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COULD MR. AND MRS. CAPITAL MARKET IMPERFECTION PLEASE STEP FORWARD?

An Empirical Analysis of Adverse Selection and Moral Hazard in Capital Markets

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ABSTRACT: Despite the voluminous and growing literature on financial constraints, the *origins* of the constraints are hardly ever empirically analyzed. This paper offers such an analysis. We study, in particular, the empirical prevalence of adverse selection and moral hazard in capital markets using a unique survey data on Finnish small and medium-sized enterprises (SMEs). The survey data suggest that adverse selection is empirically more prevalent than moral hazard in the capital markets that the SMEs face. We also find that of the variables indicating the presence of adverse selection and moral hazard, the former has more explanatory power in regressions modeling the availability of external finance to the SMEs than the latter. Finally, we document that our proxies for adverse selection and moral hazard are inversely related to the age of firms, just like Diamond (1989) predicts.

KEYWORDS: financial constraints, adverse selection, moral hazard

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TIIVISTELMÄ: Huolimatta useista tutkimuksista, joissa tarkastellaan yritysten rahoitusrajoitteita, tiedetään rahoitusrajoitteiden syistä melko vähän. Tarkastelemme tässä tutkimuksessa empiirisesti juuri näitä syitä. Hyödyntäen ainutlaatuista kyselyaineistoa suomalaisista pienistä ja keskisuurista (pk-) yrityksistä tutkimme erityisesti sitä, kuinka yleistä ns. haitallinen valikoituminen (adverse selection) ja moraalikato (moral hazard) ovat rahoitusmarkkinoilla. Tutkimme myös näiden ilmiöiden vaikutusta ulkoisen rahoituksen saatavuuteen. Huolimatta eräistä kyselyaineiston ongelmista, käytössämme oleva yritystason aineisto viittaa siihen, että adverse selection -ongelma on moral hazard -ongelmaa vallitsevampi rahoitusmarkkinoilla, jotka pk-yritykset kohtaavat. Löydämme myös, että regressioissa, joissa mallinnamme ulkoisen rahoituksen saatavuutta, on adverse selection -ongelmaa kuvaavalla muuttujalla enemmän selitysvoimaa kuin moral hazard -ongelmaa kuvaavalla muuttujalla. Lopuksi osoitamme, että molemmat muuttujat ovat käänteisessä suhteessa yrityksen ikään, juuri kuten Diamondin (1989) tutkimus ennustaa. Tutkimus siis vahvistaa usein esitettyä näkemystä, että erityisesti uudet ja nuoret pk-yritykset kärsivät rahoituksen tehokasta kohdentumista heikentävistä adverse selection ja moral hazard -ongelmista.

Table of Contents

1 Introduction

Despite the voluminous and growing literature on financial constraints, we know almost nothing about the *origins* of these constraints: Is obtaining external finance difficult mainly because financiers cannot reliably distinguish a good firm from a bad firm? Or is it difficult, because financiers suspect that a firm may use the financing granted to it for other than the indicated purpose or take other actions that endanger the repayment? The received economic theory strongly suggests that these two phenomena, i.e., the problems of adverse selection and moral hazard, are the two primary sources of frictions in capital markets. But how prevalent are these problems empirically? Do they reduce the availability of external finance? Which of them is empirically more relevant? In this paper, we address these questions using a unique Finnish survey data set on about 600 small and medium sized enterprises (SMEs).

Our empirical approach is straightforward and transparent: The survey data contain the SMEs' stances to the above two fundamental questions about the type of capital market imperfections, as well as to questions about the availability of capital. In this paper we make use of these stances to measure the prevalence of adverse selection and moral hazard as well as the probability that an SME passes investment opportunities because of lack of capital. We construct an econometric model for the probability and estimate the effects of adverse selection and moral hazard on it. The effects we uncover and report are consistent with the predictions of the received economic theory. They are also robust to using alternative econometric specifications and proxies for capital market imperfections and availability of capital.

The earlier economic literature that explores the existence and consequences of financial constraints in the capital markets does not typically try to uncover the origins of the constraints. The diverse and still growing literature on the cash-flow sensitivity of corporate behavior does not, for example, typically single out the sources of the constraints (for a survey, see Hubbard 1998; see also Alti 2003 and Almeida, Campello, and Weisbach, in press). Neither does the insightful literature on relationship lending, such as Petersen and Rajan (1994) or Hadlock and James (2002), attempt to identify the underlying reasons why a healthy relationship to banks enhances the availability of capital. More recent tests of the existence of financial constraints echo the findings of the earlier literature (Baker, Stein and

Wurgler 2003, Banerjee and Duflo 2002, and Banerjee, Duflo and Munshi 2003), but provide no direct evidence on the potential origins of the constraints. The aim of this study is to start filling this apparent gap in the contemporary corporate finance literature.[1]

The main findings of this paper are as follows: First, the Finnish SMEs' stances to the survey questions suggest that adverse selection is empirically more prevalent than moral hazard. Second, the SMEs' stances "make sense" in that the estimated effects of adverse selection and moral hazard on the availability of capital are consistent with the predictions of the received economic theory. However, the results show that our proxy for adverse selection has more explanatory power in regressions modeling the availability of capital than our proxy for moral hazard. A number of robustness tests show, in particular, that the effect of adverse selection is statistically more robust and larger than the effect of moral hazard. Finally, we document that our proxies for adverse selection and moral hazard are inversely related to the age of firms, just like Diamond (1989) predicts.

The rest of the paper is organized as follows: In the next section we outline a theoretical framework for our empirical analysis. In section 3 we discuss the data. In section 4 we present the results of our empirical analysis. Section 5 contains a brief summary.

2 Theoretical Preliminaries

The literature on capital market imperfections, and their effects on corporate investment, has during recent years grown rapidly if not exploded. Nice roadmaps to this literature are, for example, Berger and Udell (1998), Hubbard (1998) and Stein (in press). As shown by these roadmaps, there is no unified theory of capital market imperfections. Instead, there are many theories, which vary a great deal both in terms of their focus and generality. A dominant prediction of many of these various theories is, however, that in the presence of capital market imperfec-

[1] Ausubel (1999) studies adverse selection in the credit card market and finds convincing supporting evidence for it. There is only one study - Cressy and Toivanen (2001) - we are aware of which touches upon the subject matter of our paper. To be sure, this is not the case in the literature on insurance markets, as there are quite a few empirical studies focusing directly on the existence of adverse selection and moral hazard (see, e.g., Chiappori and Salanié 2000, and Dionne, Gouriéroux and Vanasse 2001).

tions in general and adverse selection and/or moral hazard in particular, the supply curve of capital to firms is either upward sloping or vertical (rationing).[2]

The very essence of adverse selection refers to the problem that an external financier faces at the origination stage of financing: When confronted with a pool of firms in need for external finance, the financier cannot distinguish a good firm from a bad one. It therefore can grant financing only at a higher rate that compensates her for losses if the firm turns out to be bad. As Stiglitz and Weiss (1981) have shown, this may have the result of worsening the pool of firms that demand external finance. If the pool of firms with demand for external finance becomes severe enough because of the higher rate, rationing may be optimal (see however de Meza and Webb 1987).

The very essence of moral hazard refers, in turn, to the problem that an external financier faces after she has provided a firm with financing: The firm may use the financing granted to it for other than the indicated purpose or take other actions that endanger the repayment. The owner-entrepreneur of the firm may, for example, work less hard or alternatively take more risk than would be optimal from the viewpoint of the financier. If firms do not behave diligently enough, rationing may be optimal (see, Stiglitz and Weiss 1981 and Bester and Hellwig 1987). In some circumstances, these two problems may even be complementary: adverse selection can, for example, translate into moral hazard, as shown by Diamond (1989) and Petersen and Rajan (1995).

A stylized model of corporate investment best illustrates the effects of adverse selection and/or moral hazard (see, e.g., Stein in press, Banerjee and Duflo 2002, and Banergee, Duflo and Munshi 2003): If the firm invests k it obtains a gross return of $R = F(k)$, where the production function is, as usual, increasing and concave. Assuming that the firm has no internal resources, the entire investment has to be raised from the capital markets. We capture the presence of adverse selection and/or moral hazard by the cost of funds function $\hat{C} \equiv rk + \theta C(k)$, where the function $C(k)$ is increasing and convex in k, the parameter θ is a

[2] While this view appears to be dominant, convincing theoretical results suggesting the opposite also exist: De Meza and Webb (1987), for example, call into question the extent to which informational problems lead to underinvestment. De Meza and Webb (2000) also show that under reasonable assumptions, asymmetric information does not necessarily mean that there is too little lending. They show, in particular, that the full-information equilibrium may involve less borrowing than a credit-rationing equilibrium.

measure of adverse selection and/or moral hazard and r is by definition the marginal cost of funds in a first-best world. In the first best world, there are no adverse selection, moral hazard or other frictions (i.e., $\theta = 0$), implying that $\hat{C} = rk$.

Let k_0 be a firm's current level of investment. Following Banerjee and Duflo (2002), we say that the firm is *financially constrained* if $\theta > 0$ and the firm wants to raise more external finance at the marginal cost of capital it faces at k_0. Formally, this definition requires that $F'(k_0) > r + \theta C'(k_0)$. If $\theta > 0$, but the firm does *not* want to raise more external finance at its current marginal cost of capital, it faces *financing frictions.* In this case, $F'(k_0) = r + \theta C'(k_0)$ holds. Finally, if $\theta = 0$ and $F'(k_0) = r$, the firm neither is strictly financially constrained nor suffers from financing frictions.

The three possible scenarios are depicted in Figure 1, where the horizontal axis measures k and the vertical axis the marginal product (and cost) of capital. The downward sloping curve represents $F'(k)$. In scenario A, the horizontal line depicts the marginal cost of capital in the first-best world; in scenario B, the upward sloping curve reflects $r + \theta C'(k)$; and in scenario C, the supply curve of capital is vertical, implying rationing. These scenarios (from A to C) demonstrate an increasing amount of market imperfections: The worse the problems of moral hazard and adverse selection, the higher the likelihood that a firm faces financing frictions and is financially constrained. In the worst-case scenario C, the supply of capital is rationed: as drawn, the firm wants to raise more external finance than it can at the marginal cost of capital that it faces at k_C. The idea here is in other words that, because of rationing, the firm is financially constrained and cannot raise more external financing from the capital market. It therefore follows that at k_C, the marginal cost of the last dollar raised from the market, $r + \theta C'(k_C)$, is lower than $F'(k_C)$.

