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Investment-cash flow sensitivities, credit rationing and financing constraints

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Abstract

The controversy over whether investment-cash flow sensitivity is a good indicator of financing constraints is still unresolved. We tackle it from several different angles and cross-validate our analysis with both balance sheet and qualitative data on self-declared credit rationing and financing constraints. Our qualitative information shows that (self-declared) credit rationing is (weakly) related to both traditional a priori factors – such as firm size, age and location – and lenders' rational decisions based on their credit risk models. We use our qualitative information on firms that were denied credit to provide evidence relevant to the investment-cash flow sensitivity debate. Our results show that self-declared credit rationing significantly discriminates between firms that do and do not have such sensitivity, whereas a priori criteria do not. The same result does not apply when we consider the wider group of financially constrained firms (which do not seem to have a higher investment-cash flow sensitivity), which supports the more recent empirical evidence in this direction.

Keywords: financing constraints, credit rationing, investment/cash flow sensitivity

JEL classification numbers: D92, G21

Aiheuttavatko luotonsäännöstely ja rahoitusrajoitteet riippuvuuden yritysten investointien ja kassavirran välille?

Suomen Pankin keskustelualoitteita 15/2008

Leonardo Becchetti – Annalisa Castelli – Iftekhar Hasan
Rahapolitiikka- ja tutkimusosasto

Tiivistelmä

Yritysten investointien ja kassavirran välisen korrelaation tulkinnasta käydään taloustieteissä yhä vilkasta keskustelua. Viime kädessä kysymys on siitä, aiheutuuko investointien havaittu riippuvuus kassavirrasta yritykseen kohdistuvista rahoitusrajoitteista vai reagoivatko investoinnit sittenkin yrityksen tulo-odotusten muutoksiin, joita kassavirran vaihtelut ilmentävät. Tässä tutkimuksessa investointien kassavirtaherkkyyttä rahoitusrajoitteiden indikaattorina tarkastellaan empiirisesti eri näkökulmista. Tarkastelujen apuna käytetään sekä yritysten tasetietoja että kvalitatiivisia kyselyaineistoja yrityksiin kohdistuvista luotonsääntelystä ja rahoitusrajoitteista. Yritysten kokema luotonsäännöstely korreloi käytetyn kvalitatiivisen aineiston perusteella sekä perinteisten indikaattoreiden – kuten yrityksen koko, ikä ja maantieteellinen sijainti – että lainanantajien luottoriskimalleista laskettujen päätösten kanssa. Korrelaatiot eivät tosin ole kovin vahvoja. Tarkastelujen yksi keskeinen ajatus on löytää näyttöä yhteydestä yritykseen kohdistuvan luotonsäännöstelyn sekä sen investointien ja kassavirran korrelaation voimakkuuden välillä. Tulosten mukaan yrityksen raportoimaa tietoa luotonsäännöstelystä voidaan selvästi käyttää hyödyksi eroteltaessa toisistaan yritykset, joissa investointien riippuvuus kassavirrasta on selvä, niistä yrityksistä, joissa tätä riippuvuutta ei ole havaittavissa. Perinteiset indikaattorit eivät ole tällaisen erottelun kannalta hyödyllisiä. Yrityksiin kohdistuvalla luotonsäännöstelyllä ei kuitenkaan ole vastaavaa erotteluvoimaa laajemmin rahoitusrajoitteista kärsivien yritysten keskuudessa. Näiden yritysten investointien ja kassavirran välinen riippuvuus ei nähtävästi ole vertailuryhmän yrityksiin verrattuna voimakkaampaa. Nämä tulokset ovat sopusoinnussa tuoreissa tutkimuksissa raportoidun empiirisen näytön kanssa.

Avainsanat: rahoitusrajoitteet, luotonsäännöstely, investointien ja kassavirran korrelointi

JEL-luokittelu: D92, G21

Contents

1 Introduction

A main point in the literature on the empirical tests on the existence of financing constraints remains unsettled. The controversy is represented by the criticism of Kaplan and Zingales (hereafter also KZ) (1997) about the well known Fazzari, Hubbard and Petersen (hereafter also FHP) (1988) results on the higher investment-cash flow sensitivity of financially constrained firms.[1] KZ (1997) theoretically demonstrate that firm investment choices under profit maximising behaviour do not imply a monotonic relationship between financing constraints and the sensitivity of investment to cash flow. Therefore, they conclude, it is not correct to test for the existence of financing constraints by comparing investment cash-flow sensitivities of two subgroups based on given a priori cut-off criteria (ie small firms are financially constrained and large firms are not). This is because the cut-off does not necessarily separate a subgroup of more financially constrained firms in which the sensitivity is significantly higher, from one of less financially constrained firms in which the same sensitivity is significantly lower.

To test empirically their point, the two authors consider the 49 low-dividend payout firms that FHP selected a priori as more financially constrained in a given historical period. By using qualitative and quantitative information they divide the available firm-year observations into five groups according to the degree of financing constraints revealed by qualitative information.[2] They find that investment-cash flow sensitivity is not higher (it is in fact lower) for the subgroup of more financially constrained firm-year observations.[3] Empirical findings similar to those of KZ are found by Cleary (1999) who uses multiple discriminant analysis to identify firm financing constraints and finds that less constrained firms are those whose investment is more sensitive to cash flow. An original theoretical interpretation of these findings comes from Almeida et al (2004) who analyse the demand of precautionary savings of constrained and unconstrained firms and find that financially constrained firms have a higher sensitivity of cash (reserves) to cash flow which justifies the observed reduced sensitivity of their investment to cash flow.

Additional theoretical rationales supporting the criticism to the FHP interpretation of the investment-cash flow sensitivity come from Alti (2003). The author shows that FHP findings may simply result from a standard neoclassical model in which younger firms face uncertainty about their growth prospects and

[1] Findings which do not contradict FHP (1988) results are those of Bond and Meghir (1994), Withed (1992) and Hoshi et al (1991).

[2] The qualitative information is taken from the 10-K annual report containing information on financial conditions.

[3] The authors test financing constraints directly with the investment-cash flow equation and are therefore subject to all the critiques related to problems in measuring the marginal Tobin's q and the replacement cost of capital (Chirinko, 1993).

this uncertainty is resolved by cash flow realizations which, in part, represent the option value of their long-term growth potential. Calibration of the Alti (2003) model shows that investment is sensitive to cash flow for all firms after correcting for the Tobin's q. In this model, investment-cash flow sensitivity is higher for younger and smaller firms with high growth rates since these firms learn about their project quality through cash flow realizations. In a similar way, Gomes (2001) and Abel and Eberly (2002 and 2004) develop frameworks in which positive investment-cash flow correlations arise in absence of financial market imperfections.

FHP (2000) reply to KZ (1997) theoretical argument by identifying conditions under which the investment-cash flow sensitivity is larger for financially constrained firms. They argue that, as far as the constrained/unconstrained ratio of the second derivative of the supply curve for external finance is higher than the ratio of their marginal productivity of capital, the constrained group exhibits a higher investment-cash flow sensitivity (for analytical details on this point see section 2). Even though in this way they admit that the relationship between investment-cash flow sensitivity and financing constraints is non monotonic, FHP (2000) argue that the above mentioned condition on the slope of the supply of external finance is likely to be met for the a priori classification criteria (size, age, dividend payout, access to public debt) usually considered in the literature.

This paper aims to provide an additional contribution to this literature. It shows how the combination of survey and balance sheet information on credit rationing may provide additional evidence and disentangle many of the joint hypothesis/observational equivalence problems which prevent to shed light on the alternative interpretations of the investment/cash flow sensitivity.[4] More specifically, we argue that:

i) the newly available qualitative information on self declared credit rationing overcomes the KZ objection on the inaccuracy of the sorting criteria used for testing the correspondence between the investment/cash flow sensitivity and the presence of credit rationing. In section 2 we in fact show that, even though – according to KZ – such sensitivity is not monotonically increasing in the

[4] Empirical papers closely related to our are those of Cole (1998) and Sapienza (2002). Cole (1998) uses survey data to examine the likelihood of credit denial for small US firms, finding that firms without pre-existing relationships, younger firms and smaller firms are more likely to be denied credit. Sapienza (2002) documents that Italian firms with higher leverage and lower profitability are more likely to lose their credit lines. The difference of our approach with Cole (1998) is in the matching of qualitative and balance sheet data and the use of qualitative information on credit denial to shed light on the investment/cash flow sensitivity debate. The difference with respect to Sapienza (2000) is that our analysis is not limited to target banks' and borrower banks' prior to bank acquisition and the focus is the loss of credit lines while ours is on the more general issue of credit denial (without reference to the previous existence of credit lines).

degree of financing constraints, it is definitely higher for credit rationed than for non credit rationed firms.[5]

ii) the combination of survey data and balance sheet information allows us to disentangle the traditionally tested hypothesis (subgroups of firms defined according to a priori criteria exhibit excess investment/cash flow sensitivity and therefore are financially constrained) into three separate hypotheses: a) H0: a priori criteria used for subgroup classification significantly affect the probability of (self declared) financing constraints and/or credit rationing; b) H1: (self declared) credit rationed and/or financially constrained firms have higher investment/cash flow sensitivity; c) H2: a priori criteria used to discriminate among different degrees of financing constraints identify firms with higher investment/cash flow sensitivity (links among these hypotheses are illustrated in Figure 1).

Another contribution of this paper is in the construction of credit risk indicators based on the most relevant available results of the credit risk empirical literature.[6] This allows us to test whether credit denial is the rational outcome of the application of lender's credit risk measures or, alternatively, discrimination based on a priori criteria (size, age, etc).

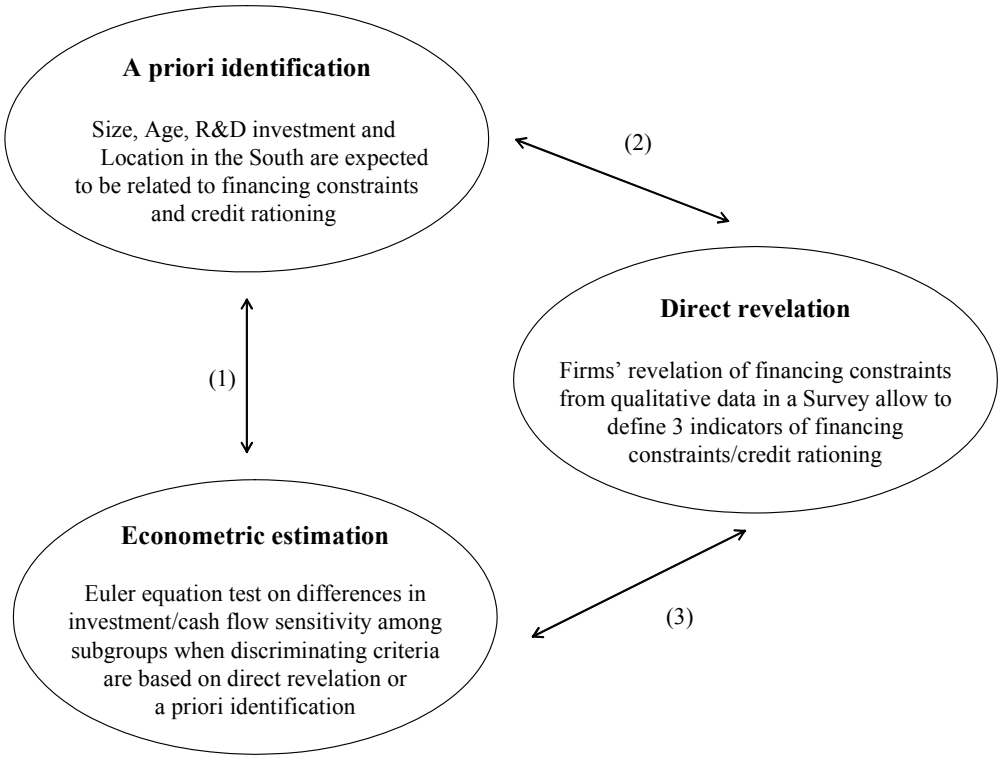
Finally, while most empirical papers on financing constraints work on samples of large companies listed at the US stock exchange, our paper focuses on a representative sample of mainly small and medium sized firms which are not public (the median size in our sample is 22 employees). We believe this is important since the impact of financing constraints or credit rationing on corporate behaviour may differ whether we consider large companies, which have alternative sources of external finance such as bond or equity issues, or small and medium sized companies, whose main source of external finance is bank debt.

The paper is divided into seven sections (including introduction and conclusions).

[5] For financing constraints we intend a wedge between the cost of external and internal finance. For credit rationing the impossibility of obtaining (additional) finance from external sources.

[6] Our use of credit risk indicators is different from that of Cleary (1999). We use these variables as regressors in the estimate of the determinants of self declared credit rationing and not as sorting criteria used to test the investment/cash flow sensitivity of firms with financing constraints.

Figure 1. **The 3 pillars' approach**



The three validating checks

(1) Do subgroups of smaller, younger, R&D investing and South located firms pass restrictions of the neoclassical Euler equation and present a significantly positive and higher cash flow coefficient?
(2) Do firms classified as financially constrained and/or credit rationed according to the 3 indicators from qualitative survey data are significantly smaller, younger, relatively more R&D investing and preferentially located in the South of Italy?
(3) Do subgroups of firms financially constrained and/or credit rationed according to the indicators from qualitative survey data pass restrictions of the neoclassical Euler equation and present a significantly positive and higher cash flow coefficient?

In the second section we explain why a credit rationing/non credit rationing cutoff – where we regard credit rationing as the extreme bound of a continuous measure of financing constraints – passes the KZ critique and may be consistently used to test the investment-cash flow sensitivity hypothesis. In the third section we describe our data and comment some descriptive findings on the characteristics of the subgroups of firms classified according to their financing constraints/credit rationing status. In the fourth section we use the credit rationing declaration as a dichotomous dependent variable. We test whether its realization is affected only by proxies of credit scoring evaluations, which are expected to be the rational

outcome of the bank screening process, or also by 'discrimination variables' such as firm size, age, R&D investing status and geographical location.

In the fifth and sixth sections we check the consistence among qualitative declarations, a priori criteria and the FHP test on investment-cash flow sensitivities. We estimate Euler equations for subgroups of firms in our sample, according to different sorting mechanisms based either on the traditional a priori criteria or on the qualitative declaration of credit constraints contained in our survey data. In the seventh section we comment our empirical findings.

