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Collateral Requirements and Relationship Banking: Empirical Evidence from Unique Finnish Credit-files*

ABSTRACT

The academic research of the use and role of collateral in small business finance has been under active discussion in recent years. Despite the theoretical and empirical studies, there has been no clear convergence of reaching congruent results. Conventional banking wisdom versus empirical and theoretical research presents puzzling results of the role of collateral in bank loans among small businesses. According to banking wisdom, borrower risk and collateral requirements should be positively associated.

In this study the theoretical and empirical studies are reviewed and an empirical analysis is conducted by using Finnish credit file data. This unique data source includes detailed information on small business bank loans that were granted between 1995 and 2001 by one of the major Finnish banks. Empirical results show that low risk firms pledge more collateral than high risk firms.

Our analyses of the role of collateral include an original sample of 936 Finnish small businesses. We form three groups of variables: firm-, relationship-, and loan-specific characteristics, in order to test

* Data programmed by: SAS software. As a condition of being given access to the loan files of the bank, confidentiality has been promised.

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two hypotheses. First, we test whether moral hazard might be the primary concern. This occurs if borrower risk and collateral requirements are positively related. If the relation is negative, then the primary concern may be closer to adverse selection, which is our second hypothesis. According to our results, higher borrower quality (low-risk borrowers) is associated with higher collateral requirements. Thus, the evidence seems to relate our second hypothesis, that the primary concern may be adverse selection. Our finding implies that it is possible that there exists a signaling effect such that low-risk firms are willing to signal their quality to the subject bank.

We conclude that the signaling effect may occur because high-risk borrowers are not willing to pledge more collateral. For low-risk firms, signaling is a valuable way to reveal their good quality. The interpretation of the result is that high collateral requirements may be too costly for high-risk firms and can increase the probability of default. The result is robust after separately examining two sub-samples of (i) secured and partially secured loans and (ii) two separate legal types of firms. In addition, we examine whether relationship characteristics and collateral are related. We find that firms with stronger relationships with the bank receive loans with lower collateral requirements. Also, when examining the effect of the strength of relationship on collateral terms in secured and partially secured loans as well as with separated legal types, the result remains consistent. We measure the strength of relationship by using duration and scope of relationship-based variables. Our proxy for the scope of relationship is the number of financial services that a firm has in the bank. Previous studies have documented that the scope measure is an important factor of the strength of relationship between bank and firm.

Key words: *collateral, relationship banking, small business finance*

1. INTRODUCTION

Despite intensive research on collateral use in small business loans, the theoretical and empirical results are ambiguous. The implications of this ambiguity indicate that we need to find precise mechanisms of the characteristics that are related to the theoretical and empirical foundations of this issue. The past literature shows that one of the main forces for the driving results in the two major categories seems to be related to the differences that are emerging from conventional banking community wisdom versus mixed empirical and theoretical findings (Boot, Thakor & Udell 1990; Chan & Thakor 1987). One of the key elements that triggers the separation is the approach towards collateral requirements and borrower risk. Conventional banking community wisdom suggests that higher borrower risk should indicate higher collateral requirements in the credit contract. Theoretical and empirical studies show that collateral and borrower risk can be either positively (Orgler 1970, Leeth & Scott 1989, Berger & Udell 1990, Boot, Thakor & Udell 1991, Welch 1997, Longhofer & Santos 2000, Inderst & Müller 2004) or negatively (Bester 1985, Chan & Thakor 1987, Chan & Kanatas 1985, Besanko & Thakor 1987, Machauer & Weber 1998, Capra,

Fernandez & Ramirez 2001) related. The literature review in this study concludes with one important explanation for this controversy. The suggestion is that when moral hazard is dominant, we should expect positively related borrower risk and collateral; and under adverse selection this relationship can be reversed.

