116.9
A-U	Total	51,997	100.0	57,798	100.0	111.2

Source: APLR and own calculations

Table 2 shows the size structure of the Slovenian economy. While the number of micro and small firms increased throughout the investigated period, number of large firms decreased for almost 8 percent. Number of medium sized firms remained almost unaltered. At the same time number of firms with foreign ownership increased for 40 percent and their share among firms in Slovenia increased by 1 percentage point as indicated in Table 3. Simultaneously, the number of firms with state ownership decreased by almost 20 percent, while the average export orientation of Slovenian firms increased by almost 19 percent. However, the value added per employee in 2011 increased by only 4 percent relative to 2006, although in 2009, when it reached highest level in this period, it was almost 8 percent higher compared to the level of 2006.

TABLE 2: FIRMS BY SIZE IN SLOVENIA IN THE PERIOD 2006-2011

Firm size	2006		2008		2011		Index 11/08	Index 11/06
	No.	%	No	%	No	%		
Micro	42,046	92.76	48,070	92.45	53,966	93.37	112.3	128.3
Small	1,784	3.94	2,390	4.60	2,397	4.15	100.3	134.4
Medium	745	1.64	763	1.47	740	1.28	97.0	99.3
Large	755	1.67	774	1.49	695	1.20	89.8	92.1
Total	45,330	100	51,997	100	57,798	100	111.2	127.5

Source: APLR and own calculations

TABLE 3: OWNERSHIP AND EXPORT ORIENTATION OF FIRMS IN THE DATASET

	Foreign firms*		State owned firms		Exports in total sales (in %)	Value added per employee (in EUR)
	No.	%	No.	%		
2006	4,452	9.82	450	0.99	9.1	32,098
2007	5,324	10.91	401	0.82	9.4	33,949
2008	5,937	11.41	394	0.76	9.6	32,705
2009	5,965	11.06	379	0.70	9.7	34,625
2010	6,051	10.85	366	0.66	9.9	32,955
2011	6,241	10.79	366	0.63	10.8	33,382
Index 11/06	140.2	109.9	81.3	63.6	118.7	104.0

* 10 percentage foreign ownership threshold is considered

Source: APLR and own calculations

B. Models specification and methodology

The specification of the empirical model for the analysis of factors that determine financial constraints of a particular firm follows theory and empirical findings discussed above. Our model's specification is thus:

$$FCindex_{ijt} = \beta_0 + \sum \beta_{1,ijt} dsize + \beta_2 \ln Productivity_{ijt-1} + \beta_3 EXor_{ijt-1} + \beta_4 fdi_{ijt-1} + \beta_5 public_{ijt-1} + \sum \beta_{6,j} dindustry_j + \sum \beta_{7,t} dyear_t + u_t \quad (1)$$

where subscripts i , j and t refer to firms, industries and years, respectively. \ln in variable names denotes that the variable enters the equation in its natural logarithm form. Following methodology proposed by Musso and Schiavo (2008), the dependent variable is a synthetic index

of financial constraints (*FCindex*), constructed from seven different variables: (i) firm size, measured in terms of total assets, (ii) profitability in terms of return on total assets, (iii) liquidity as a ratio between current assets and current liabilities, (iv) cash flow generating ability in terms of a maximum amount of resources that a firm can devote to self-financing, corresponding to the sum of profits and depreciation, (v) firm solvency as own funds over total liabilities, measuring the ability by a firm to meet its long-term financial obligations, (vi) trade credit over total assets, and (vii) repaying ability, measured in terms of financial debt over cash flow. For each of the seven dimensions, a firm/year observation is placed in one of the quintiles of the firm distribution. Hence, each firm/year observation ends up with seven scores ranging from one to five. We use a simple sum of these seven scores to get a synthetic index of financial constraints, where smaller value of the index is related to financially more constrained firms. Musso and Schiavo (2008) use also other ways of combining seven scores and report the index of financial constraints to be very robust to the different ways to aggregate the information from the seven scores. u_{it} is composed of $u_{it} = \mu_i + v_{it}$, where μ_i is an unobserved individual-specific time-invariant effect which allows for heterogeneity in the means of the growth across individual firms and v_{it} is a disturbance term.