2 Financing constraints, credit rationing and the KZ/FHP controversy

To explain how we devise our test we start from the benchmark used by KZ (1997) and FHP (2000) in their controversy: a one period model in which a representative firm chooses I to maximise the following

$$\mathrm{Max} F(I) - C(E, k) \tag{2.1}$$

where F(I) is the revenue function, I = W+E is investment which can be financed with internal (W) or external finance (E), while C(.) is a cost function convex in E (the amount of external funds raised) and depending on (k), a measure of the firm's wedge between internal and external finance.

By implicitly differentiating the first order condition we obtain an expression for the investment-cash flow sensitivity on which both KZ (1997) and FHP (2000) agree

$$\frac{dI}{dW} = \frac{C_{11}}{C_{11} - F_{11}} \tag{2.2}$$

where C_{11} is the second derivative of the cost function with respect to external finance and F_{11} is the slope of the marginal productivity of investment.

We start from the definition of financing constraints in which financially constrained firms are intended as those having a positive wedge between the cost of external and internal finance. As far as the intensity of financing constraints is higher, we end up to a point in which firms are refused additional credit at the existing interest rate. We may then consider this type of credit rationing as the

extreme which delimits the interval of a continuous measure of the intensity of financing constraints.[7]

Consider that, if we use as cut-off the rationing/non rationing status, we definitely meet the FHP (2000) and Zingales (1997) condition (equation 2) for the correspondence between higher financing constraints and higher investment cash-flow sensitivity. Credit rationing in fact implies that C_{11} tends to infinite and, therefore, $\lim_{C_{11}\to\infty} \frac{dI}{dW} = 1$, while, under the standard assumptions of $F_1 > 0$ and $F_{11} < 0$, $dI/dw < 1$ for the subgroup of non credit rationed facing less than infinite marginal cost of external finance. Hence, the latter have an investment/cash flow sensitivity which is significantly lower than that of credit rationed firms.[8]

A similar reasoning considers that, under the assumption that the denied credit would have been used for investment, credit rationed firms are able to finance with bank debt only a share α of their planned investment with $\frac{dI}{dW} = \frac{C_{11}}{C_{11} - F_{11}}$, while, for the remaining share (1–α), their sensitivity of investment to cash flow is, by definition, equal to one. On the contrary, non financially constrained firms succed in financing all their investment and, therefore, their sensitivity coincides with $\frac{dI}{dW} = \frac{C_{11}}{C_{11} - F_{11}}$. As far as α gets smaller in the credit rationed subgroup, marginal and average investment/cash flow sensitivity coincide and are necessarily higher than the corresponding average and marginal values for the non credit rationed subgroup.

3 The database

The opportunity of discriminating among the above mentioned different conclusions on the significance of the investment-cash flow sensitivity is provided by a unique source of information, the Capitalia Survey, which is the most important, periodically repeated, quantitative-qualitative survey on Italian firms.[9]

[7] Consider that KZ (1997) have similar information for the fifth subgroup of firm-year observations which they define as undoubtedly financially constrained. In this group they include companies 'in violation of debt covenants, cut out of the usual source of credit, renegotiating debt payment or forced to reduce investments for liquidity problem'. It is likely that some of these firms would fall into our credit rationed subgroup. Since firm-year observations for these firms are too few, KZ do not test the investment-cash flow sensitivity on this specific subgroup.

[8] Credit denial implies that the supplier of credit is not available to provide additional finance at any (no matter how higher) interest rate and is therefore equivalent as saying that the price for external finance for the borrower approaches infinity.

[9] The Survey has been previously known as Mediocredito Centrale Survey and the related questionnaire is entirely reported in Appendix 2.

The survey has been repeated every three years, starting from 1989, on a sample of around 4,500 firms with more than 9 employees. In order to maintain representativeness and take into account the high exit/entry rate of firms in the Italian market, the original sample has been reshaped for each wave. The different waves have been stratified by size classes based on the number of employees, geographical areas and macrosectors according to the Pavitt (1984) classification.[10] The value added per employee has been used as a stratifying factor.

For the purpose of this study we start from the last wave of the survey (1998–2000) and match information on firm financial status and balance sheet data from the previous waves. Balance sheet and income statement data come from the CERVED and AIDA databases. Qualitative data are obtained from questionnaires answered by a representative of each firm and then checked for inconsistencies.[11]

From the overall sample, we select firms for which complete balance sheet and income statement are available. We select firms with positive values of total assets, net worth and net sales.[12] The result is a balanced panel of 3,840 firms for the period 1992–2000 (Capitalia survey merged with balance sheets from CERVED and AIDA databases).

[10] Size classes: 11–20; 21–50; 51–250; 251–500; more than 500. Macroareas: North East (Trentino Alto Adige, Veneto, Friuli Venezia Giulia and Emilia Romagna), North West (Piemonte, Valle d'Aosta, Lombardia and Liguria), Central Regions (Toscana, Umbria, Marche and Lazio), South and Isles (Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia and Sardegna). Pavitt sectors: Scale Economies, Specialised, Traditional and High tech.

[11] All balance sheet data in the Capitalia Survey database are accurately checked. These data come from official sources: the CERVED database (first sample period) and AIDA – Bureau Van Dijk database (last two sample periods) which collects from CERVED all balance sheets for the same firms. CERVED obtains the information from the Italian Chambers of Commerce and is currently the most authoritative and reliable source of information on Italian companies. Qualitative data from questionnaire are filled by a representative appointed by the firm collecting information from the relevant firm division. The questionnaire has a system of controls based on 'long inconsistencies', namely inconsistencies between answers to questions placed at a certain distance in the questionnaire. In case of inconsistent information the firm is subject to a second phone interview. Firms which do not provide reliable information after being recontacted are excluded from the sample. A supplementary list of 8000 firms is built for each of the three year surveys in order to avoid that exclusions generated by missing answers or inaccuracies in the questionnaire, may alter the sample design. Substitutions follow the criteria of consistency between the sample size and the population of the Universe.

[12] In order to eliminate the influence of extreme values we follow the procedure adopted by Cleary (1999) and winsorize the data according to the following rules: i) return on equity (ROE) greater than 100 per cent or lower than -20 per cent; ii) return on assets (ROA) greater than 30 per cent or lower than -20 per cent; iii) ratio of total sales to total assets greater than 300 per cent or lower than 20 per cent; iv) ratio of investment to net fixed assets greater than 50 per cent; v) ratio of total sales to net fixed assets grater than 400 per cent; vi) ratio of cash flow to net fixed assets grater than 50 per cent; vii) ratio of total debt to net fixed assets grater than 200 per cent.

Results presented in the next sections are nonetheless robust to the inclusion of outliers. Evidence on this point is available from the authors upon request.

3.1 Some descriptive findings on the Capitalia sample

We inspect the properties of our balanced sample by looking at characteristics of firms by size classes (Table 1).[13]

Large firms are much older than small firms (approximately 39 against 23 years). Firms are also generally smaller in the Center and South of Italy. As expected, large firms are affiliated to groups (around 84 per cent against 12 per cent) and export (around 94 per cent against 64 per cent) in a much higher proportion than small firms. Significant differences in size classes also arise in R&D expenditures (76 per cent against 31 per cent). The reader can verify that medium firms are somewhere in the middle between these two extremes for each of the above mentioned variables.

When we look at bank-firm relationships we find that small firms have in higher proportion the first lender located in their same province (65 per cent against 47 per cent of large firms). Large firms have, on average, commercial relationships with around 10 different banks, while small firms only with 5. As expected, the share of debt held by the first lender is larger in small firms (41 against 19 per cent) and its relationship with the borrower is younger (17 against 19 years). Finally, a higher share of large firms obtains government subsidies (60 per cent against 38 per cent).

3.2 Some descriptive findings on credit rationing and financing constraints

To identify the subsample of credit rationed firms we consider the following questions in the survey: 1) in the year 2000 had the company desired more credit at the market interest rate? In case of affirmative answer the following two questions are asked: 2) had the company been willing to pay a higher interest rate in order to obtain more credit? 3) Did the company demanded in the year 2000 more credit without obtaining it?

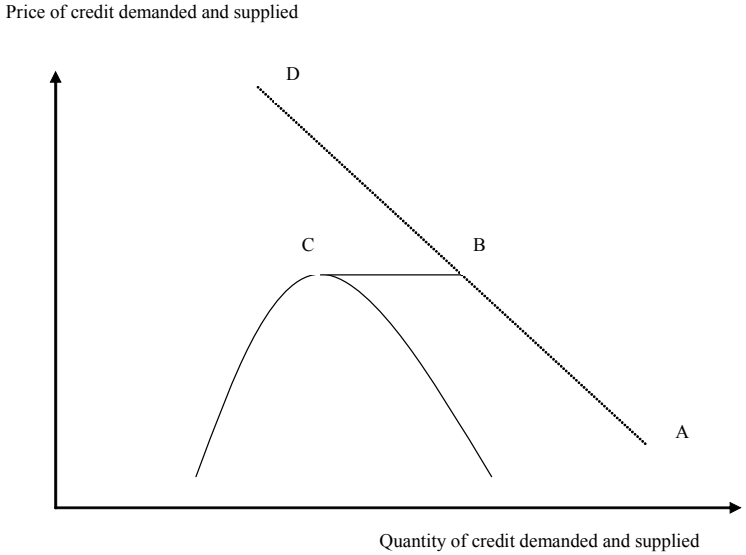
We classify as highlyrationed firms those answering positively to all of the three questions, deniedcred firms those answering positively to questions 1) and 3) and desirecred firms all firms answering affirmatively to question 1) (even when they do not answer positively to questions 2 and 3).

These three classifications identify some potential differences in the intensity of financing constraints. Consider, in fact, that an affirmative response to question 2) indicates the existence of a positive difference between demand and supply of

[13] We adopt here the standard EU classification which considers as small firms those below 50 employees, as medium firms those between 50 and 250 employees and as large firms those above 250 employees.

credit in correspondence of the additional (demanded and refused) marginal unit of credit (and, therefore, a gap between the reservation price and the market price at that point), while affirmative response to question 3) does not necessarily imply it (see Figure 2). Consider also that the set of the desirecred firms obviously includes as a subset the group of deniedcred and highlyrationed firms, but that many firms (around 14 per cent of the sample) respond affirmatively to question 1) and not to questions 2) and 3). These firms may just be financially constrained (being offered additional finance at a price higher than the market rate which they may have refused), but not necessarily credit rationed, given the absence of positive answers to questions 2) and 3).

Figure 2. **Admissible credit demand and supply schedules implied by Survey answers**



The demand for credit ABD is not incompatible with answers of the highly rationed and deniedcred subgroups. The kinked demand for credit ABC is consistent with answers of the deniedcred subgroups only. This is because the highlyrationed subgroup expressely declares to have a reservation price higher than the market price for the marginal unit of credit denied by the bank.

Descriptive evidence provided in Table 2a gives us preliminary information on the magnitude of self declared credit rationing and on the characteristics of firms which fall under this category.

Table 2a shows that, as far as our definition of financing constraints gets tighter, the share of financially constrained firms becomes smaller: desirecred firms are around 18.4 per cent of the sample, deniedcred firms are around 4.6 per cent, while highlyrationed firms are just around 2 per cent. In Table 2a we also

find that firms belonging to the three subgroups of financially constrained firms are smaller than the complementary sample (desirecred firms have mean and median size of respectively 43 and 20 employees against 74 and 22 of the control sample). Financially constrained firms are also younger in both mean and median with a difference with respect to the complementary sample ranging between 1 and 3 years.

With regard to the credit rationing geographical breakdown, Table 2b shows that, while only 14 per cent of sample firms are located in the South, this share jumps to 22 (25) per cent when we consider the deniedcred (highlyrationed) subgroup. In the same way, firms below 15 employees are 26 per cent in the overall sample and 31 (36) per cent in the deniedcred (highlyrationed) subgroup.[14]

Descriptive evidence provided in Table 3 also suggests that both the deniedcred and desirecred subgroups underperform with respect to their complementary samples in terms of both ROI and ROE which are up to 2 to 3 points lower in both mean and median. The difference in leverage among subgroups is also quite strong. For the deniedcred subgroup we observe a 10 point difference in median with respect to the control sample (0.18 against 0.8) which is reduced to a 5 point difference in the desirecred subgroup. The financial situation of the three subgroups is also worsened by the fact that highlyrationed firms have a median interest on net sales ratio of 4% against the 3% of the deniedcred and desirecred subgroups and the 2% of the overall sample.[15] On the other hand, we observe that mean and median productivity per worker (net sales per worker) among the same subgroups are not so different, even though firms in the three subgroups appear slightly less productive than the complementary sample.

4 Logit econometric findings: efficient screening vs discrimination

The literature of financing constraints has today its main focus on theoretical models and empirical tests aimed to solve the question of the relationship between the investment-cash flow sensitivity and the existence of financing constraints.

[14] This threshold of 15 employees identifies a discontinuity in firing costs determined by an Italian law (Law 300/1975) which establishes that workers fired by firms with more than fifteen employees must be reintegrated in their workplace if a judge concludes that they have been fired without giusta causa (ie fair grounds). The same 'fair grounds' rule cannot be applied to workers fired in firms with less than 15 employees

[15] More in detail, by observing the subgroup distribution of this variable at some relevant points we find that more than 25 per cent of the deniedcred (19 per cent of the desirecred) firms are above 50 per cent in the interest payment/net sales ratio against the 9 per cent (8 per cent) of the non deniedcred (non desirecred) firms. In the same way, more than 24 per cent (16 per cent) of deniedcred firms (desirecred firms) have an average leverage above .40 against about 10 per cent of firms in their respective complementary samples having leverage above that level.

We want to enlarge this focus by testing a related hypothesis which has relevant normative consequences. Are financing constraints under the extreme form of credit rationing the rational outcome of bank credit scoring processes based on balance sheet indicators? How much additional environmental variables (geographical location, size, age, R&D investment) matter in the credit rationing decisions? Were rationed firms relatively less productive ex ante than the rest of the sample?

We test these hypotheses by combining the traditional expected determinants of financing constraints in the specific literature with those identified as enhancing borrower risk in the bankruptcy risk literature. This literature has grown extensively since Beaver (1966) and Altman (1968) proposed the use of linear discriminant analysis to predict firm bankruptcy. After these first contributions, discrete dependent variable econometric models, namely logit or probit models, have become the most popular tools for credit scoring.[16] The main commercial application using logistic approach for default estimation is the Moody's KMV Risk-Calc Suite of models developed for several countries.[17] In recent years, alternative approaches using non parametric methods have been developed. These include classification trees, neural networks, fuzzy algorithms and k-nearest neighbours.

