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THE INTERDEPENDENCES BETWEEN ITALIAN FIRMS' ACCESS TO FINANCE AND THEIR PROBABILITY OF DEFAULT

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Abstract:
This paper addresses the interdependences between Italian firms' access to finance and their probability of default, over the period 2005 to 2011. From a theoretical point of view, an increased default probability limits the firms' access to bank loans. At the same time, a high indebtedness rate increases their risk of default. Therefore, in order to shed light on this nexus, we use a VAR specification and a large dataset including 143,000 Italian firms. We document a bidirectional causality between the bank loans to sales ratio and the Altman Z-score used as proxy for the probability of default. However, even if we find no clear evidence in the favour of the indebtedness effect or financing effect, we show that an increased probability of default does not limit the Italian firms' access to bank loans, on the contrary.

Keywords: firms' access to finance, probability of default, Z-score, causality, Italy

1. INTRODUCTION

Starting with Modigliani and Miller (1958), the literature documented widespread evidence regarding the link between firms' performance and their capital structure. One related topic is the relationship between firms' performance and their access to finance (for a review of the literature see Rahaman, 2011). In this line, Klapper et al. (2006) test several competing theories of capital structure choices using firm-level data. They report a positive firm size effect on financial intermediation, and a negative influence of profitability on firms' leverage ratios, which support the "pecking order" theory showing that firms prefer to use internal financing sources when asymmetric information is high.

Another related topic studies the implications of firms' access to finance on loan market default rates (Jacobson et al., 2005, Fidrmuc and Hainz, 2010; Blazy and Weill, 2013). For example, Fidrmuc and Hainz (2010) use several panel probit models and show that liquidity and profitability factors are important determinants of small and medium-sized enterprises' (SMEs) defaults. They also find that indebtedness significantly increases the probability of default.

However, the interdependencies between the firms' access to finance and their leverage ratios on the one hand, and the firms' probability of default on the other hand, are complex. A bidirectional relationship might exist and different competing hypotheses can be verified. For example, a low probability of default risk is expected to increase the firms' access to bank loans. At the same time, an increase of their indebtedness rate might amplify the default risk or, on the contrary, if firms have access to finance and to liquidity, their probability of default might decrease.

In this context our purpose is to fill in the void existing in the current literature and to perform a firm-level analysis to test the bidirectional causality between firms' access to finance and their probability of default. More precisely, while previous studies focus on SMEs, we consider all categories of Italian firms and we perform a panel data investigation over the time-span 2005 to 2011. The firms' access to finance is assessed through the bank loans to sales ratio (BLTSR), while the probability of default is computed based on the classic Altman's (1968) Z-score (ZSCORE). We therefore avoid the firms' size effect using the BLTSR variable, and we are in line with previous researches regarding the use of Z-score as a proxy for the probability of default.

While previous studies employ simple regression analyses, probit or logit models, as well as differenced-generalized method of moments (GMM) models to investigate the relationship between firms' performance and their access to finance, we resort to a simple vector autoregressive (VAR) technique, as well as Granger causality tests and impulse response function for panel VARs. The use of a panel VAR model represents thus the second contribution of our paper and it is recommended given the multiple interdependencies existing between our variables.

Finally, the third contribution of our paper consists in the use of a large data sample including 143,000 Italian firms. Data covering the time-span 2005 to 2011 are extracted from the AMADEUS database.
The rest of the paper is as follows. The next section describes the research hypotheses. Section 3 presents the data and the methodology. Section 4 highlights the results, while the last section concludes.

2. RESEARCH HYPOTHESES

Our research practically tests two different effects, namely the access to finance and the indebtedness effect. One the one hand, the access to finance is equivalent with the access to liquidity, which helps firms to diminish their default probability. On the other hand, the access to finance means an increase of the indebtedness level, which might spur the probability of default during financial crisis episodes.

However, it is also expected that a reduced probability of default will increase the firms' access to finance, as banks assess the financial strength of companies before granting loans.