Among the most important firm characteristics that affect firm's financial constraints the theories postulate firm's size and age. In our model, we test for two different measures of firm size. First, firms are grouped into four size categories (*dsize*: micro, small, medium and large) based on three criteria average number of employees, sales revenues and the value of assets in line with European Commission's recommendations concerning the definition of micro, small and medium-sized enterprises. Second, firm size is measured based on the number of employees (*L*). Due to the limitations of the applied dataset, we are not able to include age in the model specification. Firm productivity (*Productivity*) is defined in terms of value added per employee. The impact of firm ownership on its financial constraints is analyzed by inclusion of two dummy variables; one for foreign firms (*fdi*), where 10 percent threshold of foreign ownership is considered, and one for public ownership (*public*). To test whether exporting affects financial constraints of firms, we include export orientation (*EXor*) or dummy variable for selling in foreign markets (*exporter*). To avoid likely endogeneity issue, firm-specific variables enter the model specification in a one year lag form. Time-specific individual-invariant effect is captured with the set of time dummies among regressors, while the time-invariant effect of industry is captured by set of industry dummy variables. Industry membership is defined based on 2-digit NACE Rev. 2 classification of industries.

Since financial health of a firm is measured by a composed index, it is relatively hard to interpret the magnitude of estimated impact of various firm -, industry- and time-specific determinants on financial health of a firm. To facilitate the more comprehensive interpretation of our results we form three broad categories. We base the categorization on *FCindex* and obtain three clearly ordered groups of firms (*FCgroup*) according to the severity of their financial constraints. A firm is classified into group of "non-constrained firms" (*FCgroup*=1) if the value of its *FCindex* is equal to or higher than 28, moderately constrained firms (*FCgroup*=2) in case of *FCindex* between 14 and 28 and highly constrained firms (*FCgroup*=3) with *FCindex* less than 14. We use *FCgroup* variable as the dependent variable in an ordered probit model of firm's financial constraints which we deem more appropriate than a linear regression model. Namely, in a linear regression a firm with *FCgroup* of 2 would be considered twice as financially constraint as one with *FCgroup*=1, whereas in the ordered probit model no such presumption of cardinality is made; *FCgroup* = 2 simply indicates higher financial constraints than *FCgroup* = 1.

Following Greene (2003), the basic notion underlying the ordered probit model is the existence of a latent continuous variable, *FC*, ranging from $-\infty$ to $+\infty$ and indicating the degree of

financial constraints of a firm. This latent variable is related to a set of explanatory variables as specified in (1). We cannot observe FC^* variable, but what we do observe is $FCgroup$ which is related to FC^* in the following way:

$$\begin{aligned} FCgroup=1 & \text{ if } FC^* \leq \mu_1, \\ FCgroup=2 & \text{ if } \mu_1 < FC^* \leq \mu_2, \\ FCgroup=3 & \text{ if } \mu_2 \leq FC^*, \end{aligned} \quad (2)$$

where μ_i are unobserved thresholds defining the boundary between the different levels of FC^* . With the normal distribution we obtain the following probabilities:

$$\begin{aligned} \text{Prob}(FCgroup = 1) &= \Phi(\mu_1 - \beta'x) \\ \text{Prob}(FCgroup = 2) &= \Phi(\mu_2 - \beta'x) - \Phi(\mu_1 - \beta'x) \\ \text{Prob}(FCgroup = 3) &= 1 - \Phi(\mu_2 - \beta'x). \end{aligned} \quad (3)$$

The value of the threshold μ is estimated as additional parameter of the model. Estimates are obtained by maximum likelihood.

IV. RESULTS

In table 4 we first report the results of the standard panel model estimation of (1). According to the results of Hausman test, we report only fixed effects model results.

Results of the fixed effect estimation confirm that firm size and labor productivity are in general positively related to the degree of firm's financial health. Yet, small firms are not significantly different in terms of their financial constraints compared to the group of micro firms, while medium and large firms exhibit similar difference compared to the benchmark group of micro firms. We fail to find significant impact of foreign and public ownership variables on financial constraints in fixed effects specification. However, when firms are grouped into three classes according to the severity of their financial constraints, publicly owned firms turn to be less financially challenged. This finding is in line with Blanchard and Shleifer (2000), who argue that state ownership reduces financial constraints due to preferential treatment by other market participants, e.g. banks. The significant impact of firm's share of sales in exporting markets on firm's financial constraints is in line with Greenaway et.al, (2007) supporting evidence on the prediction that exporters face smaller financial constraints.