Since our sample is mostly composed by non listed firms, we focus on corporate credit risk modelling for privately held firms in order to choose credit scoring measures adequate to our needs. Although firms with unlisted equity or debt represent a significant fraction of the corporate sector worldwide, research in this area has been hampered by the scarce availability of public data. This implied that, for privately held firms, accounting based credit scoring models have been mostly applied.[18]

Table A1.1 in Appendix 1 reports the results of a selection of some of the most important published credit risk papers with the identification of the estimated vector of variables and parameters which maximize the likelihood that a borrower is going to fail. We test whether some of these credit risk predictors have relevance if added to the vector of traditional determinants of financing constraints. In order to avoid correlation problems between balance sheet indicators and credit risk predictors we test the balance sheet and credit risk variables separately, in the following two logit model specifications written in compact form

[16] See Barniv and McDonald (1999) for a detailed survey on the issue.
[17] See Dwyer et al (2004).
[18] Although credit scoring has well known disadvantages (see for example Allen, 2002), it remains the most effectively and widely used methodology for the evaluation of privately-held firms' risk profiles.

$$\text{Raz(Fc)}_i = \alpha_0 + \sum_{j=1}^{12} \alpha_j \text{Identity}_{ij} + \sum_{k=1}^{6} \gamma_k \text{Balance}_{ik} + \varepsilon_i \quad (4.1)$$

$$\text{Raz(Fc)}_i = \alpha_0 + \sum_{j=1}^{12} \alpha_j \text{Identity}_{ij} + \sum_{l=1}^{7} \delta_l \text{Creditscore}_{il} + \varepsilon_i \quad (4.2)$$

where the dependent variable Raz(Fc) is, alternatively, one if the firm belongs to the desirecred, deniedcred or highlyrationed subgroup and zero otherwise. Our twelve identity variables include ten dichotomous dummies (Small, Young, South and Isles, Export, Group, R&D, Local bank, Main fin. by bank debt, Subsidy and Art. 18) taking the value of one if the firm has the relevant characteristic and zero otherwise. Among them, Local bank is a dummy for firms whose main lender's headquarter is located in the same province, Main fin. by bank debt is a dummy for firms whose main source of external finance is bank debt and the Art. 18 dummy takes the value of one for firms with less than 15 employees and zero otherwise. This variable tests the effect on credit rationing of the discontinuity in firing costs established by an Italian law (Law 300/1975) which states that workers fired by firms with more than 15 employees must be reintegrated in their workplace if they are judged to have been fired without giusta causa (ie fair grounds). The remaining Identity variables are Number of banks (number of different banks with which the firm has commercial relationships), Debt share (share of bank debt on total non short term debt).

Our vector of balance sheet variables (Balance) includes the following regressors calculated on 1998 balance sheet values: ROS, ROI, ROE, Leverage, Interests on Net Sales and Net Sales per worker which measure, respectively, the value of operating profits over net sales, operating profits over total assets, net earnings over net worth, firm leverage debt, interest payments over net sales and net sales over the number of workers.

Finally, we identify a vector of credit risk indicators (Creditscore) as follows. We select a limited number of published empirical papers (Table A1.1 in Appendix 1) in which credit risk measures have been successfully tested out of sample in given periods and countries. We calculate 1998 values for the credit risk predictor by applying the methodology of each of these papers. Unfortunately our data do not allow to construct all the credit risk indicators reviewed.[19] The scoring variable is therefore introduced as an additional regressor in our estimate where we test, one by one, the inclusion of the credit scores from each of the reviewed papers. Results of specifications including insignificant indicators are omitted for reasons of space and are available upon request. The indicators which result significant and are finally selected are those suggested by Altman (1984), Altman, Baidya and Riberio-Dias (1979), Zmijeski (1984), Shumway (2001) and Saretto

[19] Indicators tested are the ones marked with * in table A1.1 in Appendix 1.

(2004).[20] The correlation matrix between balance sheet and credit risk indicators is provided in Table 4.

All estimates in different specifications are run at a constant number of observations to avoid that our results be driven by sample selection effects caused by missing variables. Results are presented in Tables 5, 6, 7 and 8 where we test, respectively, the determinants of affiliation to the group of desirecred (but non deniedcred and non highlyrationed), of deniedcred and of highlyrationed.

The question whether rationed firms were ex ante more indebted has undoubtedly a positive answer. Table 5 shows that rationed firms have significantly higher interest payment/net sales ratios. The inclusion of the significant credit risk indicators (Tables 6, 7 and 8) shows that financially constrained firms would result as significantly more riskier if bank screening were based on the reported risk measures. According to the Altman's indicator (1984) a high Z-score is associated with a good financial position of the firm and this means that the negative sign we find in logit estimates is consistent with our interpretation of efficient screening. On the other side, the Zmijeski's indicator (1984) is increasing in the probability of failure which is, again, consistent with the positive sign we get in logit estimates.[21]

The interesting finding though, is that, after correcting for performance, indebtedness and risk measures, identity variables such as location in the South, size, R&D investment status, age and the number of banks still remain (weakly or strongly) significant, even though only in some of the presented estimates. Our interpretation is that credit rationing is a mix of efficient screening and discrimination from the lender. On the one hand, the significance of the reported credit risk indicators leads us to consider the imposition of financing constraints as an efficient screening process and not as discrimination among firms with similar performance characteristics. On the other hand, the (weak or strong) significance of identity variables after correcting for performance, indebtedness and risk measures may be explained in two different ways. First, these variables are proxies for additional risk factors not captured by previously considered balance sheet indicators. Second, we have enough measures of risk, indebtedness and performance in the estimate to capture all risk dimensions and, therefore, the

[20] Shumway (2001) and Saretto (2004) reproduce both Altman (1984) and Zmijeski (1984) indicators proposing different approaches for their estimations and applying them to different samples. For this reason we consider two indicators for Shumway (2001) (Shumway Altman and Shumway Zmijeski) and two for Saretto (2004) (Saretto Altman and Saretto Zmijeski).

[21] The Z-model implies that all the accounting ratios included in the function have positive coefficients. And this is in fact true for the Altman (1984), Altman Baydia (1979) and Saretto (2004) Altman indicators. On the contrary Altman's coefficients, as estimated by Shumway (2001), have negative signs and this explains the counterintuitive sign of the Shumway–Altman indicator in our logit estimates. The same is true for the negative sign of the Zmijeski Up (Unweighted Probit) indicator whose coefficients have positive sign.

significance of identity variables supports the hypothesis of discrimination of firms along these characteristics.

The intepretation of the significance of some of the identity variables deserves further attention. With regard to the South variable, consider that the wave of mergers and acquisitions occurred in the Italian banking system in the 90's has transferred, for large part, ownership of overindebed banks of the South in the hands of banks of the North.[22] The empirical analysis on the effects of this change shows that the process of bank concentration and ownership transfer has increased bank performance (Focarelli et al, 2002) but some authors, on the other side, complain that it has also generated a loss of local information and reduced credit to local firms, as shown by the dramatic drop in the total volume of financed investment in the area (Mattesini and Messori, 2004). This should explain why location in the South is significant in the credit rationing estimate in the 1998–2000 sample and not in the 1989–1991 sample (Bagella et al, 2001).

The alternative interpretation however is that the South variable proxies risk factors not captured by credit risk indicators. To this purpose Guiso, Sapienza and Zingales, (2004) and Jappelli, et al (2005) specifically show that regional differences in the efficiency of the Italian courts has a notable effect on the availability of credit to small businesses.

Another important result (the inverse relationship between size and credit rationing) seems to be a constant in Italian empirical analyses on financing constraints (Bagella et al, 2001). The important additional point in our estimate is that, with the exception of the desirecred subgroup, we find that, being below the 15 worker threshold generates an additional significant effect on the probability of being credit rationed, net of the effect of being below the 50 worker threshold, measured by our size dummy (Table 5). As already mentioned above and in section 3.2, we test the impact of this additional threshold since regulation of the Italian job market establishes significantly lower firing costs for firms below 15 employees, thereby creating a downsizing incentive. Our analysis does not reject the hypothesis that the incentive to remain small produced by the law has negative consequences on the availability of external finance (Tables 5–8).

Another apparently unexpected result is the significance of the local bank dummy on the desirecred (but not on the deniedcred and highlyrationed) variable. The two most likely interpretations are that: i) a relationship with a local (and presumably smaller) bank is a signal of firm weakness; ii) if credit markets are segmented the local bank has some monopoly power which translates into a wedge between external and internal finance.

Finally, an apparently counterintuitive finding is the weak positive effect of the number of lenders, but only when the dependent variable is represented by

[22] Some relevant examples of it are Banco di Napoli acquired by S. Paolo IMI, Banco di Sicilia acquired by Capitalia and Banco di Sardegna acquired by Cassa di Risparmio di Reggio Emilia.

affiliation to the deniedcred subgroup (Table 5). This is at odd with the hypothesis of Detragiache, Garella and Guiso (2000) who argue that multiple banking reduces the probability of credit rationing and von Thadden (1995) finding that a higher number of lenders reduces banking rent extraction. On the other side, though, it is compatible with results of Bolton and Scharfstein (1996) showing how multiple banking may make debt renegotiation more difficult and, mainly, with those of Petersen and Rajan (1994) showing that the passage from single to multiple borrowing increases the cost of credit and reduces its availability. Furthermore, the choice of multiple borrowing may be pursued by the firm to increase its 'opacity' with the result of a relatively lower production of information in equilibrium.

Overall, our results suggest a profile of credit rationed firms as firms which tend to be relatively small and preferentially located in the South. Credit rationed firms are also more indebted on average and financially constrained firms have higher scores in terms of credit risk indicators (Tables 6–8).[23]

5 Our approach to solve observational equivalence in econometric tests of financing constraints

Four are the main methods employed in the financing constraints empirical literature to test the investment/cash flow relationship: i) the direct estimate of the investment demand function obtained from first order conditions of standard profit maximization in which the shadow value of capital (marginal Tobin's q) is proxied by the average Tobin's q (Fazzari, Hubbard and Petersen, 1988; Gertler and Hubbard, 1988; Kaplan and Zingales, 1997 and 2000, for the US; Hayashi-Inoue, 1988; Hoshi, Kashyap and Sharfstein, 1991, for Japan; Devereux and Schiantarelli, 1989; Schiantarelli and Georgoutsos, 1990, for the UK); ii) the Euler equation approach which combines two first order conditions to avoid the inclusion of the marginal Tobin's q among regressors when testing for financing constraints (Bond and Meghir, 1994; Withed, 1992; Hubbard, Kashyap and Withed, 1995); iii) an estimate of the investment demand function in which the shadow value of capital is proxied by a VAR forecast of firm fundamentals observable to the econometrician (Gilchrist and Himmelberg, 1995); iv) calibration methods in which artificially generated data originated by stochastic dynamic models are used to estimate the investment-cash flow relationship and to

[23] Logit estimates for the desirecred subgroups including desirecred firms which are also in the highlyrationed and deniedcred subgroups have also been performed without significant changes in our findings. Results are omitted for reasons of space and are available from the authors upon request.

test the consistency between a given original theoretical framework and the stylized empirical findings (Moyen, 2004; Caggese, 2004).

Among most relevant shortcomings, the first method has the problem of measurement errors in the marginal Tobin's q which generate biases in the measurement of the investment-cash flow relationship. It shares with the other methods also two additional problems relative to i) the difficulties in finding the correct depreciation rates when estimating the replacement cost of capital (Chirinko, 1993; Schiantarelli, 1996); ii) the ambivalent information provided by the cash flow variable which may proxy for both financing constraints and future investment opportunities when firms and markets are still learning how to extract the latter from the Tobin's q (Gilchrist and Himmelberg, 1995).

Our choice of the Euler equation approach for the econometric analysis of financing constraints hinges upon these considerations and on the characteristics of our dataset (see section 3) in which very few firms are public and it is almost impossible to obtain a reliable measure of the average Tobin's q from balance sheet data.

Furthermore, the availability of the qualitative source of information on credit rationing provides us with an important opportunity. Without qualitative information on financing constraints in fact the traditional test on the investment/cash flow sensitivity of subgroups of firms classified according to a priori criteria (size, age, etc.) is actually a test of two different hypotheses: i) H0 – a priori criteria are significantly related to higher financing constraints (ie small and young firms have higher financing constraints); ii) H1 – firms with higher financing constraints exhibit excess investment-cash flow sensitivity.

Alti (2003) and Abel and Eberle (2003 and 2004) have shown that the findings of younger and smaller firms with excess investment-cash flow sensitivity do not necessarily imply that H0 and H1 are not rejected, since excess investment-cash flow sensitivity may simply arise from the fact that younger and smaller firms learn from current cash flow about future investment opportunities (and they therefore tend to invest more if their cash flow is higher).

With our information we may avoid observational equivalence between Alti (2003) and FHP rationales by testing separately H0 and H1 using credit rationing as discriminating factor, thereby overcoming the KZ objection to FHP discriminating criteria (see introduction and section 2). Finally, we may test whether the classical a priori criteria used for subgroup classification, identify firms with higher investment/cash flow sensitivity (hypothesis H2).

To estimate investment-cash flow sensitivities we follow the Bond and Meghir (1994) approach.[24] In addition to the considerations developed in the previous section, this approach allows to consider two features which we believe are important in the Italian bank-firm relationship: the presence of tax advantage for borrowing and for retained earnings against new shares issues, and of bankruptcy costs. [25]

In the model firms are assumed to follow three regimes. In the first regime firms pay dividends and do not issue new shares ($D_t > 0$, $N_t = 0$). They finance investments partly with debt and partly with retained earnings. Following their optimal debt policy, they borrow until they are indifferent between one extra unit of debt and one extra unit of retained earnings.

In the second regime firms do not pay dividends and do not issue new shares ($D_t = 0$, $N_t = 0$). In this regime firms can finance themselves only by borrowing, because new investment opportunities do not compensate high costs of equity issues. Facing a cost of borrowing which increases in the amount of debt (in terms of interest rate and bankruptcy probability), these firms do not finance all the projects that would have been profitable in case of adequate availability of self-financing. Firms in this second regime should present excess sensitivity of investments to cash flow, because retained earnings reduce the amount of borrowing and the cost of marginal investment financing. Considering our Survey, firms declaring that they were denied additional credit and firm declaring that they would have desired more credit should behave like those in regime 2.

The third and last regime is the one which considers firms that do not pay dividends but issue new shares ($D_t = 0$, $N_t > 0$). In this case, profits from new investment opportunities more than compensate lemon costs of external finance. This is why new projects are nonetheless financed, even though at a higher cost in absence of internal finance and borrowing.

