Credit Rationing and the Financial Structure of Italian Small and Meduim Enterprises

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Our aim is to analyze the effect of public subsidies on the development path of Italian small and medium enterprises (SMEs). Public subsidies to SMEs have been often used with the aim of favoring economic growth in less developed regions. The main theoretical arguments justifying this intervention are related to the idea that public subsidies can solve lack-of-capital problems deriving from asymmetric information. According to Stiglitz and Weiss (1981), public subsidies to rationed firms can reduce the informational gap, leading subsidized firms to reduce their financial constraints and to increase their investment levels. Results obtained modelling leverage, performance and investment behaviour in a panel of around 1,900 enterprises over the years 1989 to 1994 seem to confirm the working hypotheses. However, they can not be considered as conclusive and further research is needed in this context.

I. Introduction

Public subsidies to small and medium enterprises (SMEs) have often played a relevant role in industrial policies to stimulate economic growth in less developed regions, assuming that public subsidies can solve lack-of-capital problems which limit firms' investment decisions.

From a purely theoretical perspective, informational asymmetries between borrowers and lenders can justify government intervention aimed at helping firms to reduce their financial constraints and increase their planned investment levels (De Long and Summer 1991, Bergström 1998). However,

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few empirical studies have analyzed their impact. Our aim is to evaluate the effects of informational asymmetry on the financial structure of Italian SMEs using the Stiglitz and Weiss (1981) model as theoretical support. For this purpose, we have analyzed data drawn from the MedioCredito Centrale database, which includes qualitative and quantitative information on 3696 firms for 1989-1991 and 4389 firms for 1992-1994. Approximately 50% of firms have obtained public subsidies during this period. Our results seem to confirm the relevant effects of public subsidies on firms' leverage, as well as the role of public subsidies to help SMEs overcome credit rationing conditions.

The paper is structured as follows. In section II we discuss asymmetric information and credit rationing as theoretical justifications for public subsidies. In section III we describe the analyzed panel of firms. In section IV we introduce the empirical model, and in Section V we present the results obtained from fitting the proposed models. The last section gives concluding remarks and outlines the future research agenda.

II. Economic Background

For the financing constraint literature, imperfections in capital markets create a gap between internal and external sources of funds (see Hubbard 1998 for a survey). Our empirical model explores whether the policy of subsidies to SMEs helps to counteract the external credit restrictions that firms face. We assume firms can obtain external financial resources only from the private sector (bank loans) or from the public sector (subsidies). We also assume that only SMEs know their real financial structure, the real strength of the investment project and the effective intention to repay the debt, i.e., firms have superior private information. Hence, the bank manager makes decisions under asymmetric information, and operates under moral hazard and adverse selection risk. In this context, the bank can use the subsidy like a sort of added guarantee in case of project's default, since the

government usually repays part (or the totality) of the loan to banks.

Stiglitz and Weiss (1981) explained the choice among different financing sources under conditions of asymmetric information and credit rationing. Asymmetric information can lead to credit rationing conditions by modifying the risk-return distribution; this fact encourages banks to refuse capital for investments and produces divergence between capital demand and supply. Financing refusal derives from banks' rational behaviour; since banks act in an asymmetric information market, equilibria are not efficient and firms with less profitable investment projects obtain capital. Therefore, asymmetric information can explain asymmetric distribution of credit among firms with identical characteristics: the lenders, not being aware of the exact bankruptcy likelihood for the firms, know only that this likelihood is positive and therefore choose to increase debts' cost. The firm accepts to invest only in riskier projects which can produce higher income levels, which are needed to cover debts. The result is that the lender cannot avoid to select the riskier project and therefore must accept the risk of the firm. In presence of excess of demand, the lender has different maxima corresponding to the rates with the lower adverse selection likelihood for credit rationing (Stiglitz and Weiss 1981). Furthermore, rationing conditions reduce financial resources not only for new investment, but also for employment (Nickell and Nicolitsas 1999).

From a theoretical perspective, loan guarantees can help solve credit rationing (Stiglitz and Weiss 1981, 1983). Thus, a possible justification for public intervention derives from credit rationing conditions in financial markets. Hoff and Stiglitz (1998), assuming monopolistic competition, showed that subsidies could increase the interest rate or market attrition in credit markets characterized by moneylenders and bank credit. The effect on credit supply is positive: firms without financial resources from banks can use public subsidies to fund their projects. If subsidies heavily affect credit demand, the result is that rationing persists in the market and the equilibrium is not market clearing.