So far most of the collateral studies dealing with small business finance are focused on the borrower risk and the collateral level. In this paper, using detailed credit-file data from one of the major banks in Finnish credit markets, two research problems are addressed.[1] First, is there a domination of moral hazard or adverse selection present in the bank-firm relationship concerning collateral requirements in our Finnish data? In another words, in this study, we try to find whether the riskiness of the firm and collateral requirements are positively or negatively related. We expect that a positive relationship may imply the existence of moral hazard and a negative relationship adverse selection.

In moral hazard, the firm undertakes a riskier project than was contracted with the lender bank. This causes the lender to require *ex ante,* more collateral from the borrower firm. Thus, the *ex post* actions of the borrower are *ex ante* unobservable to the lender. In the adverse selection condition, the bank is not able to identify borrower quality, which leads the high-quality borrower to be willing to signal its true quality to the lender by pledging more assets as collateral.[2]

Second, how does the strength of the relationship affect the pledged collateral level? We measure proxy the strength of the relationship by the number of financial services that a firm holds in the bank. The scope of relationship-measurements has also been used in Degryse & van Cayseele (2000) and Mörttinen (2000).[3] In addition, we use the duration of the relationship as another proxy for the strength of the relationship. Several bank-firm relationship studies document that duration and/or scope of the relationship are important factors in defining the strength of the relationship (Berger & Udell 1995, Petersen & Rajan 1995, Blackwell & Winters 1997, Harhoff & Körting 1998, Scott & Dunkelberg 2003). However, there are fewer studies discussing the association between the strength of the relationship and collateral requirements.

The theoretical framework for our first research problem relates closely to the studies by Boot, Thakor & Udell (1991) and Chan & Thakor (1987). Both studies conclude that the signaling effect may dominate under adverse selection, i.e. low-risk borrowers put up more collateral than high-risk borrowers. In addition, Boot *et al*. (1991) show that under moral hazard the borrower

1 As a condition of being given access to the loan files of this bank, we have promised confidentiality to the bank and the customers regarding identity and location.

2 We refer to signaling effect also when a high-quality borrower accepts higher collateral requirements by the bank.

3 Degryse & van Cayseele (2000) use information-sensitive services, which they find negatively related with the interest rate of the loan. Mörttinen (2000) documents that the amount of borrower deposits and cost of credit are negatively related.

risk and collateral are *positively* related, but when considering both moral hazard and adverse selection, this relationship can be either *negative or positive*. Moreover, Chan & Thakor (1987) derive a model in which borrower risk and collateral requirements are negatively related under moral hazard and adverse selection. These results imply that the research question is rather empirical than theoretical. Other notably related theoretical studies are found in Bester (1985), Chan and Kanatas (1985) and Besanko & Thakor (1987), which support the signaling effect under adverse selection, i.e. negatively related borrower risk and collateral.

The second research problem contributes to the recent work of Elsas & Krahnen (2002), which covers the use of collateral in relationship lending. They find that there is no relationship between collateral requirements and borrower risk. However, in a close bank-firm relationship, i.e. 'housebank,' the collateral requirements are higher. They explain their result stating that it is the bank's strategic choice for strengthening future renegotiations with the borrower. In that sense, the probability of a lock-in borrower in the 'housebank' relationships increases. Our paper analyses how the strength of the bank-firm relationship is related to collateral requirements. In this approach, the collateral requirements are analyzed with different relationship intensities between bank and firm in contrast to Elsas & Krahnen (2002).

Our paper contributes to the current literature in two ways:

- how the borrower risk defined by the bank's internal rating is directly related to the continuous variable of the level of collateralization (earlier studies mostly use a dichotomy variable values, except Machauer & Weber 1998 and Elsas & Krahnen 2002), and
- how the bank-firm relationship factors are related to the collateralization by using a measurement of the number of financial bank services of the firm, as a proxy for the scope and strength of relationship, and the duration of relationship, as a proxy for the strength of relationship.