[Insert Figure1 about here]

The empirical implications of the three scenarios of Figure 1 can be summarized as follows: If a firm is financially constrained, it *foregoes* good investment oppor-

tunities because of capital market imperfections. We can contrast this firm's position to that of a firm facing financing frictions. The latter would *not* like to raise more external finance at its current marginal cost of capital to expand, but the former would. The firm facing financing frictions does not thus forego profitable investment opportunities, at least not in the sense the financially constrained firm does. It foregoes them only in a counterfactual sense: *If* the firm faced a more elastic supply curve of capital, it *would* expand by raising more external finance. Of course, this counterfactual shows that the firm facing financing frictions invests less than its counterpart in the first-best world. But it is not at all obvious that it would actually have to forego investment opportunities in which the marginal product of capital exceeds the firm's current marginal cost of financing.

Why do we bother with this rather elementary theoretical analysis? For two reasons: First, the analysis shows that the firms that are financially constrained are more likely to report that they have actually foregone important investment opportunities because of financing problems than the firms facing some or no financing frictions. This difference is important, because it allows us to interpret the proxies for the availability of capital that we will use in the empirics. Second, the analysis summarizes a robust prediction from the received economic theory: the supply curve of capital to firms can be vertical (or "backward sloping"). Such rationing and redlining implies a positive probability for the event that a firm foregoes investment opportunities in the presence of adverse selection and/or moral hazard (Figure 1, scenario C).

3 Data

3.1 Data Source

The data that we utilize in this paper come from a set of three consecutive surveys conducted between December 2001 and August 2003 on a sample of close to 1000 SMEs.[3] Providing the substance for the empirical analysis in this paper is

[3] Technology-based SMEs were initially over-sampled (standard stratified sampling based on exogenous variables) and account for 60% of the sample. Technology-based firms are from the high-technology (NACE Rev.1: 244, 30, 321, 322, 353), medium-technology (NACE Rev.1: 24 excluding 244, 29, 31, 323, 33, 34, 352), and information-intensive service (NACE Rev.1: 642, 721, 722, 73, 743) sectors. There were other two sectors ("other manufacturing" and "other services") in addition to these three sectors that were used as the strata.

data from the most recent of the surveys, conducted between July and August 2003.[4] This survey includes questions that directly ask firms about their perceptions of whether certain factors hamper in general the availability of external finance to firms. It also includes questions about the ability of firms to undertake important investments as well as about their ability to obtain external finance when they face the need. How the measures are constructed is discussed in more detail in the next section.

Of the initial sample of 936 firms in the first survey conducted in 2001 (36% response rate from 2600 initial contacts), 734 firms also replied to the third survey (78% response rate). Removing firms with missing or "do not know" replies (to the important questions utilized in this paper) leaves us with a sample of 597 SMEs.

3.2 Definition of Variables

Measuring the Availability of Capital

Ideally, we would like to measure by how much, if at all, the presence of adverse selection and moral hazard reduces the availability of capital to firms. Absent an ideal measure of the availability, we approximate it by constructing an indicator variable that equals one if a firm has passed important investment opportunities and zero otherwise. The survey question, as presented to the SMEs between July and August 2003, is: "*Has your firm foregone any important capital-, R&D-, marketing- or other investment projects because of financing problems ever since the beginning of year 2002?*" (YES/NO).[5] We denote this indicator variable FOREGO. Alternative measures can also be proposed. Our alternative dependent variable, NEEDMORE, is defined as the *difference* between the (self-reported) number of cases a firm has had a need for external finance ever since the begin-

[4] The initial survey was designed to gather data particularly on the funding sources and financial structure of SMEs. It also collected basic firm information such as firm age and size, export-, growth-, and R&D-orientation as well as corporate governance measures, and so provides a number of control variables for this study. The data of the second survey is not used in this study.

[5] Translation by the authors.

ning of 2002 and the (self-reported) number of cases it actually managed to raise the needed financing during the period.[6]

The two dependent variables share two common properties: First, they both reflect unsatisfied demand for external finance and allow for the possibility that some of the SMEs have faced a vertical supply curve of capital. Thus, in accordance with the above theoretical analysis, our preferred interpretation of these variables is that they describe whether an SME has been financially constrained. Second, they both refer to the same eighteen-month period: the questions on which they are based were asked during the third survey, i.e., between July and August 2003. We trust that the two measures capture in a representative fashion the SMEs that passed investment opportunities because of lack of external finance during the eighteen-month period.

Measuring the Presence of Adverse Selection and Moral Hazard

Measuring adverse selection and moral hazard is known to be difficult. The unique feature of our survey data is, however, that it contains two questions and the SMEs' stances to them that we can use to construct two direct indicators for the presence of adverse selection and moral hazard. The first equals one if a firm agrees with the position that "*Obtaining external finance is difficult because financiers cannot reliably distinguish a good firm from a bad firm*", and is zero otherwise. The second equals one if a firm agrees with the position that "*Obtaining external finance is difficult, because financiers suspect that a firm may use the financing granted to it for other than indicated purposes or take other actions that endanger the repayment*", and is zero otherwise. We denote the indicators ASELECTION and MHAZARD.

Albeit simple, the two indicators capture something of the very essence of adverse selection and moral hazard: The strength of ASELECTION as a proxy for the presence of adverse selection is that it directly refers to the origination stage of financing: When confronted with a pool of firms in need for external finance, the

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[6] These survey questions are as follows: "*How many times has your firm had a need for external finance ever since the beginning of 2002?*" and "*How many times have you managed to raise the financing?*" When asked, the respondents were informed that external financing refers to all kinds of financing from sources outside the firm (i.e., from sources other than the firm's sales, or financing from owner-managers or other owner-employees) and that it includes both debt and equity financing, and can be either short- or long-term.

financier cannot distinguish a good firm from a bad one. The strength of MHAZARD as a proxy for the presence of moral hazard is that it refers to the problem that an external financier faces after she has provided a firm with financing: The firm need not behave diligently and may take actions that endanger the repayment. The *impersonal* way in which both of these questions were presented is also worth noting. They do not refer to the behavior of the respondent and relate the problem to the financiers' behavior and suspicions. This framing is probably less important for the reliability of ASELECTION than for that of MHAZARD, because the managers responding to the survey may wish to underreport moral hazard problems. They may wish to do so, because moral hazard implies that managers are taking self-interested actions that are undesirable from the financiers' point of view. It would not be unprecedented if they did not wish to admit to being suspected of such behavior.

A skeptical reader may, of course, call for better measures than ASELECTION and MHAZARD. We respond in four ways. First, we can to some extent "validate" these two proxies by showing that the SMEs' stances "make sense". We show that these two measures correlate strongly with a couple of alternative proxies for capital market imperfections that the survey provides.[7] Second, the above two questions appear in fact *twice* in the survey, first when they are asked from all the sampled SMEs and then later again when they are asked only from those SMEs who actually have tried to raise external finance ever since the beginning of 2002. We show that our key results continue to hold when the sample is constrained to this subset of firms and when the second set of SMEs' stances is used to construct the indicators. Third, to the extent that the two indicators fail to measure any important aspects of adverse selection or moral hazard, we should probably not find any statistically significant effects. Finally, our measures have the merit of simplicity, as they do not depend on a specific theoretical model or on indirect inference.

[7] For more details about these alternative proxies, see the robustness tests. See also section 4.5, where we show that the two variables behave as Diamond's (1989) seminal model about the dynamic evolution of moral hazard and adverse selection predicts: The age of a firm is inversely related to ASELECTION and MHAZARD and it is practically the only variable that is systematically related both to ASELECTION and MHAZARD.

Control Variables

We employ two different sets of control variables. The regressors in the first set are: the age of the firm (AGE = firm age in years since initial incorporation), the size of the firm (EMP = the number of employees), district dummies for the type of district where the firm is located (city, urban, and countryside districts), region dummies for the geographic region of firm location (southern, western, eastern, and northern Finland), and dummies for the sector of the firm (high-technology, medium high-technology, information-intensive service, traditional manufacturing, and traditional trade and service sectors).

To start with, this first set of regressors is meant to control for variation in the availability of capital that is *not* related to the presence of adverse selection or moral hazard. Controls AGE and SIZE are included to this end on the following two grounds: First, the larger and better known the firm, the less dependent it is on its local capital market and the more likely that it has access to wider and more diversified national or international capital markets. Second, AGE and SIZE may capture the effects of reputation on the availability of capital. Holding the relevant capital market constant, a large and/or known firm might, for example, have a strong bargaining position when negotiating with the external financiers. Dummies for the type of district where the firm is located and the geographic region of firm location control for regional variation in the availability of capital. Such variation may be induced, for example, by the supply of government funding to SMEs that is allocated across regions as a part the government's regional policy (for a description of Finnish practices, see Hyytinen and Väänänen 2003). Yet another source of variation is regional differences in the market structure and degree of competition in the local capital markets. A local monopoly bank (or a dominant local venture capitalist) might, for example, ration capital for reasons other than adverse selection or moral hazard (for the industrial organization explanations of monopoly rationing, see for example Denicolò and Garella, 1999 and Gilbert and Klemperer, 2000). Rationing of this type can even take place in a local duopoly, as shown by Boyer and Moreaux (1988). Finally, differences in local financial development may result in cross-regional variation in the availability of capital that is not necessarily related to the problems of moral hazard and adverse selection (Guiso, Sapienza, and Zingales 2003).

The first set of regressors also includes the sector of an SME. We control for the sector, because an SME from the high-technology sectors may (have to) resort to different types of external financiers (and thus face different kinds of supply curves) than an SME from the more traditional sectors does (see Berger and Udell 1998, Lerner and Kortum 2000, and Hall 2002).[8]

The second set of regressors consists of variables that are related to the growth-opportunities and international orientation of SMEs. The regressors in this set are as follows: the export-orientation of the firm (HIGHEXPORT = 1 if the firm's exports relative to its total sales exceed 25%), the ownership of patents (PATENT = 1 if the firm owns patents), and the ownership of intangible assets other than patents (INTANG = 1 if the firm owns intangible assets other than patents, such as trademarks). We also control for the growth-intensity of the firm (GROWTH = 1 if the firm's average sales growth rate over the next three years, as predicted by the firms/entrepreneurs themselves (in December 2001), exceeds 10%).