Following Bond and Meghir (1994) we obtain the model of investment to be tested, by specifying the net revenue function as follows

$$\Pi_t = p_t F(K_t, L_t) - p_t \frac{1}{2} b K_t [(I/K)_t - c]^2 - w_t L_t - p_t^I I_t \qquad (5.1)$$

[24] Bond and Meghir (1994) solve the problem of a firm by maximising its net present value at the beginning of period t under the usual law of motion of capital stock $K_t = (1-\delta)K_{t-1}+I_t$, where δ is the depreciation rate and I_t is gross investment. The firm's share value V_t is derived from the capital market arbitrage condition $(1 + (1-m_{t+1})\iota_t)(V_t-(1-m_t)\vartheta_t D_t + N_t) = E_t[V_{t+1}]-\zeta_{t+1}(E_t[V_{t+1}] -V_t-N_t)$, where m_t is the rate of personal income tax on dividend and interest income at time t, ι_t is the interest rate on the riskless asset, θ_t is the dividend received on one unit of firm's earnings distributed after corporate tax, D_t is dividends paid in period t and N_t is the value of new share issued in period t. Defining z_t as the effective capital gains tax rate to be the present value in period t of the tax paid by the marginal shareholder on a unit of capital gains made between periods t and t+1 the ζ_{t+1} is the value of that tax in period t+1.

[25] Similar considerations are developed by Bonato, Hamaui and Ratti (1993).

where the first term is a constant return to scale production function, the second term is a symmetric adjustment-cost function, linearly homogeneous in (K, L), and p_t^I, p_t and w_t are, respectively, the price of investment goods, the price of the firm's output and a vector of prices for the variable inputs L_t. Computing first derivatives with respect to capital stock and investment, and replacing them in (5.1) we get[26]

$$\left(\frac{I}{K}\right)_{t+1} = c(1-\phi_{t+1}) + (1+c)\phi_{t+1}\left(\frac{I}{K}\right)_t - \phi_{t+1}\left(\frac{I}{K}\right)_t^2 - \frac{\phi_{t+1}}{b\alpha}\left(\frac{CF}{K}\right)_t + \frac{\phi_{t+1}}{b\alpha}J_t + \frac{\phi_{t+1}}{b(\varepsilon-1)}\left(\frac{S}{K}\right)_t - \frac{(1+r_t)v_t}{b(1-\delta)\alpha}\left(\frac{D}{K}\right)_t^2 + v_{t+1} \quad (5.1)$$

which can be specified for the empirical estimate as

$$\left(\frac{I}{K}\right)_{it} = \beta_1\left(\frac{I}{K}\right)_{i,t-1} + \beta_2\left(\frac{I}{K}\right)_{i,t-1}^2 + \beta_3\left(\frac{CF}{K}\right)_{i,t-1} + \beta_4\left(\frac{S}{K}\right)_{i,t-1} + \beta_5\left(\frac{D}{K}\right)_{i,t-1}^2 + d_t + \alpha_i + v_{it} \quad (5.2)$$

where firm (α_i) and time (d_t) specific effects help to capture the impact of the unobservable user cost of capital. Summary statistics of variables used in the estimates are presented in Table 9. Given the influence of outliers on balance sheet data we control for outlier effects as explained in footnote 12. According to the specification of the profit function, β_1 should be positive (not necessarily greater than one if we assume the presence of sunk costs of investment) and β_2 should be negative. We espect β_3 to be negative if the firm is not financially constrained and positive for firms in regime 2. In presence of imperfect competition β_4 is expected to be positive. Finally, β_5 should not be significant with the Modigliani-Miller assumption of debt irrelevance for firms in the first and third regimes, while we expect it to be negative for firms in the second regime under costly bankruptcy and under financing costs which are increasing in the amount borrowed.

[26] For the complete derivation of the Euler equation see Bond and Meghir (1994). In our equation (5.2) we have $\phi_{t+1} = (1 + \rho_{t+1})/(1-\delta)$ where $(1 + \rho_{t+1}) = (1 + r_{t+1})(p_t/p_{t+1})$ and ρ_{t+1} is the real discount rate. The term $\alpha = 1-(1/\varepsilon)$ is greater than 0 with the demand price elasticity (ε) assumed constant and greater than 1. $(CF/K)_t$ is the ratio of real cash flow to capital stock and is $(CF/K)_t = (p_tY_t - w_tL_t)/(p_tK_t)$; J_t represents the user cost of capital and is expressed as $J_t = (p_t^I/p_t)\{1-p_{t-1}^I(1-\delta)/[(1+r_t)\ p_t^I]\}$; $(D/K)_t^2$ is the debt over capital stock ratio expressed as $(D/K)_t^2 = (p_t^I/p_{t+1})[D_t/(p_t^iK_t)]^2$ and the term v_{t+1} reflects the forecast error. A standard assumption to avoid the need of specifying a parametric form for the production function F(.) is that $\partial F/\partial L$ can be replaced by $w/\alpha p$.

6 Results from Euler equation estimations

The specification of firm investment demand presented in (5.3) contains lagged values of the dependent variable among regressors. Considering this Arellano and Bover (1995) and Blundell and Bond (1998) demonstrate that the correlation between the lagged dependent variable and the error term makes OLS estimates biased and inconsistent, even when error terms are not serially correlated.

To address this issue the usual approach is that of using 'first generation' first-differenced GMM which we also follow to estimate Euler equations in our paper.

To estimate equation (5.3) we use the following variables: pS (net sales); p^iI (total new fixed assets); pCF (cash flow which is operating profit before taxes plus depreciation); D (total debt repayable in more than one year); p^iK= net capital stock at replacement cost. To calculate p^iK we use the usual perpetual inventory formula: $p_{t+1}K_{t+1} = p_tK_t(1+\delta_t)(p_{t+1}/p_t) + p_{t+1}I_{t+1}$. The depreciation rate is estimated applying the legal depreciation coefficients for land and machinery (land and building share on total capital stock 30% and plants and machinery 70%). Our instruments are two period lagged values of non dummy (or dummy interacted) regressors.

In table 10 we present our findings from Euler equation estimation when using self declared credit rationing as subgroup criteria. Diagnostics on these estimates show that residuals are first order, but not second order, autocorrelated and the Sargan test does not reject the null hypothesis of the overall validity of the instruments we use in our estimates.[27]

Model coefficients in the estimate of the unsorted sample (Table 10, column 1) show the expected signs on cash flow (negative), firm output (positive), debt (negative or insignificant) and on the level (positive) and square (negative) of the investment /capital ratio.

A positive and lower than one coefficient for the level of the investment /capital ratio may be interpreted in the logit of the real option hypothesis (Dixit and Pindyck, 1994) (negative c in equation (5.1)) on investment adjustment costs is supported here against the traditional Bond and Meghir (1994) specification in which c is positive.

Overall, these findings do not reject the investment choice model proposed by Bond and Meghir (1994). Columns 2, 3 and 4 of Table 10 show that the hypothesis of higher positive sensitivity of investment to cash flow for the subgroups of deniedcred and highlyrationed firms is not rejected. The apparently surprising result on the desirecred subgroup is that the dummy measuring the excess sensitivity of the cash flow coefficient for these firms is significant and negative. This finding may be interpreted as reconciling different perspectives in

[27] Exceptions are the two estimates in which we test the cash flow/investment sensitivity of the R&D investing firms and the desirecred subsamples.

the financing constraint literature. When the extreme form of financing constraints applies (deniedcred and highlyrationed subgroups), the hypothesis of excess sensitivity of investment to cash flow is not rejected. Under the more generic case of financing constraints (wedge between costs of external and internal finance) the Almeida et al (2004) argument seems to apply and the higher sensitivity of cash reserves and precautionary savings of these firms may generate the result of their (negative) excess sensitivity of investment to cash flow, thereby supporting also KZ findings on this issue.

In Table 11 (columns 2, 3, 4 and 5) we use traditional a priori such as size, age, R&D investment status and location in the South as subgroup criteria. In this case we do not find any evidence of higher (positive) sensitivity of investment to cash flow for the subgroup of smaller, younger, R&D investing and located in the South firms.

How the overall picture of our results relates to the financing constraints and investment/cash flow sensitivity debate? First, in relation to the FHP argument it seems to show that, on the one hand, a priori criteria are significantly (even though sometimes weakly) correlated to the most extreme forms of financing constraints represented by (self declared) credit rationing. This relationhip holds even after controlling for credit risk measures which are usually not considered in this literature. On the other hand, though, a priori criteria indicated by FHP do not seem to be strong enough, at least in our sample, to become efficient sorting criteria in the identification of subgroups of more financially constrained firms with higher investment/cash flow relationship.

Second, our balance sheet/qualitative approach allows to disentangle the observational equivalence problem in the interpretation of the investment/cash flow sensitivity outlined by Alti (2003). In our data we find support for the hypothesis that the investment/cash flow sensitivity is associated to self declared credit rationing and not to the uncertainty about growth prospects of younger firms.

Third, our findings are somehow consistent with the KZ hypothesis on the non monotonicity of the investment/cash flow relationship with respect to financing constraints. A priori criteria are shown to be not sufficient to discriminate between subgroups of less (more) financially constrained firms with lower (higher) investment/cash flow sensitivity. In section 2 of the paper, by using the common benchmark in the FHP/KZ debate, we argue that a significant difference in the investment/cash flow sensitivity arises only when we consider the extreme form of financing constraints represented by credit rationing and our findings are consistent with this hypothesis.[28]

[28] GMM estimates for the desirecred subgroups including desirecred firms which are also in the highlyrationed and deniedcred subgroups have also been performed without significant changes in our findings. Results are omitted and available from the authors upon request.

7 Conclusions

The missing link of qualitative survey data in which firms directly declare whether they have been credit rationed usually prevents the solution of the controversy among different interpretations of the investment/cash flow sensitivity. In this paper we exploit the opportunity (availability of qualitative survey data) provided by the Capitalia survey database to shed light on this issue. First, we find that standard credit risk measures extracted from previous literature findings, together with 'discrimination' variables, significantly affect the probability of self declared credit rationing. The latter include some of the a priori criteria (size, age) used by Fazzari et al (1988 and 2000) to discriminate among subgroups in their test on financing constraints and investment/cash flow sensitivity. Second, we observe that the subgroup of self declared credit rationed firms has excess positive investment/cash flow sensitivity, differently from the complementary subgroup, while this does not occur when we use traditional a priori criteria.

Overall, we believe that our findings support the hypothesis that only the credit rationing status may overcome the KZ critique on the non monotonicity between investment-cash flow sensitivity and financing constraints. On their side, a priori criteria appear to be significantly related, in the expected direction, to the probability of credit rationing. Taken as themselves though, they demonstrate to be not enough good predictors of such probability for their successful use in the financing constraint, investment/cash flow literature.

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Table 1. **Descriptive features of the Capitalia sample (size breakdown)**

Our sample includes 3,840 firms. Firms are grouped by average number of employees in the period 1998–2000. Small firms are those with less than 50 employees, medium firms are those with less (more) than 250 (50) employees, large firms are those with more than 250 employees. Pavitt is sector classification as defined by Pavitt. Macroareas: North West, North East, Central Regionsa and South and Isles. Group, Susidy, R&D and Export are the % of firms that respectively belong to a group, have been subsidised, have invested in R&D and export part of their production. Age is the difference between 2001 and firm's year of birth. Number of banks is the number of banks with which the firm has commercial relationships. Debt share is the share of the overall bank debt held by the main lender. Local bank means that the main lender is located in the same province. Duration is the length in years of the main bank relationship.

		Small	Medium	Large
Pavitt	traditional	55.30	43.77	40.82
	scale economies	18.51	15.08	23.67
	specialised	22.38	32.30	28.16
	high tech	3.80	8.85	7.35
Macroareas	north west	35.32	43.11	44.90
	north east	26.98	29.51	37.14
	central regions	23.18	14.10	12.24
	south & isles	14.51	13.28	5.71
Group		12.07	31.58	84.43
Subsidy		38.27	56.03	60.50
R&D		31.11	57.00	76.67
Export		63.51	86.84	93.88
Age		23.24*	30.30*	38.66*
Number of banks		4.46	7.13	10.51
Debt share		41.10	34.76	19.31
Local bank		65.39	57.65	47.47
Duration		17.02*	19.31*	19.12*

Percentage values except * which are averages.

Table 2a. **Identity features of the Capitalia sample (credit rationing breakdown)**

Our sample includes 3,840 firms. Firms are grouped by intensity of financing constraints. Total weight is the percentage of firms belonging to the desirecred, deniedcred and highlyrationed group (for group definitions see section 3.2). Size is the average number of employees in the period 1998–2000. Age is the difference between 2001 and firm's year birth. Number of banks is the number of banks with which the firm has commercial relationships in the considered period. Debt share is the share of the overall bank debt held by the main lender.

		All	Desirected		Deniedcred		Highlyrationed	
Total weight			yes	no	yes	no	yes	no
			18.42	81.58	4.62	95.38	1.97	98.03
Size	mean	7784	43.17	74.41	56.78	68.57	46.84	78.46
	median	22.00	20.00	22.33	20.67	21.67	20.33	22.00
	sd	283.90	82.89	264.07	145.72	245.57	98.21	286.38
	obs.	3853	696	3083	170	3507	76	3777
Age	mean	25.34	23.74	25.39	24.22	25.11	21.55	25.42
	median	21.00	19.00	21.00	18.00	21.00	18.50	21.00
	sd	18.51	19.81	17.63	20.75	17.93	16.58	18.54
	obs.	3853	696	3083	170	3507	76	3777
Number of banks	mean	5.23	5.34	5.21	5.82	5.17	5.43	5.23
	median	4.00	4.00	4.00	5.00	4.00	4.00	4.00
	sd	3.69	3.59	3.69	4.09	3.62	3.91	3.68
	obs.	3806	695	3072	169	3497	75	3731
Debt share	mean	39.53	40.86	39.17	41.92	39.44	43.15	39.45
	median	30.00	40.00	30.00	40.00	30.00	40.00	30.00
	sd	24.08	22.02	24.61	23.77	24.06	24.09	24.08
	obs	2666	554	2094	138	2433	61	2605

Table 2b. **Identity features of the Capitalia sample (credit rationing breakdown)**

Our sample includes 3,840 firms. Firms are grouped by intensity of financing constraints. Size classes: small, medium and large are firms with respectively less than 50, between 50 and 250 and more than 250 employees. Macroareas: North West, North East, Central Regions, South and Isles. Art. 18 refers to the Italian Law 300/1975 increasing firing costs for firms with more than fifteen workers (footnote 14 in the paper). Share of debt is the share of the overall bank debt held by the main lender. Main financing by bank debt, Local bank, Export, Group, Subsidy and R&D are the percent of firms that respectively have financed their investments mainly with bank debt, whose main lender is located in the same province, export part of their production, belong to a group, have been subsidised and have invested in R&D.