At the same time, under the assumption of asymmetric information, firms presenting financial problems are forced to access external financial sources. Therefore, firms which succeed in hiding their real economic situation might access bank loans and increase this way their leverage ratio.

Against this background we test four hypotheses regarding the relationship between firms' probability of default and the financing effect, vs. the indebtedness effect.

First, if we consider the determinants of firms' default discussed in the earlier literature (i.e. Altman, 1968), we notice that causes of bankruptcy are related to profitability, liquidity and solvency. As such, if firms do not have access to bank credits, their probability of default increases.

Hypothesis 1: Firms are more likely to default if they are less liquid and do not have access to finance.

Second, if firms are highly indebted, they have to pay a higher proportion of their payoffs to banks. This happens especially during crisis episodes and in the context of bank loans with variable interest rates. In addition, for indebted firms, the difference between the payoffs for success and failure decreases. Consequently, the incentive to invest the loan for the purpose agreed in the credit contract reduces, as well as the incentive to exert efforts in order to increase the success of their projects (Fidrmuc and Hainz, 2010).

Hypothesis 2: More indebted firms are more likely to default.

Third, if we suppose that banks know *ex ante* the firms' probability of default, they can adjust the terms of the credit contract accordingly. Therefore, under the so-called "observed-risk hypothesis", if the firms' probability of default is high, the access to credit becomes more difficult. The rationale is that banks sort the borrowers using information about their quality (Blazy and Weill, 2013).

Hypothesis 3: The higher the probability of default is, more difficult the access to finance becomes.

Forth, an opposite situation may arise in the presence of adverse selection. For example, if banks cannot select borrowers based on their quality because they do not have access to information, they reach to grant loans to more risky firms. Usually, firms with a high probability of default need to obtain bank credits to continue their activity. Consequently, in the presence of asymmetric information, a higher probability of default generates an increased level of indebtedness.

Hypothesis 4: A higher probability of default may determine firms to contract bank loans.

3. DATA AND METHODOLOGY

3.1. Data

Data on 198,166 Italian firms are extracted from the AMADEUS database, over the period 2005 to 2011. After an automatic drop of outliers, we have retained into the analysis around 143,000 firms. However, data are not available for all firms and for all the years. Consequently, the final estimations include 393,140 observations.

The bank loans to sales ratio is directly extracted from the database. The Altman's Z-score is also provided by AMADEUS (Bureau van Dijk) and is calculated based on five financial ratios, as follows:

$$ZSCORE = 1.2 \times A + 1.4 \times B + 3.3 \times C + 0.6 \times D + 1.0 \times E \quad (1)$$

Where: A is the working capital to total assets ratio, B represents the retained earnings to total assets, C are the earnings before interest and tax to total assets, D represents the equity market value to total liabilities and E is the sales to total assets ratio.

A high value of the Z-score is associated with a reduced probability of default.

3.2. Methodology

To test for the bidirectional relationship between BLTSR and ZSCORE, we use an unrestricted panel VAR model (pVAR). A simple VAR is characterized by a set of K endogenous variables $y_t = (y_{1t}, \dots, y_{kt}, \dots, y_{Kt})$, with $k = 1, \dots, K$. A general VAR(p)-process can be defined as:

$$y_t = c + A_1 y_{t-1} + \cdots + A_p y_{t-p} + \varepsilon_t \quad (2)$$

Where: A_l are $(K \times K)$ coefficient matrices with $l = 1, \dots, p$ and ε_t is a white noise K-dimensional process with $E(\varepsilon_t) = 0$ and time invariant positive covariance matrix $E(\varepsilon_t \varepsilon_t^T) = \Sigma_\varepsilon$.