TABLE 4: FIXED EFFECTS ESTIMATION OF FIRMS' FINANCIAL CONSTRAINTS MODEL

<i>Dependent variable</i>		
<i>FCindex</i>	<i>Coef.</i>	<i>Std. Err</i>
Size dummies		
small	0.125	(0.0926)
medium	0.415**	(0.178)
large	0.447*	(0.238)
lnProductivity(-1)	0.217***	(0.0178)
fdi(-1)	-0.0572	(0.139)
public	0.479	(0.294)
EXor(-1)	0.216**	(0.102)
Year dummies		
2008	-0.0744	(0.0593)
2009	-0.390***	(0.0593)
2010	-0.494***	(0.0593)
2011	-0.590***	(0.0595)
Constant	20.46***	(0.424)
Industry dummies	INCLUDED	
financially constrained (sign. negative industry effect)	Forestry and logging, Manufacture of wood, products of wood Accommodation, Creative, arts and entertainment activities	
financially unconstrained (sign. positive industry effect)	Mining of metal ores, Wholesale and retail trade Legal and accounting activities, Human health activities, Activities of membership organizations	
N	162,283	
Number of firms	44,418	
R-squared	0.0640	
F test that all $u_i=0$	F(44417, 117769) = 4.76***	(0.000)
Hausman test	chi2(96) = 8247.61	Prob>chi2 = 0.0000

Source: Research results

As a result of the recent financial and economic crisis, during the investigated period average financial conditions in the Slovenian economy have worsened. The negative sign of the year dummy regression coefficients confirm the negative effect of financial crisis on financial constraints of firms, while the increasing absolute size of these coefficients from 2009 onwards indicate the growing deterioration of financial health of Slovenian firms throughout this period. Yet, the worsening of the access to finance was not the same for all firms across all economic sectors and industries. From the estimated time-invariant industry-specific effect, measured by regression coefficients of set of industry dummy variables (Table 4) it is evident, that the degree of financial constraints of some industries significantly deviates from others. When all other determinants of financial constraints are controlled for, industries that exhibit superior financial health throughout the period studied are the following 2-digit NACE industries: industries 7-Mining of metal ores, 45-Wholesale and retail trade and repair of motor vehicles and motorcycles, 69-Legal and accounting activities, 86-Human health activities, and 94-Activities of membership organizations. On the contrary, firms from 02-Forestry and logging, 16-Manufacture of wood and of products of wood and cork, except furniture, 55-Accommodation, and 90-Creative, arts and entertainment activities are found to be in weaker financial position than firms with equal characteristics from other industries.

Generally, as more deeply analyzed in Table 5, firms operating in C - Manufacturing, F - Construction, G - Wholesale and retail trade, repair of motor vehicles and motorcycles, H - Transporting and storage, and M - professional, scientific, and technical activities were most severely affected by the current crisis and consequently became more financially constrained (significantly negative *industry x crisis* interaction term). Also, with the onset of the crisis financial health of the foreign firms worsened more compared to domestic firms (statistically significant negative *fdi(-1) x crisis* interaction term), on the other hand availability of financial resources deteriorated less for more productive firms and for exporters (significantly positive *lnProductivity(-1) x crisis* and *EXor(-1) x crisis* interaction terms). The latter additionally confirms exporting firms are less affected by recession in their home country. Even though firm's size has a significant impact on firm's financial constraint (significantly positive *medium* and *large* size dummies), crisis didn't have an additional significant negative effect on firms' financial distress for all but small firms (statistically significant positive *small x crisis* interaction term).

In order to release the assumption of cardinality of the dependent variable and increase the comprehensiveness of our results, we show also results of the ordered probit estimation. Model specification (1) from Table 6 is identical to the specification of the fixed effects estimation from Table 4, while specification (2) uses alternative specification of size and export status to test the robustness of the model.

**TABLE 5: FIXED EFFECTS ESTIMATION OF FIRMS' FINANCIAL CONSTRAINTS MODEL
 – IMPLICATIONS OF FINANCIAL CRISIS**

<i>Dependent variable</i>		
<i>FCindex</i>	<i>Coef.</i>	<i>Std. Err</i>
crisis	-0.457	[0.323]
Size dummies		
small	0.002	[0.104]
× crisis	0.127*	[0.072]
medium	0.362*	[0.190]
× crisis	0.067	[0.119]
large	0.444*	[0.246]
× crisis	-0.012	[0.129]
lnProductivity(-1)	0.179***	[0.023]
× crisis	0.051**	[0.024]
fdi(-1)	0.069	[0.145]
× crisis	-0.306***	[0.070]
public	0.641**	[0.314]
× crisis	-0.208	[0.184]
EXor(-1)	-0.004	[0.114]
× crisis	0.322***	[0.082]
Constant	20.466***	[0.411]
Industry dummies	INCLUDED	
Industry × crisis dummies	INCLUDED	
	C – Manufacturing***	
Sign. negative	F – Construction***	
industry× crisis	G - Wholesale and retail trade **	
interaction effect	H - Transporting and storage*	
	M - Professional, scientific, technical activities**	
N	162,283	
Number of firms	44,418	
R-squared	0.014	
F test that all $u_i=0$	F(44417, 117822) = 4.88*** (0.000)	