Rather than leading to under-investment, asymmetric information could drive to over-investment in equilibrium (de Meza and Webb 1987, 1990): in this case, only capital taxes can drive credit market to optimal values. Moreover, de Meza and Webb (1992, 2000) argue that credit rationing can be considered as endemic also in fully informative markets, and that rationing and "excessive lending" can coexist in equilibrium, even if they do not consider explicitly government intervention. Within this perspective, the "appropriate policy is to increase the attractiveness of alternatives to self-employment rather than to subsidize lending" (de Meza and Webb 2000, p. 217). As can be easily noted, subsidies are not univocally claimed as an efficient solution to lack-of-capital problems; in fact, their economic efficiency is far from clear. Capital subsidies could lead to over-investment and excess of production capacity due to distortions in input relative prices; therefore, it would be desirable to achieve labor market improvements with active labor policies, rather than capital subsidies to firms (Begg and Portes 1993). This viewpoint is corroborated by Schwartz and Clements (1999) and Tollison (1997).

Looking at the excess-of-credit literature, subsidies allow less profitable firms to survive paying a higher cost for credit; subsidized firms obtain new public financial resources and the equilibrium is market clearing without rationing (de Meza and Webb 1987). The empirical literature in any case does not produce a clear-cut set of results regarding the correlation among profitability, credit rationing and subsidies (Cowling and Mitchell 2003); this reflects the lack of a unifying theoretical framework to describe relationships between these variables.

All these phenomena affect firms' financial structure, generating disequilibria between financial sources and corresponding investments. According to the literature discussed above, subsidies can be used as partial substitution for bank debt. By reducing moral hazard and adverse selection risk, they contribute to reduce the SMEs rationing conditions. In this case, obtained subsidies affect positively SMEs leverage, which represents a synthetic variable measuring firms internal financial dynamic.

III. Data

The Mediocredito database collected information from two surveys conducted on a sample of Italian manufacturing firms during the period 1989-1994: the first survey, which took place in 1991, covers the period 1989 to 1991, while the second survey, conducted in 1994, covers the period 1992 to 1994. Firms with 11 to 500 employees have been included in the sample according to a stratified sampling design reflecting geographical and size distribution of Italian firms. Firms with more than 500 employees have all been included. In both surveys qualitative and quantitative data (balance sheets for the 1989-1994 period) have been collected providing information on ownership structure, availability of external finance, entitlement to public subsidies, and successful introduction of products and processes. The analyzed panel includes all those enterprises with less than 250 employees which were present in the database for the whole period 1989 to 1994; following this selection scheme, we considered 1919 firms participating to both surveys with information available for all years from 1989 to 1994. We now describe the primary responses and the covariates in detail.

To define the debt structure, we use the leverage variable (*Lev*) which represents the ratio between total bank debts (short and long term) and total assets. We have used as scale variable total assets rather than equity capital because all firms are small-medium sized, not listed in the stock exchange and most of them are family owned. As a consequence, equity capital is often a symbolic balance sheet item, extremely volatile and not representative of firm's stock of total assets.

Sub represents the binary variable indicating that the firm has been subsidized during years 1989 to 1994. It dynamically divides the sample into two different sets: the firms who have received a subsidy and the others (the control sample). This variable represents the direct action of the State in the economic system. The subsidies we have considered for the present analysis are those given to

improve firms' technological and capital endowment (see Table A.1 for more details).

Exp is a dummy variable representing the international state of a firm: 1 if the firm exports, 0 otherwise. It is important to analyze the empirical connection between export and debt structure, since exporting firms face additional exchange rate risk.

Pat is a factor to identify prevalent activity sector among Traditional Sector (*Pat*=1), Scale Sectors (*Pat*=2), Specialized Sectors (*Pat*=3), Hi-tech Sectors (*Pat* =4).