The empirical results of this paper can be summarized as follows. We find the relationship between the borrower risk and collateral requirements seem to be consistent with the signaling effect. The results show that low-risk firms pledge more collateral than high-risk firms. We test the results with both full data and four sub-samples. The sub-samples are separated by the collateralization level and the legal form of the firm. The former contains fully secured loans and partially secured loans; and the latter includes two different firm types, and limited liabilities and partnerships. The results remain robust after estimating the sub-sample regressions. Earlier empirical studies have mostly found results related to a moral hazard -type of proposition. Our finding seems to be related to the signaling effect under the existence of adverse selection, and supports theoretical frameworks in Boot, Thakor & Udell (1991) and Bester (1985). Low-risk borrowers tend to be more willing to put up more collateral than high-risk borrowers in order to reveal their true

quality to the lender, even after controlling the capability to pledge collateral. For high-risk borrowers, the expected cost of pledging more collateral may be too high and thus their willingness to increase the collateral might be smaller than with low-risk borrowers.

In addition, we find that the strength of the relationship is negatively related to the required collateral level. We measure the strength of relationship by the duration and scope of the relationship. Our findings show that firms with a broader use of financial services provided by the bank, receive loans with a lower collateral requirement. This result is robust after testing the potential effect customer profitability has on collateralization. However, we did not find any correlation between the duration of the relationship and required collateral level. Our results imply that the scope of the relationship is a more important determinant of the strength of the relationship concerning collateral requirements than the duration of the relationship. The association between the collateral and the scope of the relationship is supported by earlier relationship banking oriented studies (Harhoff & Körting 1998, Degryse & van Cayseele 2000, for instance).

The rest of this paper is organized as follows. Section 2 describes the data and methodology. In Section 3, the empirical analysis is conducted and the results are presented. Section 4 concludes the study.

2. DATA AND METHODOLOGY

Our data consist of all granted small business loans from a local corporate division of one the major Finnish banks between 1995 and 2001.[4] The data cover detailed information of loan terms, relationship-, collateral- and firm-specific characteristics. Our full data includes 1436 loan contracts and 936 firms.[5] We excluded 125 loans related to 112 non-profit organizations from the data and focused on two legal types of firms, limited liabilities and partnerships/sole proprietorships.[6] Since our research focuses on collateral requirements, we excluded 102 loans that do not contain information on the level of collateral requirement. We found 98 firms to be related to such loans. Then, we excluded loans with personal guarantees; 348 loans and 269 firms.[7] Hence, our final sample consists of 861 loans with 563 firms.

There are 420 loans for limited liabilities and 441 loans for partnerships. About 50 percent of the firms represent three major industries; construction, services and real estate. All the firms

4 However, the data does not include re-negotiated loans.
5 The figures do not include non-profit organizations between 1995 and 1999.
6 From this point forward we use the term "partnerships" to refer to both partnerships and sole proprietorships.
7 Due to change of the structure of credit-file information, we were not able to run analyses on full data, if personal guarantees were included. However, we tested the hypotheses with sub-samples that included the information about whether personal guarantees were required or not. The results (not reported) remain consistent.

are small or medium size companies.[8] 77.6 percent of the loans are granted as fully- or over-secured with the rest being partially secured.[9]

The complete details and description of variables can be found in Table 1. We use the collateralization level, "Collateralization" as a dependent variable in the model. This variable tells us the ratio of pledged collateral value to a firm's total responsibilities after the current loan in the bank. "Collateralization" captures the collateral for the current loan plus previously pledged collateral to the earlier bank loans that are still valid. Thus, through "Collateralization" we get the total collateral coverage over total responsibilities of the firm in the bank. However, we do not control the quality of collateral, but quantity of the level of collateralization, which is a continuous measure that stands for collateral coverage with zero and positive values. For instance, if the required collateralization level is 100 percent and the loan value is 100 units, the firm has to pledge 100 units value of the collateral. This could be 100 units cash deposit (100 percent collateral value), or 200 units of stocks (50 percent collateral value), for example. How the required collateralization is composed is customer-specific. In this paper, the pledged collateralization level is a given measurement in loan files, regardless of the collateral value per pledged asset. Zero means that no collateral has been pledged, and at value one, the responsibilities of the firm in the bank are just covered. If the value exceeds one, then the responsibilities are over-collater-

TABLE 1. Definition of variables.