For a pVAR, let y_{it} denote a vector of K endogenous variables for firm i $(i = 1, \dots, N)$ at time t $(t = 1, \dots, T)$ and $Y_t = (y_{1t}', \dots, y_{Nt}')'$. Consequently, a VAR for the firm i can be written as:

$$y_{it} = c + A_{1,i} Y_{t-1} + \cdots + A_{P,i} Y_{t-P} + \varepsilon_{it} \quad (3)$$

Where: $A_{p,i}$ are $(K \times NK)$ matrices for each lag $p = 1, \dots, P$, ε_{it} are uncorrelated over time and normally distributed $N(0, \Sigma_{ii})$, $cov(\varepsilon_{it}, \varepsilon_{jt}) = E(\varepsilon_{it}, \varepsilon_{jt}) = \Sigma_{ij}$ is the covariance matrix between the errors in the VARs of firm i and firm j.

The pVAR avoids all concerns about endogeneity and covers all sorts of static and dynamic dependencies between firms. However, an important drawback for an unrestricted pVAR with P lags is that we must estimate $G = (NK)^2 P$ autoregressive coefficients. As such, if the number of firms is large (our case), the number of parameters might exceed the number of available observations.

Nevertheless, using EViews 9, we are not able to obtain a real panel style VAR estimation. The software does in fact an ordinary least square (OLS) estimation on the stacked data. However, the advantage is that lags do not go across cross-sections.

Further, as compared to the cross-sectional analysis performed for each year of our sample, using a pVAR we are able to obtain the causality direction and to see the response of one variable to shocks in the other variable, using impulse response functions.

4. RESULTS

We start our empirical analysis with the estimation of panel unit root tests. All the tests from the first generation (Table 1) show that the variables are stationary in level and we can use the pVAR. A small exception is noticed for the ZSCORE in the case of the Breitung unit root test.

Table 1: Panel unit root tests

	Levin–Lin–Chu *Adjusted t**	Harris–Tzavalis *rho*	Breitung *lambda*	Fisher *chi-squared*
BLTSR	-4.35***	0.23***	-1.65**	86.2***
ZSCORE	-28.8***	0.17***	-1.19	33.2*
*Notes: (i) *, **, ***, mean stationarity significant at 10 %, 5 % and 1 %. (ii) For all the tests, the null hypothesis is that the panel contains a unit root.*				

Table 2 presents the results of the VAR analysis. The lag order selection is made based on the Schwarz information criterion. We can see that in the short-run $(t-1)$, an increase of the indebtedness level will lead to a decrease of the ZSCORE or to an increase of the default probability. Thus, the second proposed hypothesis is confirmed.

However, for longer time-horizons (i.e. $t-2$), the access to finance helps firms to reduce their default probability (the first hypothesis is therefore validated). However, there is not a clear trade-off between the financing effect and the indebtedness effect.

At the same time, the results highlight a negative influence of ZSCORE on BLTSR. This means that an increase of the default probability will determine firms to contract bank credits. This result points out in the favour of the validation of the forth hypothesis, while, contrary to our expectation, the third hypothesis is invalidated (the “pecking order” theory is also invalidated).

This outcome can be explained by the fact that on the Italian credit market, the adverse selection manifested around the recent financial crisis. So, firms with liquidity problems have access to bank

loans. The phenomenon can be also explained by the fact that in the period preceding the crisis, the credit boom was fuelled by a relaxation of lending standards.

Table 2: pVAR results

	ZSCORE	BLTSR
$ZSCORE_{t-1}$	0.647*** (0.00)	-0.173*** (0.02)
$ZSCORE_{t-2}$	0.240*** (0.00)	-0.193*** (0.02)
$BLTSR_{t-1}$	-0.002*** (0.00)	0.755*** (0.00)
$BLTSR_{t-2}$	0.001*** (0.00)	0.154*** (0.00)
C	0.200*** (0.00)	3.169*** (0.04)
*Notes: (i) *, **, ***, mean stationarity significant at 10 %, 5 % and 1 %. (ii) Standard errors in brackets.*		

Table 3 presents the Granger causality results. In both cases, the null hypothesis of no causality is rejected, at 1% significance level. We conclude that there is a bidirectional Granger causality between BLTSR and ZSCORE, which confirms our theatrical intuition.