Rat is the binary variable representing rationed firms. It is based on reported answers to similar questions present in both questionnaires. We used this factor to test the idea that credit rationing can be the result of a rational response of the bank system in presence of asymmetric information in order to preserve the spread of project revenues (see Stiglitz-Weiss 1981). According to Petersen and Rajan (1994), when the relation between fund demand and supply can not be accounted for, credit rationing cannot be measured directly through debt ratios. The rationed condition should be estimated through firms' marginal investments, classifying firms as rationed if they used the more expensive source of funds. This approach allows to solve the problem that a small firm's owner tends to give "bad answers" to magnify firm's financial constraints. Unfortunately, our data do not allow to adopt this approach, and therefore we had to define the variable only on the basis of answers to the questionnaire.

Rnd is a measure of firms' profitability; according to Nickell (1996) it is defined as:

$$Rnd_{it} = \frac{Pbt_{it} + Dep_{it} + R_{it} - c * K_{it}}{Va_{it}}, \tag{1}$$

where *Pbt* identifies profits before tax, *Dep* is the depreciation rate, *R* represents interest payments, *c* is the cost of capital (set to 0.07), *K* is the stock of capital, and *va* represents the added value; this variable represents a proxy for expected returns deriving from investment activities.

KL represents the current value of firm's capital/labor ratio, while *Cde* represents the ratio between

financial cost of capital and the sum of external financial sources of firm i at time t (acquired capital).

Risc and *Sdroi* represent proxies for firms' risk. The former is the ratio between provision for risk and charges (a balance item in which firms directly quantify their operating risk by creating an ad hoc reserve) and total assets (Becchetti and Trovato 2000). *Risc* can also be considered as a measure of internal financing choice, since firms can use the excess of legal provisions to finance themselves, thus avoiding to pay taxes (provisions reduce the earnings considered for taxes). The result is that the higher the taxes, the higher is the willingness to use this internal financial provision. Since *Risc* can not be considered as an effective measure of firms' risk, we also used the standard deviation of *Roi*, *Sdroi* for this purpose.

Dur is the natural logarithm of firms' age in 1989, while *Loc* is a dummy variable representing firm localization. The factor takes value 1 for North Italy and 2 for Centre and South Italy.

IV. Models

Usually, regression models are based on the assumption that the analyzed responses are independent. However, with panel data modified approaches should be considered, since responses for the same firm in different periods are likely to show a significant dependence. We have used first order Markov regression to estimate parameters for a set of multivariate models, where primary responses are the SME debt structure, as measured by leverage, the demand for new investment, the cost of debt and performance indicators. Covariates consist of firm's principal characteristics: firm localization, access to public subsidies, financial structure, expected returns of investment projects. Using this modelling approach, we implicitly assume that past values of each response directly affect its current values and introduce a flexible association structure between responses corresponding to

the same firm. In particular, we assume that the actual level of debt ratio is a function of its past levels in order to take into account possible dynamics involving the repayment process. In fact, firms must repay bank debts contracted in the past to finance old investment projects: the higher the quantity of past contracted debt, the higher the actual level of debt used to repay the old debt.

We used a maximum likelihood approach with correlated error terms, since it is likely that unobserved features of the economic environment influencing a certain primary response (for example leverage) could be related to the other responses for each time point t.

The model for leverage can be defined as follows:

$$E\left(Lev_{it}\right) = \beta_0 + \beta_1 Lev_{it-1} + \beta_2 Sub_{it} + \beta_3 Exp_{it} + \beta_4 Pat_{it} + \beta_5 Rat_{it} + \beta_6 Loc_{it} + \\ + \beta_7 Rnd_{it} + \beta_8 Risc_{it} + \beta_9 Sdroi_{it} + \beta_{10} Dur_{it} \quad . \tag{2}$$

It is worth noting that, given the adopted Markov assumptions, the regression parameters should be interpreted as short term effects on deviations of actual levels from past leverage levels. As pointed out by Petersen and Rajan (1994), the leverage variable is likely to be jointly determined by the firm's specific demand for capital and the banks supply of credit. In such a case, regression parameter estimates could suffer from simultaneous equation bias and only data on funds dynamics could help solve this problem. In the present context, we tested for the effects of endogeneity of regressors (firm return and firm risk) through a Durbin-Wu-Hausman (DWH)-type test. Details are reported in the next Section.