There is at least one empirical and one theoretical reason to control for the growth-orientation and growth prospects of SMEs: On the one hand, high-growth, high-R&D and export-oriented SMEs have been at the focus of Finnish industrial policy for some time now. Variation that the policy induces in the amount of availability of capital across SMEs need not be related to the degree of adverse selection or moral hazard in the market. On the other hand, the theory suggests that the more growth-opportunities a firm has, the more likely that its internal sources of finance are not sufficient to cover its financing needs. If the internal sources are not sufficient, capital market imperfections are more likely to matter. We also acknowledge that GROWTH may be endogenous, because it is forward looking and because unavailability of external finance may erode the growth-intensity of a firm. Our conclusions are, however, robust to excluding the variable from the regressions altogether.

[8] Controlling for the sector is also important because the high-technology sectors may have suffered relatively more from the market turbulence that began about a year before the period to which the survey questions refer.

4 Analysis

4.1 Descriptive Statistics

We begin by presenting firm-level summary statistics in Table 1 for our sample of 597 firms.[9] Our main dependent variable, FOREGO, shows that 12% of the SMEs in the sample replied having foregone important investment projects due to lack of finance between the beginning of 2002 and Summer 2003. The mean of our alternative dependent variable, NEEDMORE, is 0.14. For 9% of the sample firms it is greater than 0, i.e. 9% of the sampled SMEs would have wanted to obtain external finance more often than they did. If we took literally the framework that we developed earlier, we would say that roughly every tenth Finnish SME is financially constrained.

It can be argued that a firm that reported *no* need for external finance is unlikely to be financially constrained. It is therefore of interest to ask what is the probability that a firm is financially constrained, conditional that it has a financing need.[10] Constraining the sample to firms reporting a need for external finance (272 firms) shows that the conditional mean of FOREGO is 0.22 and that of NEEDMORE is 0.31. The conditional probability that NEEDMORE is larger than zero is 0.20, which is comfortably close to the conditional mean of FOREGO. We elaborate these calculations in the robustness tests, where we run regressions (e.g., a sample selection Probit) that account better for the variation in the need for external finance.

The table also shows that adverse selection is empirically more prevalent than moral hazard. The mean of ASELECTION is 27%, while the mean of MHAZARD is (only) 16% (for a cross-tabulation, see Table 2 below). A caveat is, however, clearly in order: As we noted earlier, the mean of MHAZARD may be biased downwards, because the managers may avoid attributing to themselves

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[9] The numbers of Table 1 are based on un-weighted data. We present the weighted descriptive statistics in appendix 1; here it probably suffices to note that the weighted average of FOREGO is, for example, 8%, while for ASELECTION it is 25% and for MHAZARD 18%. Our qualitative conclusion both about the prevalence of financial constraints and the relative prevalence of the problems of adverse selection and moral hazard does not thus depend on whether the data are weighted or not. For a discussion of weighting in regression analysis when stratification is based on exogenous variables, see the robustness tests presented later.

[10] We identify these firms using the survey question: "*How many times has your firm had a need for external finance ever since the beginning of 2002?*".

behavior that does not sound diligent. The impersonal way in which this question was presented is therefore good to remember.

Finally, the table reveals that the firms in our sample have a mean age of 18 years and employ an average of 16 people. We also find that 16% of the firms have a high share (exceeding 25%) of exports in turnover, 12% own patents and 22% have intangible assets other than patents. It is of interest to note that 61% of the SMEs are very growth-oriented, i.e., expect to grow at more than 10% per annum for the next three years.

[Insert Table 1 about here]

Table 2 tabulates our dependent variables FOREGO and NEEDMORE contingent on ASELECTION and MHAZARD, and shows a Chi2-test of independence. The results of these tabulations show that independence is rejected in all four cases at the 1% significance level. A firm with ASELECTION = 1 is four times more likely to have forgone an important investment project than its counterpart. A firm with MHAZARD = 1 is more than twice as likely to have forgone an important investment project than its counterpart. Similarly, a firm that perceives either of these financial market imperfections is more likely to have an unsatisfied need for external finance (NEEDMORE > 0). This first look at the data suggests that the SMEs' stances "make sense" in that the relation from adverse selection and moral hazard to the availability of capital is consistent with the predictions of the received economic theory. In panel B, we cross-tabulate ASELECTION and MHAZARD and see that the two are interrelated.

[Insert Table 2 about here]

4.2 Basic Regression Results

Table 3 presents our basic regression results. Panel A shows the results from Probit estimations of the model with FOREGO as the dependent variable. Panel B shows the results from Poisson estimations of NEEDMORE. The standard errors of Probit regressions that we display are not based on a robust variance-covariance matrix, but we have re-estimated *each and every* model and re-

computed the standard errors also using such a matrix: the results remain as reported here. The standard errors of the Poisson estimates are derived from the robust Huber-White variance-covariance matrix (see Cameron and Trivedi 1998, and Wooldridge 1997).

[Insert Table 3 about here]

The main finding that emerges from the table is that the coefficient of ASELECTION is positive and significant at the 1% level in each of the reported six regressions. The coefficient of MHAZARD is positive, too. It is however (marginally) significant in only two of the reported regressions. The estimated effects of adverse selection and moral hazard on the availability of capital are thus consistent with the predictions of the received economic theory. The estimations suggest, however, ASELECTION has more incremental explanatory power in regressions modeling the availability of external finance to firms than MHAZARD. If we take literally our preferred interpretation of FOREGO (and NEEDMORE), the result suggests that the probability that an SME is *financially constrained* is more related to the problem of adverse selection than to moral hazard. As we will show below, this finding is robust: ASELECTION obtains consistently a positive and significant coefficient in regressions modeling the availability of external finance to firms. The same does not hold for MHAZARD, which obtains a positive, but sometimes not significant coefficient.

We have computed likelihood ratio tests for the variables added in columns (2) and (3): relative to column (1), the *p*-value of the joint test of the additional variables in column (2) is 0.119 in the Probit model and 0.024 in the Poisson model. The *p*-value of the corresponding test between columns (1) and (3) is 0.001 in the Probit model and <0.001 in the Poisson model. The only variable in addition to ASELECTION that has a statistically significant coefficient in both Probit and Poisson regressions is INTANG. Its effect is not, however, robust to using alternative specifications, as our robustness tests will show.

To get an idea of the magnitude of the coefficient of ASELECTION, we calculate its marginal effect using the Probit estimation results for FOREGO, reported in column (3). Evaluated at the mean of the explanatory variables, ASELECTION increases the probability that a firm has foregone an investment project by 14.9 percentage points. Comparing this figure to the average probability of

having foregone an investment opportunity, 12%, shows that the effect of ASELECTION is large. The Poisson regressions echo this conclusion: Using the most conservative estimate of the Table 3 suggests that the expected number of times that a firm has had an unsatisfied need for external finance increases by a factor of 3.25, if ASELECTION shifts from zero to one.

4.3 Robustness Tests

In the following, we consider and try to rule out alternative explanations for our empirical results. Taking each robustness test in turn:

Robustness test 1 (further controls and alternative specifications): We start by including sequentially in the basic regression (i.e., column (3) of Table 3) three alternative sets of additional firm-level controls. The first controls for firms' innovativeness. It contains the variable R&D (firm's R&D intensity), and two dummies for innovation (NEWPRODUCT=1 if the firm had launched a new product into the market in the period 1999-2001, and NEWPROCESS=1 if the firm had taken up a new production process in the period 1999-2001). We include these new controls to better control for the possibility that unobserved innovativeness, which may be positively correlated with both the dependent variables and ASELECTION, is driving our main result. The second set of additional controls (in column 2) contains corporate governance variables, defined as follows: CEOAGE is the number of years that the firm's current CEO has been holding the post; CEOEDU is a dummy equal to one if the firm's CEO has a university degree; FOREOWN is a dummy equal to one if the firm has any foreign owners; and CEOCHAIR is a dummy equal to one if the firm's CEO is also the chairman of the firm's board of directors. We add these controls, because an SME with bad governance is a prime candidate for facing a limited supply of capital. Because the limited supply due to this reason may have to do with ASELECTION (and/or MHAZARD), we check the robustness of our results to this extension. Finally, the third set of variables controls for possible non-linear effects of firm age and size.[11]

[11] Appendix 2 reports descriptive statistics for these further control variables, as well as for some alternative measures used in the later robustness analysis.

Table 4 reports the results from the extensions to our basic regressions. Panel A shows the results from Probit estimations of FOREGO, Panel B shows the results from Poisson estimations of NEEDMORE. The basic result of ours remains intact: ASELECTION has significant explanatory power in regressions modeling the availability of external finance to Finnish SMEs. In these regressions MHAZARD obtains more often than in our basic regressions a coefficient that is significant at better than the 10% level.[12]

[Insert table about 4 here]

Because the polynomials of AGE and SIZE gain joint significance in both panels of Table 4, we re-run the regressions of Table 3 with the polynomials. We do not report these estimations in detail, but note only that the basic findings of Table 3 do not change: ASELECTION obtains a positive and statistically significant coefficient. We also re-run the regressions of Table 3 and 4 without GROWTH, which may be endogenous. We find that the result for adverse selection does not depend on the presence of GROWTH: The exclusion of GROWTH does, however, increase both the size and statistical significance of the coefficient of MHAZARD. Finally, we run both a Probit for FOREGO and a Poisson regression for NEEDMORE with all the new controls (cf. Table 4) included at the same time. In these estimations both ASELECTION and MHAZARD obtain a positive and statistically significant coefficient.

Robustness test 2 (restricted sample and sample selection): A potential criticism against our results is that the firms that have no need for external finance are less likely to agree with the statements underlying ASELECTION and MHAZARD. To check whether such selective reporting drives our results, we constrain the estimating sample to 272 firms that reported a need for external finance. In this restricted sample, the mean of ASELECTION is 33% and that of MHAZARD 19%. Conveniently for us, these numbers are only slightly larger than the respective proportions in the larger estimating sample. Table 5 reports the results of this robustness test. Panel A presents the results when the basic sets of regressors are

[12] The largest common sample for the three alternative specifications of Table 4 consists of 465 SMEs. Using this sample we find that the *p*-values of the likelihood ratio tests for the additional controls of Table 4 (relative to column (3) of Table 3) are 0.156, 0.001 and 0.001 in the Probit model and 0.082, 0.235 and <0.001 in the Poisson model.

used, Panel B when the additional firm-level controls (used in the previous robustness check) are included. These Poisson estimations of NEEDMORE show that the basic result is robust to using this alternative estimating sample. Finally, we have run sample selection Probit models with various control vectors, in which the selection equation is about having an external financing need or not and the main equation models FOREGO. Our analysis is robust to the selection, as these estimations endorse our earlier results. Interestingly, none of the several LR-tests for the independence of the selection and main equations reject the null hypothesis of the independence at the 10% significance level.