Source: Research results

TABLE 6: ORDERED PROBIT ESTIMATION OF FIRMS' FINANCIAL CONSTRAINTS MODEL

Dependent variable FCgroup	Coef.	Average marginal effects (dy/dx)	Coef.	Average marginal effects (dy/dx)
	(Std. Err.)	Pr(FCgroup=3)	(Std. Err.)	Pr(FCgroup=3)
	(1)	(1)	(2)	(2)
L(-1)			-0.000164** (7.51e-05)	-0.00002** (0.13e-06)
Size dummies				
small	-0.306*** (0.0203)	-0.031*** (0.0017)		
medium	-0.287*** (0.0346)	-0.029*** (0.0029)		
large	0.107*** (0.0408)	0.014*** (0.0058)		
lnProductivity(-1)	-0.555*** (0.00695)	-0.067*** (0.0009)	-0.546*** (0.00683)	-0.066*** (0.0009)
fdi(-1)	0.0039 (0.0180)	0.0005 (0.0022)	-0.00214 (0.0178)	-0.0003 (0.0022)
public	-0.208*** (0.0561)	-0.025*** (0.0068)	-0.283*** (0.0567)	-0.034*** (0.0069)
EXor(-1)	-0.208*** (0.0206)	-0.025*** (0.0025)		
exporter(-1)			-0.241*** (0.0101)	-0.029*** (0.0013)
Year dummies				
2008	0.0562*** (0.00823)	0.006*** (0.0009)	0.0537*** (0.00822)	0.006*** (0.0009)
2009	0.136*** (0.00875)	0.016*** (0.0011)	0.132*** (0.00873)	0.016*** (0.0011)
2010	0.0863*** (0.00893)	0.010*** (0.0010)	0.0839*** (0.00892)	0.0098*** (0.0010)
2011	0.101*** (0.00915)	0.0118*** (0.0011)	0.100*** (0.00913)	0.012*** (0.0011)
cut _t (μ _t)	-6.705*** (0.0700)		-6.657*** (0.0686)	

continued table

$\text{cut}_2 (\mu_2)$	-3.903*** (0.0668)	-3.852*** (0.0655)
pseudo R ²	0.1118	0.1121
Log (pseudo-) likelihood	-96468.226	-96640.655
N	162,283	162,598

Source: Research results

Robust standard errors in parentheses

dy/dx for factor levels is the discrete change from the base level.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Results of ordered probit estimation (in Table 6) confirm results of fixed effects model estimates (in Tables 4 and 5) with respect to significance and direction of all determinants of financial constraints that are considered in our model. Exporters are on average 2.9 percentage points less likely to become highly financially constrained compared to non-exporters. Probability that public firms, i.e. with state ownership, will become highly financially constrained, is 2.5 to 3.4 percentage points lower compared to privately owned firms, while the effect of foreign ownership is not statistically significant. Increase in firm's productivity for 1 percent decreases the likelihood of becoming highly financially constrained for 6.6 percentage points. Results also show that the increase in employment for additional 10 employees means 0.2 percentage points lower probability of becoming severely financially constrained. Marginal annual effects, measuring the change in probability of firms becoming highly financially constrained, show that the most critical year with respect to firm financial constraints was 2009, although also 2010 and 2011 show tight financial conditions. In these three years probability of Slovenian firms being critically financially constrained was 1.2 to 1.6 percentage points higher than in 2007 all else being equal.

V. CONCLUSIONS

The results of our analysis of determinants of financial constraints in the period before and during the recent economic crisis are in line with theoretical predictions and previous empirical findings. Accordingly, firm size, ownership, productivity, export orientation are factors that impact firm's financial situation. Exporters are on average 2.9 percentage points less likely to become highly financially constrained compared to non-exporters and public firms turn out to be around 3 percentage points less likely to become financially challenged compared to private firms. Firm size and labor productivity positively affect firm's financial health.