With respect to demand for new investments, the current value of the firm capital/labor ratio (*KL*) can be modelled as a function of its past values, as well as of subsidies (*Sub*) and rationing conditions (*Rat*). These assumptions lead to the following specification:

$$E(Inv_{it}) = \beta_0 + \beta_1 Inv_{it-1} + \beta_2 Subrat_{it} \quad . \tag{3}$$

In the previous equation, as well as in the following, the variable *Subrat* represents a polytomous

variable which has been defined combining the dummy variables *Sub* and *Rat*, with reference category *Subrat*=0 (*Sub*=0, *Rat*=0), and active categories *Subrat*=1 (*Sub*=1, *Rat*=0), *Subrat*=2 (*Sub*=0, *Rat*=1), *Subrat*=3 (*Sub*=1, *Rat*=1).

Furthermore, Stiglitz and Weiss (1981) postulated that subsidies affect the cost of the bank debt; to test these assumptions we use the following model:

$$E\left(Cde_{it}\right) = \beta_0 + \beta_1 Cde_{it-1} + \beta_2 Subrat_{it} \,, \tag{4}$$

where *Cde* represents, as described above, the ratio between the financial cost of capital and the sum of external financial sources for firm *i* at time *t*.

To test the influence of subsidies and rationing conditions on profitability and risk we employed the following models:

$$E(Rnd_{it}) = \beta_0 + \beta_1 Rnd_{it-1} + \beta_2 Subrat_{it} \tag{5}$$

$$E(Sdroi_{it}) = \beta_0 + \beta_1 Sdroi_{it-1} + \beta_2 Subrat_{it} \,. \tag{6}$$

Descriptive mean values for the modelled response variables conditioned on the adopted categorical covariates are displayed in Table 1.

Table 1 about here

V. Results

A. Leverage

In the following, only results obtained by fitting the primary model for leverage will be discussed in detail. The remaining models have been fitted in order to test for endogeneity bias (parameter estimates for all other models are reported in Table A.2 in the Appendix.).

Table 2 details parameter estimates for the leverage model as well as the *p*-values obtained from testing for endogeneity of regressors, for selection bias and for model misspecification. The adjusted

R^2 shows that almost 70% of variability is explained by the adopted model.

Table 2 about here

The main result is the significant and positive effect of Sub_{it} on firms' leverage: those SMEs which have been subsidized have higher leverage compared to those not subsidized. This result seems to be consistent with Stiglitz and Weiss (1981): the lender, operating in a context of asymmetric information, reads the signal of outsourcing debt as an increased bankruptcy risk for the firm and can not increase the rate of interest because of moral hazard and adverse selection. In the presence of public subsidies (at the same interest rate applied by banks), the result is a right shift in the credit demand. The lender could give more credit in addition to public subsidies: the subsidized credit is not enough to cover the global amount of investment, and the firm has to demand new credit at the market interest rate. The final result is increased leverage and an excess of exposure with the banking system. In fact, according to Stiglitz and Weiss (1981) subsidized firms are granted more credit and invest more; the cost of debt and the interest rate are higher if subsidies are not deducted (gross of subsidies) and the equilibrium is not market clearing. According to De Meza and Webb (1987), subsidized firms are also granted more credit and invest more; the cost of debt and the interest rate (gross of subsidies) faced by subsidized firms are not lower than those for not subsidized firms. In this case, subsidized firms have a lower profitability with respect to those firms which have not been subsidized, and the equilibrium is market clearing without rationing. Results obtained by modelling only the leverage variable do not allow to discriminate between these theories; proper modelling of the links between firms profitability and projects' risk conditions could help us in understanding the consistency of our results with these theories.

Another important result is that firms declaring to be credit rationed are more leveraged as indicated by estimated effects reported in Table 2. The connection between leverage, credit rationing and

performance may help us understand whether rationing generates market failures or correctly recognizes inefficient projects, something we turn to below.

The estimated effect of Rnd_{it} is not substantially different from zero. This is an unexpected result, which might be explained as follows. The Italian bank system seems to look only at firms' ability to repay the debt, i.e., to firms' structural conditions: firm sector (Pat), reputation (Dur), firm risk ($Sdroi$), subsidies (Sub) and past debt history (Lev_{t-1}). Current profitability should be important to determine the firm's ability to repay; however, profitability does not seem to be persistent in the analyzed sample (as shown in Table A.2) and this could be interpreted as actual profits being a bad predictor of future ones. Therefore banks' behaviour can be considered as a rational choice on the use of profitability variables in predicting firms' ability to repay the debt.