[Insert Table 5 about here]

Robustness test 3 (REALASEL and REALMHAZ in place of ASELECTION and MHAZARD): Is mis-measurement in ASELECTION or MHAZARD driving our results? This robustness check addresses this concern by using alternative measures of adverse selection and moral hazard, REALASEL and REALMHAZ. These measures are constructed from the survey questions that asked *only* those firms that actually made an attempt to obtain external finance whether it was hampered by the fact that (i) financiers have problems distinguishing a good firm from a bad one (REALASEL), and (ii) financiers fear that the firm may, through its actions, endanger the repayment of the finance (REALMHAZ). The aim of these alternative measures, which we can construct for 270 SMEs, is to capture the presence of "*real"* (or actual) adverse selection and moral hazard problems as concerns for those firms.[13]

Table 6 reports the results of estimations of FOREGO (Panel A) and NEEDMORE (Panel B) performed on the sample of 270 firms that reported a need for external finance *and* for which we are able to replace ASELECTION and MHAZARD with REALASEL and REALMHAZ. As the table shows, the robustness test echoes our earlier findings.

[Insert Table 6 here]

[13] Appendix 3 reports a contingency table showing that these alternative variables correlate strongly with our main measures. Compared to the previous robustness test, two observations are lost due to missing replies to the questions that we use to construct REALASEL and REALMHAZ.

Robustness test 4 (SPLIT or COMBINED in place of MHAZARD): Since there are reasons to believe that MHAZARD suffers from underreporting, we perform a robustness check where we use the full sample and where alternative variables replace it. Table 7 reports the results of estimations of NEEDMORE (Panel A) and FOREGO (Panel B) on the full sample of firms[14], where MHAZARD is replaced by a new proxy, called SPLIT. This new variable is a dummy equal to one if the firm reported that different financiers have had differing views of the firm's creditworthiness or its attractiveness as an investment target.[15] This variable is likely to capture the presence of both adverse selection and moral hazard problems, because if a firm's "risk" is harder to observe due to either or both of these problems, the financiers should disagree more often over the firm's creditworthiness or its attractiveness as an investment target (Morgan 2002). Our preferred interpretation of this robustness test is that since adverse selection is already controlled for in the estimations, the coefficient of SPLIT should reflect the effects of moral hazard. An alternative way of interpreting the test is to consider it as a robustness test for the definition of ASELECTION: should SPLIT capture better adverse selection than ASELECTION, the latter variable would no longer be significant (with SPLIT now included). The result that emerges from including SPLIT conforms our earlier analysis: ASELECTION matters. Interestingly enough, SPLIT obtains a positive coefficient that is significant at better than the 10% level in five out of the six reported regressions, suggesting that maybe the presence of moral hazard is not fully captured by MHAZARD.

[Insert Table 7 about here]

Table 8 reports the results of estimations similar to those in Table 7, except that now the variable accounting for moral hazard is COMBINED.[16] This new variable is a dummy equal to one if the firm replied that obtaining external finance is "hampered by the fact that it is difficult to convince potential financiers of the firm's creditworthiness or its attractiveness as an investment target". Like with

[14] Few observations are lost due to missing replies so that the sample size decreases to 579.

[15] Appendix 3 reports a contingency table showing that SPLIT correlates strongly with our main measures.

[16] Few observations are lost due to missing replies so that the sample size is 588.

SPLIT, including this variable into the regression in place of MHAZARD tests two things: First, it is likely to capture both adverse selection and moral hazard, but once controlling for ASELECTION, its coefficient should account for moral hazard alone. Second, it is also a test for the strength of the definition of ASELECTION.

As we can see from the table, the results of this robustness test echo our basic findings: when the dependent variable is FOREGO, the coefficient of ASELECTION is positive and significant at the 1% level. The significance of ASELECTION is, however, somewhat eroded in the three Poisson regressions in which the dependent variable is NEEDMORE. Despite the erosion, ASELECTION obtains a coefficient that is positive and significant at the 10% level. The effect nevertheless remains large: the most conservative Poisson estimate implies that the expected number of times of unsatisfied need for external finance increases by a factor of 2.12, if ASELECTION shifts from zero to one. What we also find is that COMBINED obtains a positive coefficient that is significant at better than the 1% level in the six reported regressions.[17]

[Insert Table 8 about here]

Robustness test 5 (SPLIT or COMBINED in place of ASELECTION): The purpose of this robustness test is to show yet in another way that mis-measurement is not driving our results. To show that, we repeat all the regressions reported in Tables 7 and 8, but this time SPLIT / COMBINED replaces ASELECTION. Controlling for MHAZARD, the coefficients of these alternative proxies should reflect adverse selection only. The alternative interpretation is that including these alternative proxies is a test for the strength of the definition of MHAZARD. We do not report these estimations in detail, but note that in each regression in which SPLIT is included with MHAZARD, the coefficient of SPLIT is positive and statistically significant at better than 5% level. The coefficient of MHAZARD is always positive, but not systematically significant at the conventional levels. The same results

[17] We conjecture that the significance of ASELECTION is eroded not so much because moral hazard (as now captured by COMBINED) is empirically more relevant, but because the correlation between COMBINED and ASELECTION makes it difficult to measure precisely the effect of ASELECTION on NEEDMORE. The analysis of Appendix 1 shows that the data supports this conjecture: COMBINED correlates strongly both with ASELECTION and MHAZARD, but especially with the former.

hold with COMBINED included. Whichever of the two above interpretations for this robustness tests hold, the results echo the conclusion that proxies for ASELECTION obtain consistently more often a positive and significant coefficient in regressions modeling the availability of external finance than proxies for MHAZARD.

Robustness test 6 (SPLIT or COMBINED in addition to ASELECTION and MHAZARD): The foregoing robustness tests can be criticized, because SPLIT (or COMBINED) is included in the model only when one of the main proxies is excluded from it. To show that the criticism is not warranted, we repeat all the regressions reported in Tables 7 and 8, but this time SPLIT (or COMBINED) is included in addition to ASELECTION and MHAZARD. For brevity, we do not report these regressions in a table. It suffices to note here that the *only* variable that obtains a positive and statistically significant coefficient in *all* regressions is ASELECTION. The coefficient is always significant at better than 5% level, bar two exceptions when its *p*-value is 0.060 and 0.087.

Robustness test 7 (stability of parameters and weighting): Our sample is an outcome of standard stratified sampling. In this type of sampling, the population is divided into mutually exclusive, exhaustive strata (here: five "sectors"), and a random sample of fixed size is taken from each stratum. The method results in a sample of independent but not identically distributed observations (see Imbens and Lancaster 1996, or Wooldridge 2001 for a formal definition). Because the stratification of our data is based on exogenous variables, the estimators that we have used (and that ignore stratification) are consistent and asymptotically normally distributed (Wooldridge 2001, especially pp. 458-460). The usual variance-covariance matrix estimators are consistent, too (Wooldridge 2001, pp. 460-461). Because we condition systematically on the five strata, these analytical results imply that stratification should not cause us any real concerns.[18] To address the concern that maybe our estimates nevertheless reflect the sampling design, we run

[18] "If the sampling were random, the parameters of the conditional distribution could be estimated consistently and efficiently by maximizing the conditional likelihood function. Even if the sampling were exogenous, by which we mean that the probability of a unit of the population being sampled depends on the values of the explanatory variables, this method would lead to consistent and efficient estimates" (Imbens and Lancaster 1996, pp. 290). In our case, the probability of a unit of the population being sampled depends by design only on the sector from which the unit (= the firm) is. This design means that the probability of being sampled should not depend directly on the values of FOREGONE (or NEEDMORE).

several regressions in which we explore the possibility. To start with, we divide the sample into "technology-based" and "other" firms using the stratums (sectors) of the sample design (which purposefully over-sampled the technology-based firms). When we rerun the Probit models for FOREGONE using these smaller sub samples, we find that ASELECTION remains positive and significant at the 1% level in the sub sample of technology based SMEs and at the 10% level in the other sub sample. MHAZARD gains significance only in the latter sample. Using the Probit models for FOREGONE, we also check the stability of the coefficient of ASELECTION by including its interaction with each of the five stratums used in the sampling. A likelihood ratio test does not reject the null hypothesis of parameter stability across the stratums (*p*-value: 0.218). A similar LR-test for the stability of the coefficient of MHAZARD echoes our earlier findings, as it suggests that the coefficient is less stable across the sectors (*p*-value: 0.051.) None of the interacted coefficients is individually significant, however.

Robustness test 8 (distributional assumptions): Is a mis-specified distributional assumption driving our findings? To address this question, we re-run the models of Table 3 for FOREGO as linear probability models, which may be more robust to the underlying assumptions about the model specification than the Probit model (see for example Wooldridge 2002). The coefficient of ASELECTION is again significant at better then the 1% level in each specification. Logit regressions confirm this result, too. Finally, ordinary least squares estimations of the models of Table 3 for NEEDMORE endorse the findings from the Poisson estimations.

Robustness test 9 (heterogeneous "treatment" effects): To explore the possibility that the effects of adverse selection and moral hazard are heterogeneous across firms, we include interaction terms of AGE and EMP with the proxies for ASELECTION and MHAZARD. We do so, because both the size and age of a firm are often used to proxy the propensity that the firm suffers from capital market imperfections (Petersen and Rajan 1994, 1995, and Hubbard 1998). Including these interactions in both Probit and Poisson specifications (of Table 3) shows that our result for ASELECTION remains intact: it again obtains a positive and significant coefficient (regression not reported). We also find that the interaction of AGE and ASELECTION gains a negative significant coefficient. This empirical finding supports the theoretical result that adverse selection may matter less for more mature firms (Diamond 1989; see also below). The results for MHAZARD

are less conclusive. Finally, an interaction between ASELECTION and MHAZARD does not obtain a statistically significant coefficient. We thus find some but not overwhelming evidence for heterogeneous "treatment" effects. Whether some types of firms suffer disproportionately more either from adverse selection or moral hazard than others is, nevertheless, an important question that future research could address.