		All	Desirected		Deniedcred		Highlyrationed	
			yes	no	yes	no	yes	no
Size Classes	small	77.81	83.91	77.33	82.35	78.87	81.58	77.73
	medium	15.83	13.22	16.7	12.94	15.74	14.47	15.86
	large	6.36	2.87	5.97	4.71	5.39	3.95	6.41
	all	100	100	100	100	100	100	100
Macroareas	north west	37.17	33.48	37.69	35.29	36.7	28.95	37.33
	north east	28.03	21.26	29.58	17.65	28.69	13.16	28.33
	central regions	21.05	23.42	20.76	24.71	21.04	32.89	20.81
	south & isles	13.76	21.84	11.97	22.35	13.57	25	13.53
	all	100	100	100	100	100	100	100
Art. 18	more than 15	73.6	69.68	74.28	68.82	73.2	64.47	73.79
	less than 15	26.4	30.32	25.72	31.18	26.8	35.53	26.21
	all	100	100	100	100	100	100	100
Debt Share	< 20%	18.53	17.67	19.07	18.82	18.73	17.11	18.56
	> 20% and < 50%	34.44	42.24	33.18	39.41	34.42	38.16	34.37
	> 50%	47.03	40.09	47.75	41.76	46.85	44.74	47.07
	all	100	100	100	100	100	100	100
Main fin. by bank debt	yes	12.31	15.41	11.76	18.79	12.23	14.29	12.27
	no	87.69	84.59	88.24	81.21	87.77	85.71	87.73
	all	100	100	100	100	100	100	100
Local bank	yes	63.19	66.32	62.59	66.06	63.21	60	63.26
	no	36.81	33.68	37.41	33.94	36.79	40	36.74
	all	100	100	100	100	100	100	100
Export	yes	69.14	66.04	69.52	66.47	68.76	63.16	69.26
	no	30.86	33.96	30.48	33.53	31.24	36.84	30.74
	all	100	100	100	100	100	100	100
Group	yes	19.75	16.09	19.58	17.06	18.92	17.11	19.8
	no	80.25	83.91	80.42	82.94	81.08	82.89	80.2
	all	100	100	100	100	100	100	100
Subsidy	yes	42.45	43.17	42.51	40.59	42.35	42.11	42.46
	no	57.55	56.83	57.49	59.41	57.65	57.89	57.54
	all	100	100	100	100	100	100	100
R&D	yes	38.09	37.03	37.88	41.42	37.58	43.42	37.98
	no	61.91	62.97	62.12	58.58	62.42	56.58	62.02
	all	100	100	100	100	100	100	100

Table 3. **Balance sheet features of the Italian survey sample (credit rationing breakdown)**

Our sample includes 3,840 firms. Firms are grouped by intensity of financing constraints. ROS is the percentage ratio of operating profits over net sales. ROI is the percentage ratio of operating profits over total assets. ROE is the percentage ratio of net earnings over net worth. Leverage is the ratio of bank debt over total liabilities and net worth. Interests on net sales is the ratio of interest payments over net sales. Net sales per worker is the ratio of net sales over the number of workers.

			ROS	ROI	ROE	Leverage	Interest on net sales	Net sales per worker
All		mean	5.52	7.06	7.83	0.15	0.02	197.77
		median	4.83	5.87	5.16	0.09	0.02	155.00
		sd	6.65	6.80	14.05	0.16	0.02	225.25
		obs	3853	3853	3853	3853	3853	3853
Desire-cred	yes	mean	4.11	5.07	4.05	0.18	0.03	195.17
		median	4.29	4.77	2.08	0.13	0.03	146.26
		sd	5.25	5.47	13.64	0.19	0.02	332.05
		obs	696	696	696	696	696	696
	no	mean	5.83	7.52	8.67	0.14	0.02	198.28
		median	5.00	6.12	6.01	0.08	0.02	156.81
		sd	6.90	6.98	14.02	0.16	0.02	195.43
		obs	3083	3083	3083	3083	3083	3083
Denied-cred	yes	mean	4.05	4.42	1.97	0.21	0.04	178.78
		median	4.18	4.33	1.38	0.18	0.03	144.59
		sd	5.48	4.55	11.72	0.21	0.03	123.10
		obs	170	170	170	170	170	170
	no	mean	5.57	7.18	8.09	0.14	0.02	196.76
		median	4.85	5.94	5.39	0.08	0.02	155.41
		sd	6.69	6.82	14.07	0.16	0.02	198.38
		obs	3507	3507	3507	3507	3507	3507
Highly-rationed	yes	mean	3.86	4.11	2.84	0.22	0.04	188.38
		median	4.31	4.21	1.81	0.18	0.04	146.15
		sd	5.74	5.17	12.47	0.23	0.03	148.39
		obs	76	76	76	76	76	76
	no	mean	5.56	7.12	7.93	0.15	0.02	197.96
		median	4.84	5.91	5.25	0.09	0.02	155.04
		sd	6.66	6.82	14.06	0.16	0.02	226.54
		obs	3777	3777	3777	3777	3777	3777

Table 4. **Correlation matrix for balance sheet and credit scoring indicators**

ROS is the percentage ratio of operating profits over net sales. ROI is the percentage ratio of operating profits over total assets. ROE is the percentage ratio of net earnings over net worth. Leverage is the ratio of bank debt over total liabilities and net worth. Interest on net sales is the ratio of interest payments over net sales. Net sales per worker is the ratio of net sales over the number of workers. Altman, Altman-Baydia, Zmijeski-Up, Shumway-Alt, Shumway-Zmi, Saretto-Alt and Saretto-Zmi are the values of credit risk indicators calculated as explained in Table A1.1 in the Appendix 1.

	ROS	ROI	ROE	Leverage	Interests on net sales	Net sales per worker	Altman	Altman Baidya	Zmijeski-Up	Shumway-Alt	Shumway-Zmi	Saretto-Alt	Saretto-Zmi
ROS	1												
ROI	0.755	1											
ROE	0.444	0.661	1										
Leverage	-0.092	-0.183	-0.160	1									
Interests on net sales	-0.019	-0.201	-0.228	0.271	1								
Net sales per worker	-0.001	0.036	0.112	0.124	-0.542	1							
Altman	0.286	0.600	0.392	-0.319	-0.518	0.158	1						
Altman Baidya	0.320	0.635	0.432	-0.321	-0.516	0.156	0.998	1					
Zmijeski-Up	0.621	0.817	0.755	-0.218	-0.277	0.058	0.560	0.610	1				
Shumway-Alt	-0.444	-0.697	-0.476	0.289	0.324	-0.141	-0.792	-0.812	-0.742	1			
Shumway-Zmi	-0.263	-0.428	-0.417	0.255	0.213	-0.030	-0.469	-0.488	-0.558	0.638	1		
Saretto-Alt	0.609	0.799	0.525	-0.212	-0.236	-0.227	0.689	0.716	0.781	-0.866	-0.492	1	
Saretto-Zmi	0.199	0.163	0.201	0.096	0.117	0.049	-0.312	-0.290	0.069	0.397	0.346	-0.234	1

Table 5. **The determinants of financing constraints and credit rationing**

Logit specification: the dependent variable is a dummy which takes value of 1 if the firm belongs respectively to the desirecred, deniedcred or highlyrationed group and 0 otherwise (for group definitions see section 3.2). Small, Young, South & Isles, Export, Group, R&D, Local bank, Main fin. by bank debt, Subsidy and Art. 18 are dummies that account respectively for firms with less than 50 employees, younger than 20th percentile of the age distribution, location in the South, export activity, group participation, R&D activity, main lender located in the same province, received subsidies and less than 15 employees. Number of banks is the number of lenders, Debt share is the share of the overall bank debt held by the main lender. Financial indicators as defined in Table 3.

	Desirecred	Deniedcred	Highlyrationed
Small	0.336	0.521	0.203
	(0.158)*	(0.279)	(0.412)
Young	-0.150	-0.183	-0.055
	(0.073)*	(0.127)	(0.189)
South & Isles	0.601	0.738	0.835
	(0.138)**	(0.226)**	(0.323)**
Export	-0.046	0.069	-0.166
	(0.115)	(0.203)	(0.297)
Group	-0.135	0.004	-0.059
	(0.145)	(0.242)	(0.367)
R&D	0.078	0.310	0.600
	(0.112)	(0.191)	(0.286)*
Number of banks	-0.001	0.053	0.017
	(0.017)	(0.025)*	(0.043)
Debt share	-0.097	0.048	0.090
	(0.072)	(0.126)	(0.193)
Local bank	0.273	0.188	-0.176
	(0.110)*	(0.188)	(0.271)
Main fin. by bank debt	0.263	0.244	-0.145
	(0.145)	(0.239)	(0.414)
Subsidy	0.087	-0.016	0.074
	(0.107)	(0.186)	(0.281)
Art. 18	0.125	0.468	0.708
	(0.122)	(0.210)*	(0.310)*
ROS	0.001	0.002	0.002
	(0.009)	(0.014)	(0.018)
ROI	-0.013	-0.030	-0.030
	(0.013)	(0.023)	(0.032)
ROE	-0.008	-0.012	-0.014
	(0.004)*	(0.008)	(0.011)
Leverage	0.233	1.497	1.307
	(0.314)	(0.491)**	(0.721)
Interest on net sales	8.882	10.363	10.923
	(1.998)**	(2.572)**	(3.003)**
Net sales per worker	0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)
Constant	-2.087	-4.348	-5.140
	(0.344)**	(0.601)**	(0.911)**
Observations	3310	3221	3333
Log Likelihood	-1297.89	-537.14	-278.32
LR(χ2)	116.11	96.05	52.32
	0.000	0.000	0.000

Standard errors in parentheses. * significant at 5% level; ** significant at 1% level.

Table 6. **The determinants of financing constraints and credit rationing (desirecred firms only)**

Logit specification: the dependent variable takes value of 1 if the firm belongs to the desirecred group and 0 otherwise. Small, Young, South & Isles, Export, Group, R&D, Local bank, Main fin. by bank debt, Subsidy and Art. 18 are dummies that account respectively for firms with less than 50 employees, younger than 20th percentile of the age distribution, located in the South, export activity, group participation, R&D activity, main lender located in the same province, received subsidies and less than 15 employees according to law 300/75. Number of banks is the number of lenders, Debt share is the share of the overall bank debt held by the main lender. Altman, Altman-Baydia, Zmijeski-up, Shumway-Alt, Shumway-Zmi, Saretto-Alt and Saretto-Zmi are the values of credit risk indicators.

	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod. 5	Mod. 6	Mod. 7
Small	0.382	0.380	0.369	0.360	0.374	0.341	0.389
	(0.156)*	(0.156)*	(0.157)*	(0.157)*	(0.157)*	(0.157)*	(0.156)*
Young	-0.116	-0.117	-0.132	-0.141	-0.557	-0.079	-0.090
	(0.072)	(0.072)	(0.073)	(0.072)	(0.103)**	(0.073)	(0.074)
South & Isles	0.593	0.592	0.706	0.643	0.744	0.654	0.751
	(0.136)**	(0.136)**	(0.134)**	(0.135)**	(0.135)**	(0.135)**	(0.134)**
Export	-0.026	-0.025	-0.029	-0.049	-0.016	-0.003	-0.038
	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.113)
Group	-0.174	-0.172	-0.102	-0.121	-0.079	-0.118	-0.126
	(0.144)	(0.144)	(0.144)	(0.144)	(0.144)	(0.144)	(0.143)
R&D	0.069	0.070	0.099	0.095	0.088	0.102	0.075
	(0.111)	(0.111)	(0.111)	(0.111)	(0.111)	(0.111)	(0.111)
Number of banks	0.006	0.005	0.009	0.006	0.005	0.009	0.013
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Debt share	-0.097	-0.096	-0.111	-0.096	-0.106	-0.111	-0.134
	(0.071)	(0.071)	(0.071)	(0.072)	(0.071)	(0.071)	(0.070)
Local bank	0.259	0.257	0.244	0.252	0.244	0.258	0.263
	(0.109)*	(0.109)*	(0.109)*	(0.109)*	(0.109)*	(0.109)*	(0.108)*
Main fin. by bank	0.257	0.254	0.258	0.220	0.254	0.244	0.301
debt	(0.145)	(0.145)	(0.144)	(0.144)	(0.145)	(0.145)	(0.144)*
Subsidy	0.041	0.046	0.110	0.081	0.072	0.076	0.031
	(0.106)	(0.106)	(0.107)	(0.106)	(0.106)	(0.106)	(0.106)
Art. 18	0.136	0.137	0.170	0.149	0.157	0.157	0.150
	(0.121)	(0.121)	(0.120)	(0.120)	(0.120)	(0.120)	(0.120)
Altman	-0.381						
	(0.060)**						
Altman-Baidya		-0.377					
		(0.058)**					
Zmijeski-up			-5.753				
			(0.958)**				
Shumway - Alt				0.337			
				(0.051)**			
Shumway - Zmi					1.852		
					(0.305)**		
Saretto - Alt						-0.551	
						(0.088)**	
Saretto - Zmi							0.185
							(0.083)*
Constant	-1.166	-1.166	-26.854	-0.431	12.016	-1.931	-0.082
	(0.357)**	(0.356)**	(4.157)**	(0.408)	(2.328)**	(0.333)**	(0.934)
Observations	3310	3310	3310	3310	3310	3310	3310
Log Likelihood	-1302.26	-1300.97	-1303	-1298.45	-1303.08	-1302	-1320.90
LR(χ2)	107.36	109.94	104.69	114.98	105.73	106.65	70.10
	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Standard errors in parentheses. * significant at 5% level; ** significant at 1% level.

Table 7. **The determinants of financing constraints and credit rationing (deniedcred firms only)**

Logit specification: the dependent variable takes value of 1 if the firm belongs to the deniedcred group and 0 otherwise. Small, Young, South & Isles, Export, Group, R&D, Local bank, Main fin. by bank debt, Subsidy and Art. 18 are dummies that account respectively for firms with less than 50 employees, younger than 20th percentile of the age distribution, located in the South, export activity, group participation, R&D activity, main lender located in the same province, received subsidies and less than 15 employees. Number of banks is the number of lenders, Debt share is the share of the overall bank debt held by the main lender. Altman, Altman-Baydia, Zmijeski-up, Shumway-Alt, Shumway-Zmi, Saretto-Alt and Saretto-Zmi are the values of credit risk indicators.