The relation between asymmetric information and returns (if asymmetric information is strong high returns should lead to reduced bank debts) does not seem to hold. But this relation is still useful if we consider the $Risc$ variable as a measure of internal financial provision. In this case, higher asymmetric conditions and higher tax rigidities lead to more explicit internal financing choices.

The estimated relation between leverage and risk ($Sdroi$) presents a negative sign: in presence of outstanding debt there could be a conflict between shareholders and debtholders (Diamond 1989). This is because the debtholders demand higher risk premia to compensate for increased bankruptcy risks (due to increased debts) so that riskier firms find debt financing relatively more expensive and have lower debt-equity ratios in equilibrium (Myers 1977).

B Conditional values

Table 3 shows predicted values conditional only on the observed covariates. Their meaning is quite different from the results in Table 2, that are conditional on past values of the response variable and

other covariates in the regression models.

<div align="center">**Table 3 about here**</div>

Credit rationing indicates a failure in financial markets when a firm does not obtain credit by the banking system regardless of whether the project could yield an expected return higher than the lending rate. Table 3 shows that rationed firms have a lower performance and result more leveraged than the control sample, i.e. not rationed firms. Therefore, the bank system tends to automatically screen out applicants using monitoring tools based on performance and leverage.

An important aspect of the Stiglitz and Weiss (1981) model is that public subsidies are an important factor to support firms' demand for new investments; as shown from predicted values reported in Table 3, subsidies seem to produce an increased propensity for capital intensive investment. In any case, the higher value of the stock of capital/labour ratio cannot be considered as a measure of firms' health. Italian firms might choose techniques with high capital intensity to avoid rigidities and inefficient conditions in the labour market, and this leads to lower profitability of capital.

The next hypothesis to be analyzed regards the effects of subsidies on the cost of capital (*Cde*). If firms are considered riskier, they face either more expensive conditions for credit or a rationing condition (De Meza and Webb 1987). Table 3 shows that rationed and not subsidized firms have an expected cost for capital slightly greater than rationed and subsidized firms, while for the control sample (not rationed firms) subsidies slightly increase the cost of debt.

Table 3 shows that rationed and subsidized firms have a lower predicted profitability and a lower predicted risk when compared with those not rationed but subsidized. The Stiglitz and Weiss (1981) model can help us in interpreting the result: when a firm is rationed it is excluded from the market and therefore it obtains a lower level of capital for investments. In this case, the firm has a lower

global level of profitability. Subsidies include in the credit market firms which were previously excluded: therefore, firms could obtain the expected profitability from the investment. Obtained subsidies seems to improve predicted profitability for rationed firms: in any case, the rationed firms have a greater predicted leverage and a lower predicted performance. Subsidies also affect firm risk and the lender has the incentive to give more credit if the firm is subsidized: the result is that the firm is more leveraged and has a cost of capital greater than the other. But, if the firm is rationed, the subsidy seems to slightly reduce the cost of capital.

According to results in Tables 2 and 3, subsidies can be not enough to clean the market, and therefore firms remain rationed in presence of a strong increase in the credit demand. Rationing condition dynamically exists also in the presence of subsidies, since around 26% of firms that have been subsidized in 1989 remain rationed (or declare to be rationed) also in the second time period (covering 1992 to 1994). According to the Stiglitz and Weiss (1981) conclusion, the equilibrium is not market clearing.

C. Causality

One relevant issue regarding the potential excess of credit in the market has been discussed, among others, by de Meza and Webb (2000). In their perspective, public subsidies have to be considered as a complement to bank financing and they are jointly used by firms. Should this not be the case, the conditional distribution of subsidies given past values of subsidies and leverage would be the same as that given past values of subsidies alone. In more formal words, we could expect Granger noncausality between leverage and subsidies, which can be stated as:

$$f(Sub_{it} \mid Sub_{it-1}) = f(Sub_{it} \mid Sub_{it-1}, Lev_{it-1}) \tag{7}$$

where $f(\cdot)$ denotes the conditional density of Sub_{it}. To test this hypothesis, we performed a likelihood ratio test comparing two logistic regression models for the primary response, Sub_{it}, with

covariates given by, respectively, *Sub_it-1* and *Lev_it-1*, and *Sub_it-1* alone. The results ($\chi^2_{2,1} \cong 2.29$, *p*-value $\cong 0.13$) show that noncausality between subsidies and leverage can not be rejected, i.e., complementarity of subsidies and bank financing is not well supported by the analyzed data.