Summing up, we have run several new regressions and each of them illustrates the robustness of our basic finding: ASELECTION obtains consistently a positive and significant coefficient in regressions modeling the availability of external finance. The results for moral hazard are not as robust, because proxies for it tend to obtain a coefficient that is positive, but not always statistically significant. The robustness tests thus support the view that the probability that an SME is financially constrained is more robustly related to adverse selection than to moral hazard.

4.4 A Test of Diamond (1989)

A conventional wisdom in the corporate finance literature is that financing constraints are especially acute for young firms (see, for reviews, Berger and Udell 1998 and Hubbard 1998). Evans and Jovanovic (1989) find, for example, that such constraints reduce entrepreneurship. Cabral and Mata (2003) provide supporting evidence from a different angle, as they find that the constraints can also explain the evolution of firm size distribution.

Diamond (1989) provides a theoretical explanation for these findings: In his model, the joint influence of adverse selection and moral hazard reduces the ability of an infant firm to raise external finance. These problems are most severe when the firm is young and has only a short track record, because then a severe enough adverse selection (leading to high interest rates) undermines the firm's incentives to behave diligently (i.e. to choose a low risk investment project). If the firm survives to next period despite its risky investment decision, adverse selection is less of a problem, for those that survive are, on average, of better quality. Once adverse selection is less of a problem, the interest rates that financiers demand will be lower. This increases the firm's incentive to choose a less risky project, for it has more to loose, if the project fails. The implication of this dynamic

evolution of incentives is that reputation that is built over time enhances firm's incentives to behave diligently and avoid moral hazard.

Our survey data allow us to explore the reason why financing constraints are especially acute for young firms. We can do so by regressing ASELECTION and MHAZARD on AGE. Because the age of a firm is a very widely used proxy for reputation, an interpretation of these regressions is that they are a test of Diamond's (1989) basic insight: Are the problems of adverse selection and moral hazard most severe when firms are young and have a weak reputation?

Table 9 reports the results of Probit regressions of ASELECTION and MHAZARD on AGE and other control variables. The basic finding is clear: AGE is inversely related to ASELECTION and MHAZARD, which is consistent with Diamond's theoretical insights. What's more, the magnitude of the effect is relatively small (marginal effects not reported), which is to be expected if reputation building takes time. Interestingly, AGE seems to be the only variable that is systematically related *both* to ASELECTION *and* to MHAZARD. The ownership of intangible assets other than patents (as captured by INTANG-dummy) is positively related only to ASELECTION. Such a relation is intuitive if these assets are opaque. We conclude that these regressions lend, if anything, further credence to the two indicators as measures of adverse selection and moral hazard.

[Insert Table 9 about here]

5 Conclusions

Is obtaining external finance difficult mainly because financiers cannot reliably distinguish a good firm from a bad firm? Or is it difficult, because financiers suspect that a firm may use the financing granted to it for other than the indicated purpose or take other actions that endanger the repayment? The received literature suggests that these two phenomena, i.e., the problems of adverse election and moral hazard, are the primary sources of frictions in capital markets. But how prevalent are these problems? How many firms suffer from them? Which of them is empirically more relevant?

In this paper, we first develop a simple theoretical framework to guide our empirical analysis. We then address the above questions using a straightforward and transparent empirical approach and unique firm-level survey data from Finland. Our main findings are as follows:

- The Finnish SMEs' stances to the survey questions suggest that adverse selection is empirically more prevalent than moral hazard.
- The estimated effects of adverse selection and moral hazard on the availability of capital are consistent with the predictions of the received economic theory. Our proxy for adverse selection has more explanatory power in regressions modeling the availability of capital than our proxy for moral hazard. A number of robustness tests show, furthermore, that the effect of adverse selection is more robust and larger than the effect of moral hazard.
- Our proxies for adverse selection and moral hazard are inversely related to the age of firms, just like Diamond (1989) predicts. The finding provides a rationale for the conventional wisdom that financing constraints are especially acute for young firms.

Despite the voluminous and growing literature on financial constraints, their empirical origins remain unexplored. The contemporary empirical corporate finance literature is, in fact, mysteriously lagging behind the related empirical literature on insurance markets, where the relevance of adverse selection and moral hazard are better established. There is, however, more to the empirical foundations of financial constraints than documented in this paper, as otherwise it would be hard to rationalize the voluminous and still growing theoretical literature on the effects of adverse selection and moral hazard in capital markets. We are forced to conclude that our survey-based empirical analysis cannot be more than a first look at this fascinating topic.

References

Almeida, Heitor, Campello, Murillo and Weisbach, Michael S., 2003, The cash flow sensitivity of cash, *Journal of Finance.*

Alti, Aydogan, 2003, How sensitive is investment to cash flow when financing is frictionless?, *Journal of Finance,* Vol. 58, pp. 707-722.

Ausubel, Lawrence M., 1999, Adverse selection in the credit card market, mimeo, University of Maryland.

Baker, Malcolm, Stein, Jeremy, and Wurgler, Jeffrey, 2003, When does the market matter? Stock prices and the investment of equity-dependent firms, *Quarterly Journal of Economics*, Vol. 118, pp. 969-1005.

Banerjee, Abhijit, V. and Duflo, Esther C., 2002, Do firms want to borrow more? Testing credit constraints using a directed lending program, mimeo, Massachusetts Institute of Technology.

Banerjee, Abhijit, V., Duflo, Esther C., and Munshi, Kaivan, 2003, The (mis)allocation of capital, *Journal of the European Economic Association*, Vol. 1 (2-3), pp. 484-494.

Berger, Allen N., and Udell, Gregory F., 1998, The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle, *Journal of Banking and Finance*, Vol. 22, Issues 6-8, pp. 613-673.

Bester, Helmut and Hellwig, Martin, F., 1987, Moral hazard and equilibrium credit rationing: An overview of the issues, in: *Agency Theory, Information and Incentives*, edited by Bamberg, G. and Spremann K., Springer, Heidelberg, pp. 135-167.

Boyer, Marcel, and Moreaux, Michel, 1988, Rational rationing in Stackelberg equilibria, *Quarterly Journal of Economics*, Vol. 103, pp. 409-419.

Cabral, Luís M. B. and Mata, José, 2003, On the evolution of the firm size distribution: Facts and theory, *American Economic Review*, Vol. 93, No. 4, pp. 1075-1090.

Cameron, Colin A., and Trivedi, Pravin K., 1998, *Regression Analysis of Count Data*, Cambridge University Press, Cambridge.

Chiappori, Pierre-André, and Bernard Salanié, 2000, Testing for asymmetric information in insurance markets, *Journal of Political Economy*. Vol. 108, pp. 56-79.

Cressy, Robert and Toivanen, Otto, 2001, Is there adverse selection in the credit market?, *Venture Capital: An International Journal of Entrepreneurial Finance*, Vol. 3, No. 3, pp. 215-238.

de Meza, David, and Webb, David C., 1987, Too much investment: a problem of asymmetric information, *Quarterly Journal of Economics*, Vol. 102, pp. 281–292.

de Meza, David and Webb, David C., 2000, Does credit rationing imply insufficient lending? *Journal of Public Economics*, Vol. 78, No. 3, pp. 215-234.

Denicolò, Vincenzo, and Garella, Paola G., 1999, Rationing in a durable goods monopoly, *Rand Journal of Economics*, Vol. 30, No. 1, pp. 44-55.

Diamond, Douglas W., 1989, Reputation acquisition in debt markets, *Journal of Political Economy*, Vol. 97, No. 4, pp. 828-862.

Dionne, Georges, Christian Gouriéroux, and Charles Vanasse, 2001, Testing for evidence of adverse selection in the automobile insurance market: A comment, *Journal of Political Economy*, Vol. 109, pp. 444-450.

Evans, David S. and Jovanovic, Byan, 1989, An estimated model of entrepreneurial choice under liquidity constraints, *Journal of Political Economy*, Vol. 97, No. 4, pp. 808-827.

Gilbert, Richard J., and Klemperer, Paul, 2000, An equilibrium theory of rationing, *Rand Journal of Economics*, Vol. 31, pp. 1-21.

Guiso, Luigi, Sapienza, Paola, and Zingales, Luigi, 2003, Does local financial development matter?, mimeo, Graduate School of Business, University of Chigaco.

Hadlock, Charles J. and James, Christopher M., 2002, Do banks provide financial slack?, *Journal of Finance*, Vol. 57, Issue 3, pp. 1383-1419.

Hall, Bronwyn H., 2002, Financing of research and development, *Oxford Review of Economic Policy*, Vol. 18, pp. 35-51.

Hubbard, Glenn R., 1998, Capital-market imperfections and investment, *Journal of Economic Literature*, Vol. 36, pp. 193-225.

Hyytinen, Ari and Lotta Väänänen, 2003, Government funding of small and medium-sized enterprises in Finland, in: *Financial Systems and Firm Performance: Theoretical and Empirical Perspectives*, edited by Hyytinen, A. and Pajarinen, M., The Research Institute of the Finnish Economy (ETLA), Series B:200, pp. 325-378.

Imbens, Guido W. and Lancaster, Tony, 1996, Efficient estimation and stratified sampling, *Journal of Econometrics*, Vol. 74, pp. 289-318.

Lerner, Josh, and Kortum, Samuel, 2000, Assessing the contribution of venture capital to innovation, *Rand Journal of Economics*, Vol. 31, pp. 674-692.

Morgan, Donald P., 2002, Rating banks: Risk and uncertainty in an opaque industry, *American Economic Review*, Vol. 92, No. 4, pp. 874-888.

Petersen, Mitchell A., and Rajan, Raghuram G., 1994, The benefits of lending relationships: Evidence from small business data, *Journal of Finance*, Vol. 49, pp. 3-37.

Petersen, Mitchell A., and Rajan, Raghuram G., 1995, The effect of credit market competition on lending relationships, *Quarterly Journal of Economics*, Vol. 110, pp. 407-443. S

Stein, Jeremy C., in press, Agency, information and corporate investment, in: *Handbook of Economics and Finance*, edited by Constantinides G., Harris, M. and Stulz, R., North Holland, Amsterdam.

Stiglitz, Joseph and Weiss, Andrew, 1981, Credit rationing in markets with imperfect information, *American Economic Review*, Vol. 71, pp. 393-410.

Wooldridge, Jeffrey, M., 1997, Quasi-likelihood methods for count data, in: *Handbook of Applied Econometrics, Volume II: Microeconomics*, edited by Pesaran, M. H. and Schmidt, P., Blackwell Publishers, Oxford, pp. 353-406.