	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod. 5	Mod. 6	Mod. 7
Small	0.478	0.474	0.478	0.447	0.486	0.424	0.492
	(0.275)	(0.275)	(0.275)	(0.276)	(0.275)	(0.276)	(0.274)
Young	-0.092	-0.094	-0.118	-0.145	-0.742	-0.036	-0.063
	(0.124)	(0.124)	(0.124)	(0.123)	(0.180)**	(0.124)	(0.127)
South & Isles	0.743	0.743	0.925	0.807	0.972	0.841	0.987
	(0.221)**	(0.221)**	(0.218)**	(0.220)**	(0.218)**	(0.219)**	(0.218)**
Export	0.108	0.109	0.114	0.078	0.124	0.154	0.103
	(0.199)	(0.199)	(0.200)	(0.200)	(0.199)	(0.200)	(0.198)
Group	-0.089	-0.087	0.007	-0.002	0.056	0.009	-0.017
	(0.241)	(0.241)	(0.241)	(0.240)	(0.240)	(0.240)	(0.241)
R&D	0.332	0.334	0.388	0.372	0.366	0.387	0.346
	(0.188)	(0.188)	(0.188)*	(0.188)*	(0.188)	(0.188)*	(0.186)
Number of banks	0.057	0.057	0.062	0.058	0.056	0.061	0.063
	(0.023)*	(0.023)*	(0.022)**	(0.023)*	(0.023)*	(0.022)**	(0.022)**
Debt share	0.011	0.013	-0.021	0.011	-0.003	-0.014	-0.045
	(0.122)	(0.123)	(0.122)	(0.123)	(0.122)	(0.122)	(0.119)
Local bank	0.168	0.165	0.155	0.149	0.152	0.173	0.190
	(0.185)	(0.185)	(0.185)	(0.185)	(0.185)	(0.185)	(0.184)
Main fin. by bank	0.249	0.246	0.268	0.210	0.244	0.240	0.311
debt	(0.238)	(0.238)	(0.237)	(0.237)	(0.238)	(0.238)	(0.237)
Subsidy	-0.093	-0.084	-0.016	-0.023	-0.055	-0.040	-0.118
	(0.183)	(0.183)	(0.184)	(0.184)	(0.183)	(0.183)	(0.183)
Art. 18	0.385	0.387	0.450	0.404	0.424	0.408	0.403
	(0.203)	(0.203)	(0.202)*	(0.202)*	(0.202)*	(0.202)*	(0.201)*
Altman	-0.595						
	(0.109)**						
Altman-Baidya		-0.592					
		(0.106)**					
Zmijeski-up			-7.778				
			(1.520)**				
Shumway - Alt				0.571			
				(0.100)**			
Shumway - Zmi					2.672		
					(0.541)**		
Saretto - Alt						-0.836	
						(0.157)**	
Saretto - Zmi							0.315
							(0.163)
Constant	-2.897	-2.899	-37.786	-1.543	16.035	-4.097	-0.846
	(0.609)**	(0.606)**	(6.619)**	(0.720)*	(4.102)**	(0.573)**	(1.786)
Observations	3221	3221	3221	3221	3221	3221	3221
Log Likelihood	-550.54	-549.54	-552.94	-547.17	-553.40	-551.48	-564.51
LR(χ2)	69.24	71.24	64.45	75.97	63.53	67.36	41.31
	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 8. **The determinants of financing constraints and credit rationing (highlyrationed firms only)**

Logit specification: the dependent variable takes value of 1 if the firm belongs to the highlyrationed group and 0 otherwise. Small, Young, South & Isles, Export, Group, R&D, Local bank, Main fin. by bank debt, Subsidy and Art. 18 are dummies that account respectively for firms with less than 50 employees, younger than 20th percentile of the age distribution, located in the South, export activity, group participation, R&D activity, main lender located in the same province, received subsidies and less than 15 employees. Number of banks is the number of lenders, Debt share is the share of the overall bank debt held by the main lender. Altman, Altman-Baydia, Zmijeski-up, Shumway-Alt, Shumway-Zmi, Saretto-Alt and Saretto-Zmi are the values of credit risk indicators.

	Mod. 1	Mod. 2	Mod. 3	Mod. 4	Mod. 5	Mod. 6	Mod. 7
Small	0.214	0.211	0.231	0.202	0.231	0.182	0.232
	(0.410)	(0.410)	(0.409)	(0.411)	(0.409)	(0.410)	(0.408)
Young	0.036	0.034	0.024	-0.025	-0.412	0.079	0.069
	(0.185)	(0.185)	(0.186)	(0.184)	(0.262)	(0.185)	(0.190)
South & Isles	0.842	0.843	1.023	0.909	1.068	0.952	1.087
	(0.317)**	(0.317)**	(0.315)**	(0.315)**	(0.312)**	(0.314)**	(0.313)**
Export	-0.098	-0.096	-0.079	-0.131	-0.093	-0.059	-0.105
	(0.292)	(0.292)	(0.294)	(0.293)	(0.292)	(0.293)	(0.292)
Group	-0.155	-0.150	-0.039	-0.077	-0.029	-0.075	-0.095
	(0.365)	(0.365)	(0.366)	(0.367)	(0.366)	(0.366)	(0.366)
R&D	0.626	0.629	0.663	0.658	0.643	0.673	0.622
	(0.281)*	(0.281)*	(0.281)*	(0.281)*	(0.280)*	(0.281)*	(0.278)*
Number of banks	0.028	0.028	0.036	0.032	0.031	0.035	0.036
	(0.040)	(0.040)	(0.039)	(0.039)	(0.039)	(0.039)	(0.039)
Debt share	0.057	0.060	0.015	0.054	0.024	0.027	-0.007
	(0.187)	(0.187)	(0.184)	(0.188)	(0.185)	(0.185)	(0.182)
Local bank	-0.219	-0.221	-0.210	-0.222	-0.212	-0.198	-0.195
	(0.267)	(0.267)	(0.267)	(0.267)	(0.267)	(0.267)	(0.267)
Main fin. by bank	-0.162	-0.165	-0.125	-0.185	-0.141	-0.159	-0.093
debt	(0.413)	(0.412)	(0.412)	(0.412)	(0.412)	(0.412)	(0.411)
Subsidy	0.000	0.011	0.072	0.072	0.034	0.050	-0.022
	(0.274)	(0.274)	(0.275)	(0.275)	(0.274)	(0.275)	(0.275)
Art. 18	0.699	0.702	0.771	0.716	0.735	0.722	0.718
	(0.303)*	(0.303)*	(0.303)*	(0.302)*	(0.301)*	(0.301)*	(0.301)*
Altman	-0.624						
	(0.163)**						
Altman-Baidya		-0.616					
		(0.158)**					
Zmijeski-up			-6.642				
			(1.991)**				
Shumway - Alt				0.572			
				(0.138)**			
Shumway - Zmi					1.846		
					(0.774)*		
Saretto - Alt						-0.759	
						(0.214)**	
Saretto - Zmi							0.300
							(0.236)
Constant	-3.609	-3.623	-33.687	-2.324	9.044	-4.872	-1.755
	(0.931)**	(0.927)**	(8.708)**	(1.060)*	(5.890)	(0.878)**	(2.619)
Observations	3333	3333	3333	3333	3333	3333	3333
Log Likelihood	-258.89	-285.50	-288.60	-284.21	-290.75	-287.53	-292.87
LR(χ2)	37.18	37.95	31.76	40.54	27.47	33.90	23.22
	0.004	0.003	0.006	0.001	0.010	0.001	0.038

Standard errors in parentheses. * significant at 5% level; ** significant at 1% level.

Table 9. **Summary statistics of the variables used in GMM estimates**

I/K is total new fixed assets over net capital stock at replacement cost ratio; CF/K is cash flow (which is operating profit before taxes plus depreciation) over net capital stock at replacement cost ratio; S/K is net sales over net capital stock at replacement cost ratio; D/K is total debt repayable in more than one year over net capital stock at replacement cost ratio. Sample period is 1993–2000.

		1993	1994	1995	1996	1997	1998	1999	2000
	p 25	-0.07	-0.07	-0.05	-0.07	-0.08	-0.07	-0.08	-0.08
	p 50	0.01	0.01	0.06	0.02	0.01	0.02	0.01	0.01
I/K	p 75	0.13	0.14	0.28	0.21	0.16	0.19	0.17	0.24
	mean	2.07	0.66	0.85	2.61	1.13	7.94	5.07	5.61
	sd	0.20	0.15	0.23	0.26	0.17	0.48	0.28	0.34
	p 25	0.33	0.33	0.39	0.35	0.34	0.33	0.29	0.30
	p 50	0.58	0.58	0.67	0.61	0.60	0.62	0.58	0.60
CF/K	p 75	1.04	1.07	1.37	1.17	1.20	1.25	1.23	1.27
	mean	7.70	3.13	2.67	10.77	9.74	16.62	66.01	9.19
	sd	1.51	1.27	1.42	1.63	1.45	1.89	2.64	1.50
	p 25	3.36	3.42	3.92	3.81	3.77	3.62	3.35	3.47
	p 50	5.49	5.92	6.83	6.70	6.87	6.89	6.43	6.69
S/K	p 75	10.91	11.44	13.49	13.18	14.25	14.61	14.54	15.09
	mean	110.56	52.99	43.00	72.09	60.67	98.74	162.29	62.28
	sd	18.75	15.83	16.65	18.49	17.58	20.25	20.54	17.95
	p 25	2.21	2.26	2.48	2.35	2.35	2.34	2.27	2.32
	p 50	3.41	3.66	4.04	3.84	3.97	4.01	3.90	4.04
D/K	p 75	6.09	6.53	7.38	7.21	8.13	8.13	8.30	8.58
	mean	50.63	36.00	24.46	44.80	37.14	56.40	71.91	40.27
	sd	10.27	9.36	9.27	9.95	9.91	11.47	11.19	10.64

Table 10. **The Euler equation testing the investment/cash flow sensitivity for subgroups of financially constrained/unconstrained firms according to self declared credit rationing**

GMM estimates – Dependent Variable: $(I/K)_{i,t}$; I/K is total new fixed assets over net capital stock at replacement cost ratio; I/Kq is I/K squared; CF/K is cash flow (which is operating profit before taxes plus depreciation) over net capital stock at replacement cost ratio; S/K is net sales over net capital stock at replacement cost ratio; D/Kq is total debt repayable in more than one year over net capital stock at replacement cost ratio squared. DU*(.) is a dummy variable which takes the value of one for firms belonging respectively to the Desirecred (excluding Deniedcred and Highlyrationed), Deniedcred and Highlyrationed group and 0 otherwise. L. stands for one period lag operator. Sample period: 1993–2000. All estimations include year dummies. Sargan statistic is distributed as a $\chi 2$ under the null of instrument validity. AR(1) and AR(2) are are tests for one and second order serial correlation in the residuals, asymptotically distributed as a N(0,1) under the null of instrument validity.

	All	Desirecred	Deniedcred	Highlyrationed
L.I/K	0.130	0.118	0.129	0.133
	(0.024)**	(0.028)**	(0.025)**	(0.024)**
L.I/Kq	-0.003	-0.004	-0.003	-0.003
	(0.001)**	(0.001)**	(0.001)*	(0.001)**
L.CF/K	-0.104	-0.039	-0.110	-0.107
	(0.011)**	(0.013)**	(0.012)**	(0.011)**
L.S/K	0.004	0.001	0.005	0.004
	(0.001)**	(0.002)	(0.002)**	(0.001)**
L.D/Kq	-0.0001	-0.0001	-0.0001	-0.0001
	(0.000)**	(0.000)*	(0.000)**	(0.000)**
DU*L.I/K		0.019	-0.160	-0.386
		(0.056)	(0.290)	(0.604)
DU*L.I/Kq		0.005	0.065	-0.058
		(0.002)	(0.169)	(0.347)
DU*L.CF/K		-0.298	0.243	0.486
		(0.030)**	(0.113)*	(0.209)*
DU*L.S/K		0.020	0.004	-0.005
		(0.004)**	(0.013)	(0.038)
DU*L.D/Kq		-0.0001	-0.0001	-0.0001
		(0.000)**	(0.000)	(0.001)
Observations	9008	8754	8417	9008
Groups	2654	2604	2529	2654
Sargan test	53.20	212.72	75.91	61.09
prob>chi2	(0.505)	(0.000)	(0.992)	(1.000)
AR(1)	-20.10	-27.85	-27.49	-28.97
prob>z	(0.000)	(0.000)	(0.000)	(0.000)
AR(2)	-0.10	0.23	-0.09	-0.11
prob>z	(0.922)	(0.816)	(0.927)	(0.909)

Standard errors in parentheses; *significant at 5% level; ** significant at 1% level.

Table 11. **The Euler equation testing the investment/cash flow sensitivity for subroups of financially constrained/unconstrained firms according to a priori criteria**

GMM estimates – Dependent Variable: $(I/K)_{i,t}$; I/K is total new fixed assets over net capital stock at replacement cost ratio; I/Kq is I/K squared; CF/K is cash flow (which is operating profit before taxes plus depreciation) over net capital stock at replacement cost ratio; S/K is net sales over net capital stock at replacement cost ratio; D/Kq is total debt repayable in more than one year over net capital stock at replacement cost ratio squared. DU*(.) is a dummy variable which takes the value of one for firms belonging respectively to the Small, Young, R&D investing and Location in the South group, and 0 otherwise. L. stands for one period lag operator. Sample period: 1993–2000. Two period lagged values of non dummy variables are used as instruments. All estimations include year dummies. Sargan statistic is distributed as a χ^2 under the null of instrument validity. AR(1) and AR(2) are are tests for one and second order serial correlation in the residuals, asymptotically distributed as a N(0,1) under the null of instrument validity.

	All	Small	Young	R&D	South
L.I/K	0.130	0.108	0.144	0.104	0.119
	(0.024)**	(0.046)*	(0.029)**	(0.032)**	(0.025)**
L.I/Kq	-0.003	-0.003	-0.003	-0.002	-0.003
	(0.001)**	(0.002)	(0.001)	(0.001)	(0.001)*
L.CF/K	-0.104	-0.108	-0.105	-0.081	-0.100
	(0.011)**	(0.027)**	(0.013)**	(0.016)**	(0.012)**
L.S/K	0.004	0.004	0.000	0.005	0.004
	(0.001)**	(0.003)	(0.002)	(0.002)**	(0.002)**
L.D/Kq	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	(0.000)**	(0.000)	(0.000)	(0.000)**	(0.000)**
DU*L.I/K		0.014	-0.064	0.047	0.030
		(0.052)	(0.050)	(0.048)	(0.093)
DU*L.I/Kq		0.001	0.000	-0.000	-0.013
		(0.002)	(0.002)	(0.002)	(0.014)
DU*L.CF/K		0.005	0.011	-0.058	-0.006
		(0.028)	(0.026)	(0.023)*	(0.054)
DU*L.S/K		0.001	0.012	0.004	0.009
		(0.003)	(0.003)**	(0.003)	(0.005)
DU*L.D/Kq		-0.0001	-0.0001	-0.0001	-0.0001
		(0.000)	(0.000)**	(0.000)	(0.000)
Observations	9008	9008	9008	8870	
Groups	2654	2654	2654	2611	
Sargan test	53.20	96.27	101.15	163.19	
prob>chi2	(0.505)	(0.783)	(0.667)	(0.000)	
AR(1)	-20.10	-0.22	-29.74	-28.31	
prob>z	(0.000)	0.000	(0.000)	(0.000)	
AR(2)	-0.10	-0.22	-0.37	-0.01	
prob>z	(0.922)	(0.830)	(0.712)	(0.990)	

Standard errors in parentheses; *significant at 5% level; ** significant at 1% level.