We found in Table 3 that rationed firms have a lower performance and result more leveraged, so the bank system tends to screen out applicants using performance and leverage. Nevertheless, the above causal relationship can be also reversed: i.e., firms are less profitable because they suffer a rationing condition. To test these competing hypotheses we performed two Granger noncausality to verify the null hypotheses that:

$$f(Rat_{it} \mid Rat_{it-1}) = f(Rat_{it} \mid Rat_{it-1}, Rnd_{it-1}) \tag{8}$$

$$f(Rat_{it} \mid Rat_{it-1}) = f(Rat_{it} \mid Rat_{it-1}, Lev_{it-1}) \tag{9}$$

To be more precise, we performed a LR test comparing two conditional regression models for the primary response *Rat_it*, to understand if a prior lower profitability lead to rationing or not. Obtained results for the first test ($\chi^2_{2,1} \cong 0.18$, p-value $\cong 0.6753$) show that firms are rationed whether they perform well or not. Moreover, if we consider leverage as causal factor for the rationing condition, then we can affirm that the past financial exposure is a causal factor for credit rationing ($\chi^2_{2,1} \cong 4.38$, p-value $\cong 0.0364$). We performed an additional Granger test to verify if rationing condition influence current profitability:

$$f(Rnd_{it} \mid Rnd_{it-1}) = f(Rnd_{it} \mid Rnd_{it-1}, Rat_{it-1}) \tag{10}$$

The obtained results show that profitability is heavily influenced by the rationing condition, since the chi-square statistic for the effect of *Rat_it-1* on *Rnd_it* is $\cong 6.82$, with a *p*-value near to zero.

From the LR tests, we can conclude that the Italian bank system is not able to capture firms' capacity to improve expected performance and, more likely, that it screens out bad applicants on the basis of

an automatic monitoring system which denies credit to applicants having ex ante higher leverage than the control sample after adjusting for all available controls.

D. Statistical tests

Several statistical tests have been performed on the data to check whether valid inferences can be made conditionally on them. To test for endogeneity of regressors, we employed a DWH test by using as instruments *Pat*, *Zone*, *Dur*, Lev_{t-1}, Lev_{t-2}, Lev_{t-3}. The aim was that of testing for endogeneity of regressors such as $Rend_{it}$, $Sdroi_{it}$; it should however be noted that a non significant value of this test statistic only implies that, if present, endogeneity does not significantly influence parameter estimates (Davidson and Mackinnon 1993). The result (see Table 2) shows that ML parameter estimates are consistent and that we can avoid considering alternative methodologies. We should remark that we considered only those firms participating in both surveys with less than 250 employees. To check whether the regression results were robust to this sample selection, we employed the Heckman's Two Step Method (HTSM, Heckman 1976). The obtained *p*-value shows that there is not enough empirical evidence to assume selection bias is present. Last, we employed a so called Hausman-type test (HST in the following) for model misspecification (Hausman 1978). The basic idea of the Hausman-type tests is that MLe estimators [$\hat{\beta}$] and their potential alternative [$\tilde{\beta}$] are, under correct model specification, consistent with the *true* parameter β_o, while if the model is not correctly specified they do not converge to the same limit (Farhmeir and Tutz 1994). In the present context, we used as competitor a maximum Quasi-Likelihood estimator [$\tilde{\beta}$], with the test can be represented by:

$$w_h = (\hat{\beta} - \tilde{\beta})^T \hat{C}(\hat{\beta}, \tilde{\beta})^{-1} (\hat{\beta} - \tilde{\beta}) \tag{12}$$

where $\hat{C}(\hat{\beta}, \tilde{\beta}) = \hat{V} - \tilde{V}$ represents the distance between the asymptotic covariance matrix of $\hat{\beta}$ and

the asymptotic covariance matrix of $\tilde{\beta}$. It can be shown that w_h has, under certain regularity conditions, an asymptotic χ_r^2 distribution with $r = rank(C)$. Two issues arise when using HST; first, the finite sample distribution could not be adequately approximated by a χ_r^2 distribution. Second, despite the singularity of C, the estimated $\hat{C}$ may be nonsingular or have higher rank than. In any case, the test seems to suggest that our model is correctly specified ($\chi_{12}^2 \cong 0$), as shown by the corresponding *p*-value reported in Table 2.