Wooldridge, Jeffrey M., 2001, Asymptotic properties of weighted M-estimators for standard stratified samples, *Econometric Theory*, Vol. 17, pp. 451-470.

Wooldridge, Jeffrey M., 2002, *Econometric Analysis of Cross Section and Panel Data*, The MIT Press, Cambridge.

Appendix 1.

Table A.1. Descriptive statistics (weighted sample)

Variable	Obs	Mean	Std. Dev.	Min	Max
$FOREGO_i$	597	0.08	0.27	0	1
$NEEDMORE_i$	597	0.10	0.40	0	5
$ASELECTION_i$	597	0.25	0.44	0	1
$MHAZARD_i$	597	0.18	0.38	0	1
AGE_i	597	18.54	15.69	2	120
EMP_i	597	12.57	22.37	1	190
$HIGHEXPORT_i$	597	0.10	0.30	0	1
$PATENT_i$	597	0.06	0.23	0	1
$INTANG_i$	597	0.13	0.33	0	1
$GROWTH_i$	597	0.50	0.50	0	1

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The sample was exogenously stratified according to firms' industry sector and includes 597 Finnish SMEs. The descriptive statistics in this table are the result of weighting the sample by sector (strata) to represent the population of Finnish SMEs. FOREGO is a dummy equal to one if the firm reported having foregone an important investment opportunity; NEEDMORE is a count variable indicating the number of times a firm has had an unsatisfied need for external finance; ASELECTION is a dummy equal to one if the firm agreed with a statement implying that adverse selection hampers availability of external finance; MHAZARD is a dummy equal to one if the firm agreed with a statement implying that moral hazard hampers availability of external finance; AGE is firm age in years since initial incorporation; EMP is the number of employees; HIGHEXPORT is a dummy equal to one if the firm's exports relative to total sales exceeds 25%; PATENT is a dummy equal to one if the firm owns patents; INTANG is a dummy equal to one if the firm owns intangible assets other than patents; GROWTH is a dummy equal to one if the firm's projected growth rate over the next three years exceeds 10% per annum. More detailed descriptions of the variables are found in text in Section 3.2.

Appendix 2.

Table A.2. Descriptive statistics (further controls)

Variable	Obs	Mean	Std. Dev.	Min	Max
$COMBINED_i$	588	0.31	0.46	0	1
$SPLIT_i$	579	0.32	0.47	0	1
$REALASEL_i$	270	0.21	0.41	0	1
$REALMHAZ_i$	271	0.08	0.27	0	1
$R\&D_i$	478	0.08	0.32	0	6.25
$NEWPRODUCT_i$	595	0.43	0.50	0	1
$NEWPROCESS_i$	592	0.33	0.47	0	1
$CEOAGE_i$	594	9.51	7.37	0	42
$CEOEDU_i$	588	0.29	0.46	0	1
$FOREOWN_i$	597	0.03	0.18	0	1
$CEOCHAIR_i$	595	0.49	0.50	0	1

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The sample was exogenously stratified according to firms' industry sector, and includes 597 Finnish SMEs. The descriptive statistics in this table are un-weighted results for the sample. The variables summarized here are used in our robustness checks and include our alternative measures of capital market imperfections (COMBINED, SPLIT, REALASEL, AND REALMHAZ) as well as our further firm-level control variables. COMBINED is a dummy equal to one if the firm replied that obtaining external finance is "hampered by the fact that it is difficult to convince potential financiers of the firm's creditworthiness or its attractiveness as an investment target"; SPLIT is a dummy equal to one if the firm reported that different financiers have had differing views of the firm's creditworthiness or its attractiveness as an investment target. REALASEL and REALMHAZ are measures constructed from the survey questions that asked *only* those firms that actually made an attempt to obtain external finance whether it was hampered by the fact that (i) financiers have problems distinguishing a good firm from a bad one (REALASEL), and (ii) financiers fear that the firm may, through its actions, endanger the repayment of the finance (REALMHAZ). The further firm-level controls are as follows: R&D is firm's R&D intensity; NEWPRODUCT is a dummy equal to one if the firm had launched a new product into the market in the period 1999-2001; NEWPROCESS is a dummy equal to one if the firm had taken up a new production process in the period 1999-2001; CEOAGE is the number of years that the firm's current CEO has been holding the post; CEOEDU is a dummy equal to one if the firm's CEO has a university degree; FOREOWN is a dummy equal to one if the firm has any foreign owners; CEOCHAIR is a dummy equal to one if the firm's CEO is also the chairman of the firm's board of directors. More detailed descriptions of the variables are found in text in Section 4.3. The number of observations for the variables varies due to different numbers of missing replies to different questions.

Appendix 3.

Table A.3. Cross-tabulations of measures of capital market imperfections

PANEL A		**ASELECTION$_i$**			**MHAZARD$_i$**		
		No	Yes	Total	No	Yes	Total
COMBINED$_i$	No	354	53	407	381	26	407
		87 %	13 %	100 %	94 %	6 %	100 %
	Yes	75	106	181	114	67	181
		41 %	59 %	100 %	63 %	37 %	100 %
	Pearson chi2	131.71			88.27		
	p-value	0.000			0.000		
SPLIT$_i$	No	318	77	395	343	52	395
		81 %	19 %	100 %	87 %	13 %	100 %
	Yes	103	81	184	143	41	184
		56 %	44 %	100 %	78 %	22 %	100 %
	Pearson chi2	38.06			7.74		
	p-value	0.000			0.005		

PANEL B		**ASELECTION$_i$**			**MHAZARD$_i$**		
		No	Yes	Total	No	Yes	Total
		181	89	270	218	52	270
		67 %	33 %	100 %	81 %	19 %	100 %
REALASEL$_i$	No	172	42	214	184	30	214
		80 %	20 %	100 %	86 %	14 %	100 %
	Yes	9	47	56	34	22	56
		16 %	84 %	100 %	61 %	39 %	100 %
	Pearson chi2	83.05			18.22		
	p-value	0.000			0.000		
REALMHAZ$_i$	No	177	72	249	210	39	249
		71 %	29 %	100 %	84 %	16 %	100 %
	Yes	4	17	21	8	13	21
		19 %	81 %	100 %	38 %	62 %	100 %
	Pearson chi2	23.73			26.63		
	p-value	0.000			0.000		

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The sample was exogenously stratified according to firms' industry sector, and includes 597 Finnish SMEs. In Panel A we loose a few observations due to missing replies to the relevant questions. The sample in Panel B contains only those firms that reported a need for external finance between the beginning of 2002 and the survey date in July-August 2003 (272 firms), from which we loose 2 firms due to missing replies, leaving us with 270 firms. The table shows that our alternative measures (COMBINED and SPLIT; REALASEL and REALMHAZ) correlate strongly with our main measures of capital market imperfections (ASELECTION and MHAZARD); the Chi2-test of independence is rejected in all of the cases. Descriptions of the variables are found in text in Section 4.3. "YES" corresponds to the dummy being equal to one, "NO" corresponds to it being zero. The table shows the number of YES/NO replies to each and the corresponding conditional percentages.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$FOREGO_i$	597	0.12	0.33	0	1
$NEEDMORE_i$	597	0.14	0.56	0	5
$ASELECTION_i$	597	0.27	0.45	0	1
$MHAZARD_i$	597	0.16	0.37	0	1
AGE_i	597	18.20	16.63	2	120
EMP_i	597	16.36	25.39	1	190
$HIGHEXPORT_i$	597	0.16	0.36	0	1
$PATENT_i$	597	0.12	0.32	0	1
$INTANG_i$	597	0.22	0.41	0	1
$GROWTH_i$	597	0.61	0.49	0	1

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The sample was exogenously stratified according to firms' industry sector, and includes 597 Finnish SMEs. The descriptive statistics are un-weighted (for weighted statistics, see Appendix 1). FOREGO is a dummy equal to one if the firm reported having foregone an important investment opportunity; NEEDMORE is a count variable indicating the number of times a firm has had an unsatisfied need for external finance; ASELECTION is a dummy equal to one if the firm agreed with a statement implying that adverse selection hampers availability of external finance; MHAZ-ARD is a dummy equal to one if the firm agreed with a statement implying that moral hazard hampers availability of external finance; AGE is firm age in years since initial incorporation; EMP is the number of employees; HIGHEXPORT is a dummy equal to one if the firm's exports relative to total sales exceeds 25%; PATENT is a dummy equal to one if the firm owns patents; INTANG is a dummy equal to one if the firm owns intangible assets other than patents; GROWTH is a dummy equal to one if the firm's projected growth rate over the next three years exceeds 10% per annum. More detailed descriptions of the variables are found in text in Section 3.2.

Table 2. Cross-tabulations

PANEL A		$FOREGO_i$			$NEEDMORE_i$		
		No	Yes	Total	= 0	> 0	Total
		523 88 %	74 12 %	597 100 %	543 91 %	54 9 %	597 100 %
$ASELECTION_i$	No	406 93 %	29 7 %	435 100 %	413 95 %	22 5 %	435 100 %
	Yes	117 72 %	45 28 %	162 100 %	130 80 %	32 20 %	162 100 %
	Pearson chi2 p-value	48.45 0.000			30.99 0.000		
$MHAZARD_i$	No	450 90 %	51 10 %	501 100 %	468 93 %	33 7 %	501 100 %
	Yes	73 76 %	23 24 %	96 100 %	75 78 %	21 22 %	96 100 %
	Pearson chi2 p-value	14.09 0.000			22.89 0.000		

PANEL B		$MHAZARD_i$		
		No	Yes	Total
$ASELECTION_i$	No	399 92 %	36 8 %	435 100 %
	Yes	102 63 %	60 37 %	162 100 %
	Pearson chi2 p-value	72.36 0.000		

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The sample was exogenously stratified according to firms' industry sector, and includes 597 Finnish SMEs. Panel A tabulates our dependent variables, i.e. measures of financial constraints (FOREGO and NEEDMORE), conditional on our main measures of capital market imperfections (ASELECTION and MHAZARD). "YES" corresponds to the dummy being equal to one, "NO" corresponds to it being zero. The table shows the number of YES/NO replies to each and the corresponding conditional percentages. It also displays Chi2-tests of independence. Panel B cross-tabulates ASELECTION and MHAZARD with each other. Detailed descriptions of the variables are found in text in Section 3.2.