Further, the financial situation of Slovenian firms on average deteriorated from 2009 onwards, although financial constraints did not increase equally across all economic sectors and industries. Our results show that in the investigated period, when all other determinants of financial constraints are controlled for, industries with superior financial health are the following 2-digit NACE industries: 02-Forestry and logging, 16-Manufacture of wood and of products of wood and cork, except furniture, 55-Accommodation, and 90-Creative, arts and entertainment activities. On the contrary, firms from industries 7-Mining of metal ores, 45-Wholesale and retail trade and

repair of motor vehicles and motorcycles, 69-Legal and accounting activities, 86-Human health activities, and 94-Activities of membership organizations are found to be in weaker financial position than firms with equal characteristics from other industries.

Because Slovenian economic crisis is to a large extent related to banking crisis, banking sector revival seem to be crucial for improving financial health of Slovenian firms. Nevertheless, our results suggest that economic policy should also focus on promoting firm's growth, both in terms of employment and productivity with support of innovative practices and employment stimulation.

VI. REFERENCES

- Akerlof, George A.**, "The Market for Lemons: Quality Uncertainty of the Market Mechanism", *Quarterly Journal of Economics*, Cambridge, 84 (1970): 488-500.
- Arteta, C., Galina, H.**, "Sovereign debt crises and credit to the private sector", *Journal of International Economics*, 74 (2008): 53-69.
- Artola, Carlos and Veronique Genre**, "Euro Area SMEs under Financial Constraints: Belief or Reality?", CESifo Working Paper no. 3650, 2011.
- Askenazy, Philippe, Aida Caldera, Guillaume Gaulier, and Delphine Irac**, "Financial Constraints and Foreign Market Entries or Exits: Firm-Level Evidence from France", Banque de France Working Paper No. 328, 2011.
- Athey, Michael J. and Wende D. Reeser**, "Asymmetric Information, Industrial Policy and Corporate Investment in India", *Oxford Bulletin of Economics and Statistics*, 62 (2000): 267-292.
- Bellone, Flora, Patrick Musso, Lionel Nesta, and Stefano Schiavo**, "Financial Constraints and Firm Export Behaviour", *World Economy*, 33 (2010): 347-373.
- Blanchard, Olivier, Andrei Shleifer**, "Federalism with and without political centralization: China versus Russia", NBER Working Paper No. 7616, 2000.
- Bond, Stephen and Costas Meghir**, "Dynamic Investment Models and the Firm's Financial Policy", *Review of Economic Studies*, 61 (1994): 197-222.
- Bougheas, Spiros, Paul Mizen and Cihan Yalcin**, "Access to external finance: Theory and evidence on the impact of monetary policy and firm-specific characteristics", *Journal of Banking & Finance*, 30 (2006): 199-227.
- Campa, Jose M. and J. Myles Shaver**, "Exporting and Capital Investment: On the Strategic Behavior of Exporters", IESE Business School, Research Paper 469, 2002.
- Canton, Erik, Isabel Grilo, Josefa Monteagudo and Van der Zwan P.**, "Investigating the perceptions of credit constraints in the European Union", ERIM Report Series No ERS-2010-001-ORG, 2010
- Chaney, Thomas**, "Liquidity Constrained Exporters", mimeo, University of Chicago. 2005.
- Coluzzi, Chiara, Annalisa Ferrando, and Carmen Martinez-Carrascal**, "Financing obstacles and growth: an analysis for euro area non-financial corporations", ECB Working Paper No. 997. 2009.