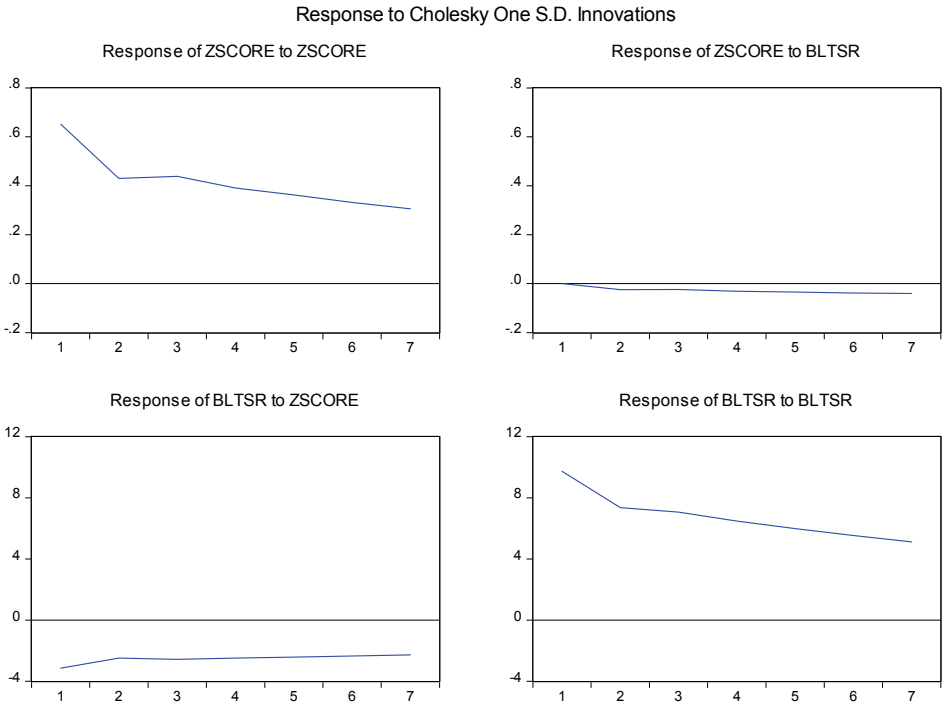
Table 3: pVAR Granger causality results

	ZSCORE	BLTSR
BLTSR	871.3***	-
ZSCORE	-	626.5***
*Notes: (i) *, **, ***, mean stationarity significant at 10 %, 5 % and 1 %. (ii) H0: y_{1t} does not Granger cause y_{2t} and the opposite. (iii) Chi-squared is reported.*		

Finally, Picture 1 shows the results of the impulse response functions. Impulse response functions show the current and future behaviour of each of two variables as response to a shock in the other variable (that is a one-unit increase or one-standard deviation increase).

We notice that the response of the default probability to a shock in the access to finance is not significant, even if the graphs show that a negative shock in the access to finance will lead to a decrease of the ZSCORE (or to an increase of the default probability). However, one standard deviation shock in the default probability will reduce the volume of bank loans to total firm's sales. This result shows that banks are sensitive not to the level of risk indicators, but especially to the change in this indicators. Therefore, the third advanced hypothesis might also be validated in the case of Italian firms.

Picture 1: Impulse response functions



5. CONCLUSIONS

Drawing on the preliminary literature regarding the relationship between firms' access to finance and their default probability, we test for the possible bidirectional causality existing between these variables. For this purpose we use a large set of Italian firms and we apply a pVAR approach in order to validate or invalidate the four theoretical hypotheses characterizing the above-mentioned relationship.

Our results show that there is no clear evidence in the favour of the indebtedness effects, or in the favour of the financing effect. While an increase in the indebtedness level causes an increase of the default probability in the short-run, the access to finance reduces the risk of default for longer time-horizons. At the same time, according to our pVAR results, when the default probability increases, the firms apply for bank loans in order to have access to liquidity.

Consequently, in the presence of asymmetric information, banks continue to grant loans, even if the firms' financial situation deteriorates. However, the impulse response functions show that shocks in default probabilities restrict the access to finance. Consequently, banks are sensitive to changes occurred in the firms' financial ratios.

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