Table 3. Basic regressions

PANEL A	Dependent variable $FOREGO_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	0.846	5.71 ***	0.826	5.31 ***	0.768	4.77 ***
$MHAZARD_i$	0.236	1.36	0.322	1.80 *	0.353	1.91 *
AGE_i			0.004	0.82	0.009	1.81 *
EMP_i			-0.003	0.76	-0.005	1.22
$HIGHEXPORT_i$					0.090	0.44
$PATENT_i$					0.111	0.48
$INTANG_i$					0.473	2.76 ***
$GROWTH_i$					0.560	3.02 ***
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	597		597		597	
Log likelihood	-201.35		-193.03		-181.68	
LR Chi^2	44.72		61.36		84.06	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.10		0.14		0.19	

PANEL B	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	1.495	3.84 ***	1.337	3.47 ***	1.178	2.70 ***
$MHAZARD_i$	0.159	0.42	0.242	0.67	0.293	0.82
AGE_i			-0.013	0.56	-0.008	0.36
EMP_i			-0.004	0.76	-0.008	1.05
$HIGHEXPORT_i$					0.750	1.85 *
$PATENT_i$					-0.937	1.88 *
$INTANG_i$					0.894	2.68 ***
$GROWTH_i$					0.201	0.44
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	597		597		597	
Log pseudo-likelihood	-256.55		-245.51		-233.91	
Wald Chi^2	31.30		71.29		106.13	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.09		0.13		0.17	

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The basic estimating sample includes 597 Finnish SMEs. Panel A is a Probit regression, with the dependent variable (FOREGO) being a dummy equal to one if the firm had foregone an important investment project. Probit regressions with robust standard errors have also been run; the results remain as reported. Panel B is a Poisson regression with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. Robustness test 1 (additional firm-level controls)

PANEL A	Dependent variable $FOREGO_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	0.689	3.82 ***	0.757	4.42 ***	0.707	4.25 ***
$MHAZARD_i$	0.570	2.71 ***	0.324	1.65 *	0.365	1.93 *
AGE_i	0.013	2.18 **	0.010	1.92 *	-0.119	3.78 ***
EMP_i	-0.006	1.35	-0.006	1.50	0.003	0.18
$HIGHEXPORT_i$	0.156	0.67	-0.004	0.02	0.043	0.2
$PATENT_i$	0.022	0.08	0.008	0.03	0.162	0.69
$INTANG_i$	0.472	2.34 **	0.518	2.86 ***	0.422	2.36 **
$GROWTH_i$	0.588	2.73 ***	0.479	2.44 **	0.494	2.55 **
$R\&D_i$	0.351	1.89 *				
$NEWPRODUCT_i$	0.034	0.17				
$NEWPROCESS_i$	0.327	1.77 *				
$CEOAGE_i$			-0.045	3.13 ***		
$CEOEDU_i$			0.371	2.11 **		
$FOREOWN_i$			0.049	0.12		
$CEOCHAIR_i$			-0.073	0.43		
$AGE\hat{}2_i$					3.E-03	3.79 ***
$AGE\hat{}3_i$					-2.E-05	3.35 ***
$EMP\hat{}2_i$					-2.E-04	0.47
$EMP\hat{}3_i$					8.E-07	0.37
Sector dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
District dummies	Yes		Yes		Yes	
Obs	474		585		597	
Log likelihood	-144.75		-165.80		-172.18	
LR Chi^2	78.23		104.82		103.07	
degr. of freedom	20		21		21	
significance	0.00		0.00		0.00	
R^2 pseudo	0.21		0.24		0.23	

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The basic estimating sample includes 597 Finnish SMEs. Due to missing replies, we loose some observations and the number of observations is not the same in the three columns. For the sake of robustness, we have also performed these estimations on the largest common sample of 465 firms, and the results remained similar. Panel A is a Probit regression, with the dependent variable (FOREGO) being a dummy equal to one if the firm had foregone an important investment project due to financial constraints. Probit regressions with robust standard errors have also been run; the results remain as reported. These are extensions of our basic estimations in Table 3., now including further firm-level controls as described in Section 4.3, robustness test 1, in the text. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 4. continued

PANEL B	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	1.197	2.61 ***	1.160	2.58 **	1.030	2.45 **
$MHAZARD_i$	0.468	1.15	0.299	0.77	0.313	0.98
AGE_i	-0.002	0.10	-0.002	0.09	-0.199	3.31 ***
EMP_i	-0.011	1.33	-0.010	1.35	0.076	1.51
$HIGHEXPORT_i$	0.946	2.32 **	0.795	1.74 *	0.595	1.42
$PATENT_i$	-1.208	1.77 *	-0.93	1.91 *	-0.784	1.50
$INTANG_i$	0.794	2.44 **	0.931	2.83 ***	0.819	2.43 **
$GROWTH_i$	0.156	0.31	0.076	0.16	-0.072	0.15
$R\&D_i$	0.003	0.01				
$NEWPRODUCT_i$	-0.006	0.02				
$NEWPROCESS_i$	0.664	1.67 *				
$CEOAGE_i$			-0.043	1.89 *		
$CEOEDU_i$			0.187	0.50		
$FOREOWN_i$			-1.128	1.20		
$CEOCHAIR_i$			0.154	0.41		
$AGE\hat{}2_i$					5.E-03	3.09 ***
$AGE\hat{}3_i$					-3.E-05	2.81 ***
$EMP\hat{}2_i$					-2.E-03	1.74 *
$EMP\hat{}3_i$					9.E-06	1.56
Sector dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
District dummies	Yes		Yes		Yes	
Obs	474		585		597	
Log pseudo-likelihood	-203.18		-224.47		-219.61	
Wald Chi^2	110.8		125.66		109.86	
degr. of freedom	20		21		21	
significance	0.00		0.00		0.00	
R^2 pseudo	0.20		0.19		0.22	

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The basic estimating sample includes 597 Finnish SMEs. Due to missing replies, we loose here some observations and the number of observations is not the same in the three columns. For the sake of robustness, we have also performed these estimations on the largest common sample of 465 firms, and the results remained similar. Panel B is a Poisson regression with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. These are extensions of our basic estimations in Table 3., now including further firm-level controls as described in Section 4.3, robustness test 1, in the text. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. Robustness test 2 (restricted sample)

PANEL A	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	1.235	3.42 ***	0.985	2.50 **	0.929	2.34 **
$MHAZARD_i$	0.086	0.25	0.162	0.45	0.091	0.26
AGE_i			-0.006	0.37	-0.008	0.46
EMP_i			-0.016	2.11 **	-0.020	2.26 **
$HIGHEXPORT_i$					0.813	2.04 **
$PATENT_i$					-0.942	1.94 *
$INTANG_i$					0.752	2.52 **
$GROWTH_i$					-0.370	0.78
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	272		272		272	
Log pseudo-likelihood	-197.94		-183.82		-175.76	
Wald Chi^2	21.26		71.76		77.36	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.08		0.14		0.18	

Notes: The data come from a set of surveys on Finnish SMEs, conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The restricted sample used in these estimations includes those 272 firms that replied having had a need for external finance between the beginning of 2002 and July-August 2003. Both panels show Poisson regressions with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. Panel A includes our basic set of controls. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5. continued

PANEL B	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	1.057	2.39 **	0.972	2.24 **	0.757	1.99 **
$MHAZARD_i$	0.263	0.70	0.017	0.05	0.078	0.26
AGE_i	-0.001	0.09	-0.007	0.46	-0.159	3.05 ***
EMP_i	-0.024	2.74 ***	-0.021	2.72 ***	0.045	0.96
$HIGHEXPORT_i$	1.092	2.87 ***	0.817	1.87 *	0.631	1.42
$PATENT_i$	-1.051	1.78 *	-0.837	1.80 *	-0.870	1.71 *
$INTANG_i$	0.610	2.07 **	0.846	2.92 ***	0.753	2.34 **
$GROWTH_i$	-0.186	0.39	-0.447	0.93	-0.412	0.93
$R\&D_i$	-0.281	0.74				
$NEWPRODUCT_i$	-0.342	0.96				
$NEWPROCESS_i$	0.425	1.21				
$CEOAGE_i$			-0.022	1.09		
$CEOEDU_i$			0.098	0.26		
$FOREOWN_i$			-1.304	1.43		
$CEOCHAIR_i$			-0.141	0.42		
$AGE\hat{}2_i$					4.E-03	2.67 ***
$AGE\hat{}3_i$					-2.E-05	2.36 **
$EMP\hat{}2_i$					-2.E-03	1.18
$EMP\hat{}3_i$					7.E-06	0.66
Sector dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
District dummies	Yes		Yes		Yes	
Obs	215		267		272	
Log pseudo-likelihood	-148.13		-169.88		-168.09	
Wald Chi^2	88.50		84.05		87.80	
degr. of freedom	20		21		21	
significance	0.00		0.00		0.00	
R^2 pseudo	0.22		0.20		0.22	

Notes: The data come from a set of surveys on Finnish SMEs, conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The restricted sample used in these estimations includes those 272 firms that replied having had a need for external finance between the beginning of 2002 and July-August 2003. Both panels show Poisson regressions with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. Panel B extends the estimations using further firm-level controls. In Panel B, we loose some observations due to missing replies, and the number of observations is not the same in the three columns. For the sake of robustness, we have also performed these estimations on the largest common sample of 212 firms, and the results remained similar. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Robustness test 3 (REALASEL and REALMHAZ)

PANEL A	Dependent variable $FOREGO_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$REALASEL_i$	1.447	6.42 ***	1.324	5.53 ***	1.349	5.20 ***
$REALMHAZ_i$	0.297	0.91	0.416	1.22	0.447	1.26
AGE_i			0.009	1.42	0.013	1.93 *
EMP_i			-0.007	1.24	-0.008	1.36
$HIGHEXPORT_i$					0.365	1.35
$PATENT_i$					0.325	1.01
$INTANG_i$					0.269	1.13
$GROWTH_i$					0.265	0.94
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	270		270		270	
Log likelihood	-111.75		-103.28		-99.45	
LR Chi^2	60.02		76.95		84.61	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.21		0.27		0.30	

PANEL B	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$REALASEL_i$	2.120	5.93 ***	1.986	4.69 ***	2.038	4.53 ***
$REALMHAZ_i$	0.124	0.39	0.206	0.55	0.129	0.37
AGE_i			0.000	0.02	-0.001	0.05
EMP_i			-0.014	1.50	-0.018	1.66 *
$HIGHEXPORT_i$					0.904	2.10 **
$PATENT_i$					-0.362	0.65
$INTANG_i$					0.424	1.13
$GROWTH_i$					-0.443	1.05
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	270		270		270	
Log pseudo-likelihood	-167.16		-158.22		-152.25	
Wald Chi^2	44.05		123.96		142.04	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.22		0.26		0.29	