Appendix 1

Table A1.1 **Credit risk measures mostly cited in the empirical literature on bankruptcy risk**

Indicators marked with * are the ones tested as regressors among the determinants of credit rationing in estimations reported in Tables 6, 7 and 8.

Author	Country	Selected variables	MODEL	Estimated function
ALTMAN* (1968)	United States Sample period: 1946–1965	X_1 = working capital/total assets; X_2 = retained earnings/total assets; X_3 = operating income after depreciation/total assets; X_4 = market value of equity/total liabilities; X_5 = sales/total assets. notes: 1) working capital = current assets-current liabilities; 2) for non listed firms market value of equity is book value of equity.	Multivariate discriminant analysis *Z-score model*	$Z = 1.2\ X_1 + 1.4\ X_2 + 3.3\ X_3 + 0.6\ X_4 + 0.99\ X_5$
EDMISTER (1972)	United States Sample period: 1954–1969	X_1 = annual flow of funds/current liabilities; X_2 = equity/sales; X_3 = net working capital/sales; X_4 = current liabilities/equity; X_5 = inventory/ sales; X_6 = quick ratio/RMA trend; X_7 = borrower's quick ratio/RMA quick ratio. Notes: 1) working capital = current assets-current liabilities. 2) quick ratio = quick assets/current liabilities; quick assets = current assets – inventories). 3) RMA = ratings institutions.	Discriminant analysis *Stepwise*	$Z = 0.951 - 0.423\ X_1 - 0.93\ X_2 - 0.482\ X_3 + 0.277\ X_4 - 0.452\ X_5 - 0.352\ X_6 - 0.924\ X_7$
VAN FREDERIK-SLUST* (1978)	The Netherlands Sample period: 1954–1974	X_1 = liquidity ratio; X_2 = profitability ratio (rate of return of equity). Notes: 1) liquidity ratio = short term debt at time t/short term debt at time t-1; 2) profitability ratio = rate of return of equity.	Discriminant analysis *Z-score model*	$Z = 0.5293 + 0.4488\ X_1 + 0.2863\ X_2$
ALTMAN, BAIDYA, RIBEIRO DIAS* (1979)	Brazil Sample period: 1975–1977	X_1 = working capital/total assets; X_2 = (total equity – capital contributed by shareholders)/total assets; X_3 = earnings before interest and taxes/total assets; X_4 = (number of shares x price of stock)/total liabilities; X_5 = sales/total assets. Notes: 1) working capital = current assets-current liabilities. 2) For not listed firms number of shares x price of stock is book value of equity.	Discriminant analysis *Z-score model*	$Z_1 = 1.44 + 4.03\ X_2 + 2.25\ X_3 + 0.14\ X_4 + 0.42\ X_5$
BILDER-BEEK* (1979)	The Netherlands Sample period: 1950–1974	X_1 = retained earnings/total assets; X_2 = added value/total assets; X_3 = accounts payable/sales; X_4 = sales/total assets; X_5 = net profits/equity.	Discriminant analysis *stepwise*	$Z = 0.45 - 0.503\ X_1 - 1.57\ X_2 + 4.55\ X_3 + 0.17\ X_4 + 0.1X_5$
OHLSON* (1980)	United States Sample period: 1970–1976	X_1 = working capital/total assets; X_2 = log(total assets); X_3 = (total liabilities/total assets)*100; X_4 = current assets/current liabilities; X_5 = net income/total assets; X_6 = funds provided by operations/total liabilities; X_7 and X_8 = two measures of past income performance. Notes: 1) working capital = current assets-current liabilities.	Static single-period conditional logit analysis *O-score model*	$Z = -8.427 + 0.022\ X_1 - 0.074\ X_2 + 5.199\ X_3 + 0.062\ X_4 + 0.242\ X_5 - 0.231\ X_6 + 0.596\ X_7 - 1.241\ X_8$
ALTMAN, LAVALLEE* (1981)	Canada Sample period: 1970–1979	X_1 = sales/total assets; X_2 = total debt/total assets; X_3 = current assets/current liabilities; X_4 = net profits after tax/total debt; X_5 = rate of growth of assets.	Discriminant analysis *Z-score model*	$Z = -1.626 + 0.234\ X_1 - 0.531\ X_2 + 1.002\ X_3 + 0.972\ X_4 + 0.612\ X_5$

Author	Country	Selected variables	MODEL	Estimated function
KO (1982)	Japan Sample period: 1970–1980	X_1 = EBIT/sales; X_2 = inventory turnover 2 years prior/inv. turnover 3 y.p.; X_3 = standard error of net income (4 years); X_4 = working capital/total debt; X_5 = market value equity/total debt. Notes: 1) working capital = current assets-current liabilities.	Discriminant analysis *Z-score model*	$Z = 0.868\ X_1 + 0.198\ X_2 + 0.048\ X_3 + 0.436\ X_4 + 0.115\ X_5$
ZMIJESKI* (1984)	United States Sample period: 1972–1978	X_1 = net income/total assets; X_2 = total liabilities/total assets; X_3 = current assets/current liabilities. The model is etimated using Unweighted Probit (Up) and Weighted Exogenous Sample Maximum Likelihood (Wesml)	Probit analysis	Up: $Z = -4.336 - 4.513\ X_1 + 5.679\ X_2 + 0.004\ X_3$ Wesml: $Z = -4.803 - 3.599\ X_1 + 5.406\ X_2 - 0.100\ X_3$
ZAVGREN* (1985)	United States Sample period: 1972–1978	X_1 = total income/total assets; X_2 = sales/net plant; X_3 = inventory/sales; X_4 = debt/total capital; X_5 = receivables; X_6 = quick assets/current liabilities/inventory; X_7 = cash/total assets. Notes: 1) quick assets = current assets – inventories.	Logit model	$Z = -1.51150 + 0.00519\ X_1 + 0.00002\ X_2 + 0.06257\ X_3 + 0.01822\ X_4 + 0.00829\ X_5 - 0.01549\ X_6 + 0.4228\ X_7$
LO (1986)	United States Sample period: 1975–1982	X_1 = Log (total assets/GNP price deflator); X_2 = Current debt liabilities/total assets; X_3 = Other debt liabilities/total assets; X_4 = Current assets/total asset; X_5 = Net income/total assets; X_6 = Lo index: (cash + intagibles)/current debt liabilities.	Logit model	$Z = 1.2140 - 0.0441\ X_1 + 0.1074\ X_2 - 3.3258\ X_3 - 1.2321\ X_4 + 10.7971\ X_5 - 4.1642\ X_6$
SKOGSVIK (1988)	Sweden Sample period: 1977–1980	X_1 = real profit before taxes and interest/total assets; X_2 = interest expenses (nominal)/all liabilities and deferred taxes; X_3 = income taxes/real business profit before taxes; X_4 = inventory/revenues; X_5 = cash/current liabilities; X_6 = owners' equity/total assets; X_7 = real growth owners' equity/owners' equity; X_8 = real growth untaxed reserves/untaxed reserves; X_9 = real realisable gain on inventory/inventory.	Probit analysis	$Z = -0.92 - 2.78\ X_1 + 12.45\ X_2 + 1.14\ X_4 - 0.66\ X_5 - 3.13\ X_6 + 0.91\ X_8 + 2.49\ X_9$
KEASEY, McGUINESS (1990)	United Kingdom Sample period: 1976–1984	X_1 = quick ratio; X_2 = 1/[(total sales – trading profit)/total creditors]; X_3 = turnover/net plant; X_4 = pre-tax profit margin. Notes: quick ratio = quick assets/current liabilities.	Logit model stepwise	$Z = 6.4202 - 1.5599\ X_1 - 0.3010\ X_2 - 0.8799\ X_3 - 0.4216\ X_4$
KEASEY, WATSON (1991)	United Kingdom Sample period: 1970–1983	X_1 = (current assets – stock)/current liabilities; X_2 = total debt (inclusive of overdrafts)/total assets; X_3 = fixed assets/total assets; X_4 = (Pre Tax Profit+depreciation)/total assets; X_5 = (Net profit+interest)/Net Worth; X_6 = (Net profit + interest)/total debt.	Logit analysis stepwise	$Z = 0.6011 + 0.7048\ X_2 - 0.9493\ X_3 - 0.2003\ X_4 - 0.1240\ X_5 - 0.4104 X_6$
SHUMWAY* (2001)	United States Sample period: 1962–1992	Estimates Altman, Zmijewski and a 2 new formulation using Hazard functions. Altman: X_1 = working capital/total assets; X_2 = retained earnings/total assets; X_3 = operating income after depreciation/total assets; X_4 = market value of equity/total liabilities; X_5 = sales/total assets; X_6 = ln(age) Notes: 1) working capital = current assets – current liabilities; 2) for non listed firms market value of equity is book value of equity. Zmijewski: X_1 = net income/total assets; X_2 = total liabilities/total assets; X_3 = current assets/current liabilities; X_4 = ln(age) Market variables: X_1 = Relative size; X_2 = past year stock performance; X_3 = idiosyncratic standard deviation of returns Market and accounting variables: X_1 = net income/total assets; X_2 = total liabilities/total assets; X_3 = Relative size; X_4 = past year stock performance; X_5 = idiosyncratic standard deviation of returns. Notes: 1) working capital = current assets – current liabilities. 2) relative size = log (firm's market capitalisation/total market capitalisation)	Hazard model	Altman: $Z = -3.226 - 0.732\ X_1 - 0.818\ X_2 - 8.946\ X_3 - 1.712\ X_4 + 0.158\ X_5 + 0.15\ X_6$ Zmijewski: $Z = -7.811 - 6.307\ X_1 + 4.068\ X_2 - 0.158\ X_3 + 0.307\ X_4$ Market variables: $Z = -12.027 - 0.503\ X_1 - 2.072\ X_2 + 9.834\ X_3$ Market and accounting variables: $Z = -13.303 - 1.982\ X_1 + 3.593\ X_2 - 0.467\ X_3 - 1.809\ X_4 + 5.791\ X_5$

Author	Country	Selected variables	MODEL	Estimated function
SARETTO* (2004)	United States Sample period: 1979–1996	Estimates Altman, Ohlson, Shumway, Zmijewski and 2 new formulations (Pvt and dur) using duration analysis. Altman: X_1 = working capital/total assets; X_2 = retained earnings/total assets; X_3 = operating income after depreciation/total assets; X_4 = market value of equity/total liabilities; X_5 = sales/total assets Notes: 1) working capital = current assets-current liabilities; 2) for non listed firms market value of equity is book value of equity. Ohlson: X_1 = working capital/total assets; X_2 = log(total assets); X_3 = (total liabilities/total assets)*100; X_4 = current assets/current liabilities; X_5 = net income/total assets; X_6 = funds provided by operations/total liabilities; X_7 and X_8 = two measures of past income performance Notes: 1) working capital = current assets-current liabilities. Shumway: X_1 = total liabilities/total assets; X_2 = net income/total assets; X_3 = idiosyncratic standard deviation of returns; X_4 = past year stock performance; X_5 = measure of market capitalisation. Zmijewski: X_1 = total liabilities/total assets; X_2 = current assets/current liabilities; X_3 = net income/total assets. Model 1 (Pvt): X_1 = working capital/total assets; X_2 = retained earnings/total assets; X_3 = operating income after depreciation/total assets; X_4 = sales/total assets; X_5 = log(total assets); X_6 = total liabilities/total assets; X_7 = current assets/current liabilities; X_8 = net income/total assets; X_9 = funds provided by operations/total liabilities; X_{10} and X_{11} = two measures of past income performance; X_{12} = (operating income – interest expenses)/absolute value of operating income; X_{13} = age. Model 2 (Dur): X_1 = retained earnings/total assets; X_2 = operating income after depreciation/total assets; X_3 = total liabilities/total assets; X_4 and X_5 = two measures of past income performance; X_6 = idiosyncratic standard deviation of returns; X_7 = past year stock performance; X_8 = log[(ratio of market capitalization at the end of the year)/ total market capitalization]; X_9 = Tobin's Q; X_{10} = age.	Duration analysis	Altman: $Z = 1.8\ X_1 - 0.081\ X_2 + 6.077\ X_3 + 0.001\ X_4 - 0.208\ X_5$ Ohlson: $Z = -8.427 + 0.022\ X_1 - 0.074\ X_2 + 5.199\ X_3 + 0.062\ X_4 + 0.242\ X_5 - 0.231\ X_6 + 0.596\ X_7 - 1.241\ X_8$ Shumway: $Z = -9.784 + 5.639\ X_1 - 0.256\ X_2 + 2.482\ X_3 - 1.004\ X_4 - 0.056\ X_5$ Zmijewski: $Z = -9.479 + 6.384\ X_1 + 0.069\ X_2 - 1.060\ X_3$ Model 1 (Pvt): $Z = -8.171 + 0.014\ X_1 + 0.388\ X_2 - 1.908\ X_3 - 0.015\ X_4 - 0.032\ X_5 + 5.240\ X_6 + 0.057\ X_7 + 0.534\ X_8 + 0.001\ X_9 + 0.478\ X_{10} - 1.265\ X_{11} - 0.006\ X_{12} - 0.024\ X_{13}$ Model 2 (Dur): $Z = -7.212 + 0.277\ X_1 - 1.720\ X_2 + 5.077\ X_3 + 0.331\ X_4 - 0.970\ X_5 + 2.633\ X_6 - 0.566\ X_7 + 0.039\ X_8 - 0.604\ X_9 - 0.024\ X_{10}$

Appendix 2

Questionnaire for the VIII Inquiry on Italian manufacturing firms – Year 2001

Section A: General information

A.1 Year of birth	

A.2 Activity

A.2.1 Main Activity	

A.2.2 Main products	

A.3 Net sales

A.3.1 1998 (mill. £) _____

A.3.2 1999 (mill. £) _____

A.3.3 2000 (mill. £) _____

A.4 Share of 2000 net sales from products unchanged in the last three years

_____

A.5 Current legal status

- Individually owned
- Unlimited liability
- Limited liability
- Cooperative
- Others

A.6 Acquisitions and spin-offs

A.6.1 Did the firm operate acquisitions, spin-offs or mergers in the period 1998–00?