VI. Concluding remarks

Our model, applied to a panel of Italian SMEs, show empirical results which are substantially consistent with the Stiglitz and Weiss (1981) model. In fact, firms' leverage is positively related to the presence of public subsidies; moreover, not rationed but subsidized firms present increased capital intensive investments, but profitability and leverage do not show a negative and significant correlation. The results are not conclusive, since alternative economic theories are consistent with them; only analyzing the process leading to projects' selection could improve the global understanding of the analyzed phenomena.

We find a negative and significant relation between leverage and *Risc*. This can be partially explained by the fact that profitability is not persistent in the analyzed sample; the hypothized negative correlation of profitability on leverage has been "replaced" in a certain sense by the negative and significant relation between leverage and *Risc* summarizing internal financing choice.

Our results seem to be consistent with the assumption that public subsidies with interest loan decrease the effective cost of debts for the firm but they do not change the rate for the banks. The result is that moral hazard and adverse selection are decreasing: in this way the banks can increase

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their credit supply. Since the firms feel the subsidy like a direct reduction of the payed interest rate, they demand more credit. The shift of both demand and supply curves of credit produce a higher equilibrium interest rate (gross of subsidies). Therefore once the subsidy has been granted, the bank system tends to increase the interest rate and the firms can use more credit but with a higher cost. According to Stiglitz and Weiss (1981) in an asymmetric information context the negative effects of rationing conditions are starker when compared with the positive effects of public subsidies and hence these negative effects persist in the credit market also after public subsidies.

However, caution is needed when considering that the present results substantially support the theory of Stiglitz and Weiss (1981); alternative theoretical specifications can be consistent as well and a final interpretation can be given only on the basis of empirical data about the efficiency of subsidies which, however, are not available in the analyzed sample.

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Appendix

Insert Table A.1

Insert Table A.2

Table 1. Descriptive Mean Values for *Lev*, *KL*, *Cde*, *Rnd*, and *Sdroi*

State	Lev	KL	Cde	Rnd	Sdroi
Sub=0	0.216	3.907	0.0476	0.275	0.124
Sub=1	0.243	4.310	0.0477	0.345	0.105
Rat=0	0.223	4.118	0.0458	0.317	0.116
Rat=1	0.264	4.201	0.0535	0.261	0.070
Exp=0	0.201	4.029	0.0444	0.269	0.126
Exp=1	0.239	4.122	0.0489	0.321	0.110
Pat=1	0.246	4.065	0.0501	0.285	0.115
Pat=2	0.214	4.254	0.0444	0.353	0.117
Pat=3	0.213	3.945	0.0472	0.289	0.008
Pat=4	0.207	3.932	0.0469	0.279	0.129

Table 2. Model for Leverage (*Lev*): Parameter Estimates and P-values for the DWH, HST and HTSM Tests

Variable	Coef.	Std. Err.	z	Pr>|z|
Sub	.0047395	.0024208	1.96	0.050
Rat	.0147798	.0031709	4.66	0.000
Pat=2	-.0093335	.0028692	-3.25	0.001
Pat=3	-.0066508	.0031763	-2.09	0.036
Pat=4	-.0217543	.0080791	-2.69	0.007
Loc=2	-.0030171	.0032134	-0.94	0.348
Sdroi	-.0234162	.0137051	-1.71	0.088
Exp=1	.0057229	.0032287	1.77	0.076
Rnd	-.0004478	.0032025	-0.14	0.889
Ris	-.1799716	.0439212	-4.10	0.000
Lev$_{t-1}$	.810062	.0097406	83.16	0.000
Dur	-.0001073	.00006	-1.79	0.073
Cons	.0503676	.0057575	8.75	0.000
Deviance	54.089			
Adj. R-squared	0.678			
F(12, 5955)	1044.041	p=0.0000		
DWH-p	0.413			
HST-p	0.999			
HTSM-p	0.414			