Notes: The data come from a set of surveys on Finnish SMEs, conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The restricted sample used in these estimations includes those 270 firms that replied having had a need for external finance between the beginning of 2002 and July-August 2003, and for which there are no missing replies. Explanatory variables REALASEL and REALMHAZ replace our main measures of capital market imperfections used in Table 3.; the control variables are the same as before. Panel A is a Probit regression, with the dependent variable (FOREGO) being a dummy equal to one if the firm had foregone an important investment project due to financial constraints. Panel B shows a Poisson regression with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Robustness test 4 (SPLIT in place of MHAZARD)

PANEL A	Dependent variable $FOREGO_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	0.812	5.53 ***	0.814	5.28 ***	0.796	4.98 ***
$SPLIT_i$	0.326	2.21 **	0.295	1.93 *	0.203	1.27
AGE_i			0.003	0.74	0.008	1.64
EMP_i			-0.003	0.84	-0.005	1.21
$HIGHEXPORT_i$					0.035	0.17
$PATENT_i$					0.103	0.45
$INTANG_i$					0.458	2.64 ***
$GROWTH_i$					0.536	2.89 ***
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	579		579		579	
Log likelihood	-196.61		-190.17		-180.27	
LR Chi^2	45.52		58.39		78.19	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.10		0.13		0.18	

PANEL B	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	1.247	3.60 ***	1.090	2.81 ***	1.004	2.56 **
$SPLIT_i$	0.957	2.80 ***	0.922	2.64 ***	0.786	2.17 **
AGE_i			-0.012	0.53	-0.009	0.40
EMP_i			-0.005	0.79	-0.008	1.03
$HIGHEXPORT_i$					0.554	1.49
$PATENT_i$					-0.917	1.87 *
$INTANG_i$					0.847	2.64 ***
$GROWTH_i$					0.082	0.18
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	579		579		579	
Log pseudo-likelihood	-244.64		-235.01		-226.33	
Wald Chi^2	34.01		70.68		106.55	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.12		0.15		0.18	

Notes: The data come from a set of surveys on Finnish SMEs, conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. As compared to the basic estimating sample of 597 firms, we are here left with 579 firms due to missing replies to SPLIT. SPLIT is an alternative measure of capital market imperfections, replacing our measure MHAZARD; the control variables are the same as before. Panel A is a Probit regression, with the dependent variable (FOREGO) being a dummy equal to one if the firm had foregone an important investment project. Panel B shows a Poisson regression with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 8. Robustness test 4 (COMBINED in place of MHAZARD)

PANEL A	Dependent variable $FOREGO_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	0.656	4.13 ***	0.659	3.99 ***	0.599	3.51 ***
$COMBINED_i$	0.635	4.02 ***	0.665	4.08 ***	0.690	4.08 ***
AGE_i			0.004	0.75	0.009	1.76 *
EMP_i			-0.001	0.35	-0.003	0.67
$HIGHEXPORT_i$					-0.021	0.10
$PATENT_i$					0.130	0.55
$INTANG_i$					0.403	2.27 **
$GROWTH_i$					0.622	3.22 ***
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	588		588		588	
Log likelihood	-190.16		-182.34		-172.27	
LR Chi^2	60.80		76.45		96.58	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.14		0.17		0.22	

PANEL B	Dependent variable $NEEDMORE_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$ASELECTION_i$	0.895	1.96 *	0.841	1.94 *	0.750	1.82 *
$COMBINED_i$	1.405	2.87 ***	1.376	2.98 ***	1.313	3.11 ***
AGE_i			-0.010	0.45	-0.006	0.29
EMP_i			-0.002	0.32	-0.004	0.69
$HIGHEXPORT_i$					0.636	1.72 *
$PATENT_i$					-0.972	1.94 *
$INTANG_i$					0.833	2.76 ***
$GROWTH_i$					0.146	0.31
Sector dummies	No		Yes		Yes	
Region dummies	No		Yes		Yes	
District dummies	No		Yes		Yes	
Obs	588		588		588	
Log pseudo-likelihood	-238.69		-228.12		-218.74	
Wald Chi^2	52.43		81.42		95.87	
degr. of freedom	2		13		17	
significance	0.00		0.00		0.00	
R^2 pseudo	0.14		0.18		0.21	

Notes: The data come from a set of surveys on Finnish SMEs, conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. As compared to the basic estimating sample of 597 firms, we are here left with 588 firms due to missing replies to COMBINED. COMBINED is an alternative measure of capital market imperfections, replacing our measure MHAZARD; the control variables are the same as before. Panel A is a Probit regression, with the dependent variable (FOREGO) being a dummy equal to one if the firm had foregone an important investment project. Panel B shows a Poisson regression with robust Huber-White variance-covariance matrix estimates for standard errors, with the dependent variable (NEEDMORE) being the number of times a firm has had an unsatisfied need for external finance. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

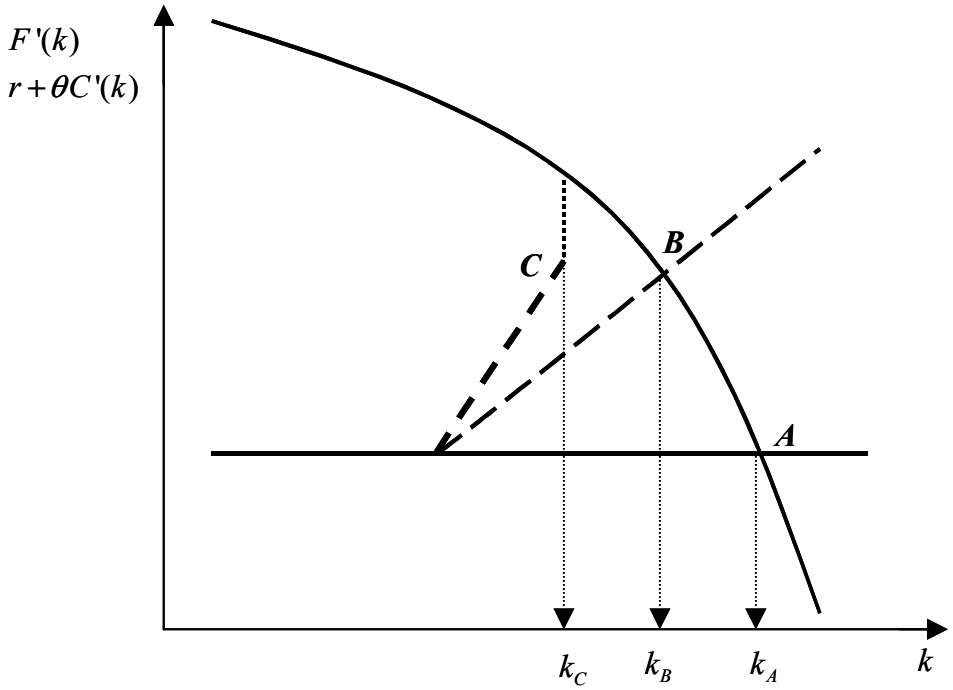
Table 9. Estimations of ASELECTION and MHAZARD

PANEL A	Dependent variable $ASELECTION_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
AGE_i	-0.012	2.62 ***	-0.011	2.41 **	-0.093	3.25 ***
EMP_i	-0.004	1.50	-0.005	1.53	-0.003	0.25
$HIGHEXPORT_i$			0.012	0.07	0.007	0.04
$PATENT_i$			-0.311	1.54	-0.319	1.57
$INTANG_i$			0.409	2.84 ***	0.399	2.71 ***
$GROWTH_i$			0.144	1.14	0.104	0.81
$AGE\hat{}2_i$					3.E-03	2.74 ***
$AGE\hat{}3_i$					0.E+00	2.39 **
$EMP\hat{}2_i$					0.E+00	0.11
$EMP\hat{}3_i$					0.E+00	0.10
Sector dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
District dummies	Yes		Yes		Yes	
Obs	597		597		597	
Log likelihood	-336.59		-331.48		-326.72	
LR Chi^2	24.85		35.06		44.57	
degr. of freedom	11		15		19	
significance	0.01		0.00		0.00	
R^2 pseudo	0.04		0.05		0.06	

PANEL B	Dependent variable $MHAZARD_i$					
	(1)		(2)		(3)	
	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
AGE_i	-0.011	2.13 **	-0.011	1.98 **	-0.042	1.49
EMP_i	-0.002	0.76	-0.002	0.71	-0.016	0.71
$HIGHEXPORT_i$			-0.104	0.54	-0.121	0.62
$PATENT_i$			-0.120	0.53	-0.128	0.56
$INTANG_i$			0.175	1.07	0.141	0.84
$GROWTH_i$			0.101	0.71	0.085	0.59
$AGE\hat{}2_i$					1.E-03	1.03
$AGE\hat{}3_i$					0.E+00	0.90
$EMP\hat{}2_i$					1.E-03	0.93
$EMP\hat{}3_i$					0.E+00	0.99
Sector dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
District dummies	Yes		Yes		Yes	
Obs	597		597		597	
Log likelihood	-255.02		-254.02		-251.48	
LR Chi^2	16.52		18.51		23.59	
degr. of freedom	11		15		19	
significance	0.12		0.24		0.21	
R^2 pseudo	0.03		0.04		0.04	

Notes: The data come from a set of surveys conducted between December 2001 and August 2003 by the Research Institute of the Finnish Economy (ETLA) and its subsidiary Etlatieto Oy. The basic estimating sample includes 597 Finnish SMEs. Panel A is a Probit regression, with the dependent variable (ASELECTION) being a dummy equal to one if the firm agreed with a statement implying that adverse selection hampers availability of external finance; Panel B is a Probit regression with the dependent variable (MHAZARD) being a dummy equal to one if the firm agreed with a statement implying that moral hazard hampers availability of external finance. Probit regressions with robust standard errors have also been run; the results remain as reported. Stars denote significance levels: * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1. The effect of capital market imperfections



Notes: The horizontal axis measures the level of firm's investment, and the vertical axis measures the marginal product (and cost) of capital. The downward sloping curve represents the marginal product of capital. Three possible scenarios are depicted. In scenario A, the horizontal line depicts the marginal cost of capital in the first-best world with no capital market imperfections; in scenario B, the upward sloping curve reflects marginal cost of capital with some capital market imperfections; and in scenario C, the supply curve of capital is vertical, implying rationing.

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