☐ Yes ☐ No

A.6.2 Did the firm operate partial acquisitions, spin-offs or mergers in the period 1998–00?

☐ Yes ☐ No

A.7 Ownership structure and control

Describe the features of shareholders who own/control the firm in descending order of ownership share N.B. direct control is intended as a determinant influence – exercised through voting power or by appointing members of the board – on medium long term firm goals and on strategies needed to achieve them, on firm's financial and real development and on investment

	Type of owner * (see footnote)	Share of onwership held by the voting owner	Does the owner directly controls the firm ?		Does the owner participate to voting agreements with other shareholders ?	
Owner A		%	Yes	No	Yes	No
Owner B		%	Yes	No	Yes	No
Owner C		%	Yes	No	Yes	No
Others		%	Yes	No	Yes	No
Total		%	Yes	No	Yes	No

* Indicate with
1. Individual of foreign nationality
2. Individual of domestic nationality
3. Private Italian nonfinancial firm
4. State participated Italian nonfinancial firm
5. Private holding
6. State participated holding
7. Banks and other financial institutions

A.8 Groups

A.8.1 Does the firm belong to a group ?

Yes
No

As a group we indend a set of firms directly or indirectly controlled by the same individual, by the same private or state participated corporation.

A.8.2 The firm is:

Holding
Is controlled but controls other firms in the group
Subsidiary

A.8.3 How many firms are in the group (including foreign firms)? _____

A.8.4 When the group has been funded? _____

A.8.5 Are firms in the group part of the same industry ?

☐ Yes ☐ No ☐ Partially

A.8.6 Do operative relationship exist among firm in the group?

☐ Yes ☐ No

A.8.7 How many employees are in the group (including foreign subsidiaries)?

☐

A.8.8 Please state the degree of independence of subsidiaries from the holding for each of the following functions

A.8.8.1 Administration

☐ controlled by the holding
☐ some independence
☐ complete independence

A.8.8.2 Finance

☐ controlled by the holding
☐ some independence
☐ complete independence

A.8.8.3 Marketing

☐ controlled by the holding
☐ some independence
☐ complete independence

A.8.8.4 R&D

☐ controlled by the holding
☐ some independence
☐ complete independence

A.9 Consortia

A.9.1 Do the firm participate to a consortium?[29]

☐ Yes ☐ No

[29] Consortia are contractual agreements ruled by Italian Civil Law among firms which choose to cooperate, to provide common funds and to share information for the development of some common activity (usually internationalisation, R&D and access to credit). They may lead or not to the creation of an independent corporation even though constituents always maintain their independent identity. Consortia differ from cartels and are tolerated by antitrust authorities because their goal is not to restrict competition by altering prices or quantities but just to promote cooperation and economies of scale among associates in order to improve their performance and efficiency.

A.9.2 Type of consortium

- ☐ credit consortium
- ☐ export consortium
- ☐ R&D consortium
- ☐ other consortia

A.9.3 Did the firm used consortium collateral services in the last three years?

☐ Yes ☐ No

Section B: Labour Force

B.1 Employees in 1998–2000

B.1.1 type of workers

Owners of the licence for operating the business if managing the business and relatives which work in the firm without fixed wage in case of individual firms. CEO and board executives in case of corporations

	end of 1998	end of 1999	end of 2000
_.1 Entrepreneurs and supporting relatives			
_.2 Executives			
_.3 Intermediate executives			
_.4 Clerks			
_.5 Blue collars			
.6 Total (.1+_.2+_.3+_.4+_.5)			
_.6.4 of which part-time workers			
_.6.5 of which full time workers			
_.6.6 of which part time workers (internship)			

B.1.2 Employees according to the educational degree

	Number at 31-12-2000
B.1.2.1 Intermediate school degree	
B.1.2.2 High school degree	
B.1.2.3 University degree	

B.2.1 Did the firm hired workers in the 1998–2000 period?

☐ Yes ☐ No

B.2.2
If yes, how many?

1998
1999
2000

B.2.3
9.1.1 Share of graduates

1998
1999
2000

B.3 How many employees exited the firm for firing, dismissal, anticipated retirement and other causes in the 1998–2000 period?

1998	1999	2000

B.4 How many employees at point B.1.1 have:

	1998	1999	2000
B.4.1 did R&D activity			
B.4.2 were hired under Employment Training Programs			
B.4.3 participated to training activity managed by private or state participated training centres			

B.5.1 Did the firm used 'agenzie di lavoro interinale' in the period 1998–2000?

☐ Yes ☐ No

B.5.2 How many workers coming from 'Agenzie di lavoro interinale' has been employed by the firm in 2000? _____

B.5.3 On average, for how many months these kind of workers have been employed during 2000?

☐ 0–3 months
☐ 3–6 months
☐ 6–9 months
☐ 9–12 months

B.5.4 How many of these workers have been hired by the firm?

B.6 On average how many atypical workers collaborate with the firm during one year?

Section C: Physical and R&D Investment and technological innovation activity

C.1 Investment

C.1.1. Did the firm invest in physical capital in the 1998–2000 period?

☐ Yes ☐ No

C.1.2 For which amount (millions of liras)?

1998	1999	2000

C.1.3.1 Did the firm invested in hardware, software, networking or telecommunications in the 1998–2000 period?

☐ Yes ☐ No

C.1.3.2 If yes for which total amount in the three years (millions of liras)

1998–2000	

C.1.3.3 Indicate the shares of the tree types of investment

hardware	%
software	%
networking or telecommunications	%

C.1.3.4 Indicate the sares per type of application

Administrative systems	%
Production systems	%
Commercial systems	%
Internet/Intranet/Extranet	%
Others	%

C.1.4 Which were the goals of physical investment in the 1998–2000 period?

(please indicate degree of importance)

High	Medium	Low	
			C.1.4.1 Quality improvement of existing products
			C.1.4.2 Higher production of existing products
			C.1.4.3 Production of new products
			C.1.4.4 Reduced environmental impact
			C.1.4.5 Reduced raw material utilisation
			C.1.4.6 Reduced manpower utilisation
			C.1.4.7 Other goals

C.1.5 How was physical investment financed in the 1998–2000 period?

C.1.5.1 Equity capital (%)	%
C.1.5.2 Internal finance (%)	%
C.1.5.3 Short term loans (%)	%
C.1.5.4 Medium-long term loans at market rates (%)	%
C.1.5.5 Medium-long term soft loans (%)	%
C.1.5.6 State grants (%)	%
C.1.5.7 Tax allowances (%)	%
C.1.5.8 Leasing (%)	%
C.1.5.9 Intergroup lending (%)	%
C.1.5.10 Industrial lenders (%)	%
C.1.5.11 Others (%)	%

C.2 Technological innovation research and development

C.2.1. Did the firm realise in the 1998–2000 period

☐	product innovations
☐	process innovations
☐	organisational innovations related to product innovations
☐	Neither of the above

C.2.2.1 Did the firm incurred in R&D expenditures?

☐ Yes ☐ No

C.2.2.2 For which amount?

1998	1999	2000

C.2.2.3 Which was the contribution of

Internal research labs	%
External research labs	%

C.2.2.3.3 And, among external labs:

Universities	%
External research centres	%
Other firms	%
Other	%

C.2.2.4 How much of R&D expenditure was devoted to

C.2.2.4.1 Improvement of existing processes	%
C.2.2.4.2 Improvement of existing products	%
C.2.2.4.3 Introduction of new processes	%
C.2.2.4.4 Introduction of new products	%
C.2.2.4.5 Others	%

C.2.2.5 How was the R&D expenditure financed (% on total amount)?

C.2.2.5.1 Equity capital	%
C.2.2.5.2 Internal finance	%
C.2.2.5.3 Medium-long term loans at market rates	%
C.2.2.5.4 Medium-long term soft loans	%
C.2.2.5.5 State or EEC grants	%
C.2.2.5.6 Tax allowances	%
C.2.2.5.7 Others	%

Section D: Internationalisation

D.1 Export

D.1 Did the firm export part or all its production in 2000?

☐ Yes ☐ No

D.1.2 Export geographic breakdown

Geographical areas	%
EU	
Russia and Central-Eastern Europe	
Other European countries	
Africa	
United States and Canada	
Central and South America	
Middle East and other Asian countries	
China	
Australia and Oceania	
Other	

D.2 The firm in the 1998–2000 period

D.2.1 Purchased patents or licences from abroad?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

D.2.2 Sold patents or licences from abroad?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

D.2.3 Stipulated productive agreements with foreign firms?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

D.2.4 Stipulated trade agreements with foreign firms?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

D.2.5 Did foreign direct investment to produce abroad?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

D.2.5.2 If yes to question D.2.5, indicate year and amount in million liras

EU

1998	1999	2000

Non EU industrialised countries

1998	1999	2000

Non EU non-industrialised countries

1998	1999	2000

D.2.6.1 Did the firm created sale structures abroad in the 1998–2000 period?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

Of which:

Directly managed local fixed structures	EU countries	Other industrialised countries	Other non industrialised countries
Fixed structures managed by local traders	EU countries	Other industrialised countries	Other non industrialised countries
Fixed structures managed by participated companies	EU countries	Other industrialised countries	Other non industrialised countries
Other types of promotional activities	EU countries	Other industrialised countries	Other non industrialised countries

D.2.7.1 Was the firm consulted by Italian individuals or institutions?

Yes, from EU countries	Yes, from other industrialised countries	Yes, from other non-industrialised countries	No

	EU countries	Other industrialised countries	Other non industrialised countries
Institute for Foreign Trade			
Embassies			
Chambers of Commerce			
Banks			
Regional institutions			
Others			

Section E: The market

E.1 2000 Net sales breakdown according to customers and trading channel characteristics

E.1.1 Domestic distributive channels	%
E.1.2 Foreign distributive channels	%
E.1.3 Specialised intermediaries (wholesalers, buyers)	%
E.1.4 Intermediaries specialised in goods for firms	%
E.1.5 Direct sale to firms	%
E.1.6 Direct sale to customers	%
E.1.7 Franchising	%
E.1.8 Other	%

E.2 2000 Net sales breakdown according to ….

E.2.1 Subcontracting	%
E.2.2 Direct sale	%

For subcontracting we mean an industrial relationship by which a firm entrusts another with the execution of a step of its own productive process or of an activity linked to the productive process itself, or of the provision of intermediate inputs or components which will be integrated in a more complex product

E.3 Breakdown of subcontracted net sales in 2000 (item E.2.1)

Firms belonging to the same group in

The same province	%
The rest of Italy	%
Abroad	%

Other firms in

The same province	%
The rest of Italy	%
Abroad	%

E.4. Localisation of the main firm's competitors

Same province	
Same region	
Other Italian regions	
EU countries	
Other industrialised countries	
LDC	

E.5 Size of competitors

Large	
Medium	
Small	

E.6. Did the firm received ISO9000 (quality) certification?

☐ Yes ☐ No

E.7 Does the firm measure customer's satisfaction?

☐ Yes ☐ No

Section F: Finance

F.1 Relationship with banks

F.1.1 Indicate the number of banks with which the firm had a commercial relationship at the end of 2000	
F.1.2 Share of firm bank debt held by the main lender at the end of 2000	%

F.1.3 Is the main bank lender located in the same province of the firm?

☐ Yes ☐ No

F.1.4 Since how many years is it the main lender? _____

F.1.5 In the year 2000 had the company desired more credit at the market interest rate?

☐ Yes ☐ No

F.1.6 Had the company been willing to pay a higher interest rate in order to obtain more credit?

☐ Yes ☐ No

F.1.7 Did the company demanded in the year 2000 more credit without obtaining it?

☐ Yes ☐ No

F.2 Innovating financial instruments and equity capital

F.2.1 Has the firm made use of innovative financial instruments from 1998 on?

☐ Yes ☐ No

Which ones?

_____

_____

_____

F.2.2 Will the firm make use of innovative financial instruments in the next 3 years?

☐ Yes ☐ No

F.2.3 Has any financial operator underwritten venture capital in the firm from 1998 to today?

☐ Yes ☐ No

F.2.4 Is the firm ready to yield venture capital minority shares to banks, merchant banks, financial holding companies, closed-end funds or other financial operators in the years to come?

☐ Yes ☐ No

F.2.5 Has the firm yielded venture capital shares to non-financial private operators?

☐ Yes ☐ No

F.2.6 Is the firm listed at the stock exchange?

☐ Yes ☐ No

F.2.7 If no, is it willing to go public in the next three years?

☐ Yes ☐ No

F.3 Subsidies

F.3.1.1.1 Has the firm applied for any type of financial subsidies in 1998–2000 period?

☐ Yes ☐ No

F.3.1.1.2 If yes, check below the type of subsidy required

Law 1329/65 (Sabatini)	☐
Law 317/91	☐
Other laws supporting Small and Medium Sized Firms	☐
Laws supporting applied research and technological innovation: Law 46/82	☐
Fund for technological innovation (Art. 14–19 Law 46/82)	☐
Laws to stimulate investment in depressed areas: Law 488/92	☐
Law 'Visco' to stimulate investments	☐
DIT Dual Income Tax	☐
Industry Guarantees	☐
Tax allowances for firms investing in depressed areas	☐
Low interest credit for export programs (loans and insurance): Law 227/77	☐
External market trade penetration programs: Law 394/81	☐
Other laws (Specify number and objective of each law)	☐
Regional laws (Specify number and objective of each law)	☐
Other laws (Specify number and objective of each law)	☐

F.4 Financial Management

F.4 1.1 The firm's financial management is carried out by:

own personnel	☐
external intermediaries	☐

F.4.1.2 External financial intermediaries are in charge of:

Cash position management in Liras or foreign currency	☐
Administrative services (collection-payments)	☐
Guaranties – bank guaranties – banker's acceptances	☐
Export finance operations	☐

Derivatives (forwards, futures, swaps) ☐

Project financing ☐

Other operations ☐

F.4.2.1 Has the firm planned a strategy to develop its own financial management?

☐ Yes ☐ No

F.4.2.2 If yes, which are the main means?

Own personnel ☐

Intermediaries ☐

-National ☐

-Foreign ☐

-External consultants ☐

F.4.3 Breakdown of the firm's financial investment?

Participation in Italian firms ☐ %

Participation in foreign firms ☐ %

Italian short term securities ☐ %

Foreign short term securities ☐ %

Italian long and mid term securities ☐ %

Foreign long and mid term securities ☐ %

Other Italian derivative instruments ☐ %

Other foreign derivative instruments ☐ %

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