Table 3. Predicted Values for *Lev, Sdroi, Rnd, KL, Cde*

	Lev	*Sdroi*	*Rnd*	*KL*	*Cde*
Sub=1,Rat=1	.2798836	.2382039	.285591	4.435318	.0542873
Sub=1,Rat=0	.2421644	.252728	.2919653	4.325143	.0470096
Sub=0,Rat=1	.2503738	.2639192	.2022387	3.985524	.0555455
Sub=0,Rat=0	.2135617	.2605988	.2784716	3.968666	.0459072
Total	.2360496	.2555063	.2787287	4.171538	.0479965

Table A.1. Summary features of principal subsidy laws operating in Italy between 1989 and 1997

LAW	INSTRUMENTS	LIMITS TO POTENTIAL RECIPIENTS
Law 64	Guarantee fund up to 80% of the guarantee provided from the Credit consortia of private firms which supports the investment	Small and medium sized firms in South of Italy
Law 488	Grants for investment which renovate capital stock differentiated according to size and geographical location of the recipient. Grants are provided in three instalments of equal amount. The law is cofinanced by UE Structural Funds	Ranking based on three criteria (financial independence, investment independence from soft loan; employment impact)
Law 46/82(R&D program)	Soft loans which cover from 35% to 70% of total investment costs. The rate is 40-50% lower (small-medium firms), 75% lower (firms from the South) than the market rate. Grants up to 70% of investment costs	
Law 657/77 (Guarantee program)	"Guarantee fund" for medium-long term bank credit up to 50% of investment financing	Small/medium firms
Law 1142/66 (BEI-EEC program).	Soft loans for investment projects of small-medium firms in domestic or foreign currency up to 50% of total investment costs. Currency specific rates are decided by BEI and may be either fixed or variable	Small-medium firms
Law 240/81 (Consortia program)	Soft loans for a maximum of 10 year for material and immaterial investments up to 70% of total investment costs. The rate is 60% of market rate for firms in the South.	All firms belonging to "consortia"
Law 44/86 (Young entrepreneurs' program)		Firms and individuals in South, underdeveloped areas, and mountain areas of Italy
Law 1329/65 (Sabatini program)	Soft loans for leasing or purchase of tangible investment goods by small-medium firms up to a maximum of 3 billion liras with a variable rate under the market rate according to firm size and location	Small/medium firms
Law 949/52 (SME program)	Soft loans for leasing or purchase of tangible investment goods by small-medium firms up to a maximum of 4 billion liras with a variable rate under the market rate according to firm size and location	Small/medium firms
Law 227/77 (Export program)	Soft loans for medium long term export commercial credit (up to 85% of total commercial credit). The incentive consists of the positive difference between the market rate and that applied by the Italian firm to the foreign importer	
Law 394/81 (FDE program)	Soft loans for foreign direct investments of firms which are already exporting up to 85% of total investment costs with a ceiling of 3 billion liras. The rate is 40% of the market rate	Exporting firms
Law 49/87 (LDCFDE program)	Soft loans for investments in LDC countries at a rate of 1% for a maximum of 30 years	

Source: Bagella and Becchetti (1997).

Table A.2. Parameter Estimates (p-values between brackets) of Models for Risk (*Sdroi*), Profitability (*Rnd*), Debt (*Cde*) and Capital/labour Ratio (*KL*)

Response	*Constant*	*Lagged response*	*Sub=1, Rat=1*	*Sub=1, Rat=0*	*Sub=0, Rat=1*	R^2
Sdroi	0.0718	0.6265	0.0212	0.0223	0.0258	0.383
	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	
Rnd	0.2844	0.0040	0.0060	-0.0831	-0.0071	0.148
	(0.000)	(0.978)	(0.811)	(0.003)	(0.595)	
Cde	0.0147	0.7513	-0.0037	-0.0001	-0.0040	0.567
	(0.000)	(0.000)	(0.000)	(0.953)	(0.000)	
KL	0.5137	0.9046	-0.1106	-0.0130487	-0.1417066	0.799
	(0.000)	(0.000)	(0.000)	(0.538)	(0.000)	