- DeAngelo, Harry, and Ronald W. Masulis**, "Optimal Capital Structure under Corporate and Personal Taxation", *Journal of Financial Economics* 8 (1980): 3-29.
- Fama, Eugen F., and Kenneth R. French**, "Testing Trade-off and Pecking Order Predictions about Dividends and Debt", *Review of Financial Studies*, 15 (2002): 1-33.
- Fazzari, Steven M., Glenn Hubbard, and Bruce C. Petersen**, "Financing Constraints and Corporate Investment", *Brooking Papers on Economic Activity*, 1 (1988): 141-206.
- Greenaway, David, Alessandra Guariglia, and Richard Kneller**, "Financial factors and exporting decisions", *Journal of International Economics*, 7 (2007): 377-95.
- Greene, William H.** *Econometric Analysis*, Englewood Cliffs: Prentice Hall, 2003.
- Guariglia, Alessandra and Simona Mateut**, "Inventory Investment, Global Engagement, and Financial Constraints in the UK: Evidence from Micro Data", *Journal of Macroeconomics*, 32 (2010): 239-250.
- Hall, Robert E., and Dale W. Jorgenson**, "Tax Policy and Investment Behaviour", *American Economic Review*, 57 (1967): 391-414.
- Hussain, Javed, Cindy Millman, and Harry Matlay**, "SME Financing in the UK and China: A Comparative Perspective", *Journal of Small Business and Enterprise Development*, 13 (2006): 584-599.
- Hutchinson, John, and Ana Xavier**, "Comparing the Impact of Credit Constraints on the Growth of SMEs in a Transition Country with an Established Market Economy", *Small Business Economics*, 27 (2006): 169-179.
- Jensen, Michael C., and William H. Meckling**, "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure", *Journal of Financial Economics*, 3 (1976): 305-360.
- Keynes, John M.** *The General Theory of Employment, Interest and Money*, London: Macmillan, 1936.
- Kumar, Anjali, and Manuela Francisco**, "Enterprise Size, Financing Patterns, and Credit Constraints in Brazil: Analysis of Data from the Investment Climate Assessment Survey", World Bank Working Paper no. 49, 2005.
- Levine, Ross**, "Financial Development and Economic Growth: Views and Agenda", *Journal of Economic Literature*, 35 (1997): 688-726.
- Marer, Paul**, "The Global Economic Crisis: Impacts on Eastern Europe". *Acta Oeconomica*, 60(2010): 3-33.
- Miller, Merton H.**, "Debt and Taxes", *Journal of Finance*, 32 (1977), Papers and Proceedings of the Thirty-Fifth Annual Meeting of the American Finance Association, Atlantic City, New Jersey, September 16-18, 1976 (May, 1977): 261-275.
- Modigliani, Franco, and Merton H. Miller**, "The Cost of Capital, Corporate Finance and the Theory of Investment", *American Economic Review*, 48 (1985): 261-297.
- Musso, Patric, and Stefano Schiavo**, "The Impact of Financial Constraints on Firm Survival and Growth", *Journal of Evolutionary Economics*, 18 (2008): 135-149.

- Muûls, Mirabelle**, "Exporters and Credit Constraints". A Firm-level Approach, National Bank of Belgium Discussion Paper 139, 2008.
- Myers, Steward C., and Nicholas S. Majluf**, "Corporate Financing and Investment Decisions When Firms Have Information That Investors Do Not Have", *Journal of Financial Economics*, 13 (1984): 187-221.
- Natke, Paul A.**, "Financial Repression and Firm Self-Financing of Investment: Empirical Evidence from Brazil", *Applied Economics*, 31(1999): 1009-1019.
- Oliner, Stephen D., and Glen D. Rudebusch**, "Sources of the Financing Hierarchy for Business Investment", *Review of Economics and Statistics*, 74 (1992): 643-654.
- Petersen, R., Schulman, J.** "Entrepreneur and banking in Canada", *Journal of Small Business and Entrepreneurship*, 4 (1987): 68-74.
- Sawyer, Malcom C.** *The Economics of Industries and Firms: Theories, Evidence and Policy*, London: Routledge, 1981.
- Scherer, Frederic M., and David Ross.** *Industrial Market Structure and Economic Performance*, Boston: Houghton Mifflin, 1990.
- Silva, Armando**, "Financial Constraints and Exports: Evidence from Portuguese Manufacturing Firms", *International Journal of Economics Sciences and Applied Research* 3 (2011): 7-19.
- Stiebale Joel**, "Do Financial Constraints Matter for Foreign Market Entry? A Firm-level Examination", *The World Economy*, 34 (2011): 123–153.
- Van Ees, Hand, Gerard H. Kuper, and Elmer Sterken**, "Investment, Finance and the Business Cycle: Evidence from the Dutch Manufacturing Sector", *Cambridge Journal of Economics*, 21 (1997): 395-407.
- Wagner, Joachim** "Credit constraints and Exports: Evidence for German Manufacturing Enterprises", Working Paper Series in Economics no. 251, University of Luneburg, 2012.
- World Economic Forum.** *Global Competitiveness Report 2012-2013*. Geneva, Switzerland, 2013.
- Worthington, Paula R.** "Investment, Cash Flows and Sunk Costs", *Journal of Industrial Economics*, 43 (1995): 49-61.

Reproduced with permission of the copyright owner. Further reproduction prohibited without permission.