Variable	Definition
Collateralization	**Pledged total collateral per firm's total responsibilities in the bank after the current loan. Responsibilities include loans and bank guarantees.**
Duration	**The length of the relationship between the bank and the firm in years.**
Scope	**The number of financial bank services of the firm. These services include accounts, credit cards, existing loans and bank guarantees, for instance.**
RiskD1	**Reference class for risk rating levels 1 or 2 (the lowest risk).**
RiskD2	**= 1 if risk rating level is 3, 4, or 5.**
Age	**Age of the firm (measured in years).**
Legtype	**= 1 if firm is partnership, limited liability otherwise.**
Maturity	**Maturity of the loan (measured in years).**
Loan size	**Size of the loan (measured in thousand FIM).**
YD1–YD7	**Year-dummies for 1996–2001. Year 1995 is the reference year.**

8 Due to data restrictions, we have the number of employees only from the period 2000–2001. The average number of employees is 13–14. One firm has 160 employees, the rest have less than 30.

9 The loan is "fully- or over-secured" when the total collateral of the firm equals or exceeds the total bank responsibilities of the firm. We define "total responsibilities" by summing the total current loans and bank guarantees for the firm. Bank guarantees occur when a bank gives a guarantee to a third party on behalf of the firm.

alized.[10] The over-collateralization occurs because part of the firms already has a stock of collateral in the bank. It is possible and common to pledge the specific collateral to cover more than one loan or all loans in the subject bank. To the author's knowledge, this study is one of the first investigations to be able to test collateralization by using a continuous variable. Earlier studies have primarily used only binary variable values, i.e. indicating whether the loan is collateralized or not (Berger & Udell 1995, Degryse & van Cayseele 2000).

The explanatory variables are divided into three groups; firm-, relationship- and loan-characteristics. The firm-characteristics include two financial risk classes of the firm ("RiskD1", "RiskD2"), the legal type of the firm ("Legtype") and the age of the firm ("Age"). Relationship characteristics contain duration of relationship ("Duration"), and scope of relationship ("Scope"). Loan-characteristics include the maturity of the loan ("Maturity") and the size of the loan ("Loan size").

Firm-characteristics are captured by using two financial risk classes, firm age and legal status of the firm. The financial risk class is internally determined by the bank. The bank requests the financial statement(s) from the firm and performs a financial statement analysis based on firm size, profitability, leverage and growth. Each factor is weighted by the bank's internal equation, which scores the firm into five different financial risk classes. We have categorized these risk classes into two separate firm types; "RiskD1" as good (two lowest risk classes) and "RiskD2" as bad (three highest risk classes).[11]

The financial risk class is determined before any terms of the loan are negotiated with the firm. Hence, the collateral requirement for the loan does not have any influence on the financial risk class. We use dummy-variables in order to analyze the effect of each risk class on the "Collateralization" level. "RiskD2" stands for the high-risk level of the firm, having the value one if the firm belongs to this class and zero otherwise. The summary statistics mean for "RiskD1" and "RiskD2" describes the proportion of observations for the risk class of the whole sample, i.e. 12.9 percent of firms have a low risk rating and 16.3 percent of firms have a high-risk rating.[12] "Legtype" has the value one if the firm is a partnership and zero otherwise. "Age" is the firm age in years.

Relationship-characteristics are determined by "Duration" and "Scope". "Duration" is the length of the bank-firm relationship in years. The information in our data gives the true length of the relationship, measured from the beginning year when the firm became a client of the bank.

10 The data contain 55 observations of Collateralization that exceed the value of two. We have set these values equal to two. We assume that the bank is indifferent as to whether the level of over-collateralization is double or more.
11 We use the assumption that the difference between the first and second lowest risk classes are smaller than compared to second and third lowest risk class.
12 The risk classes do not sum up to one, since for missing risk class observation, all risk classes equal to zero. Randomly distributed risk class values are then assumed.

TABLE 2. Summary statistics. Whole sample 1995–2001.

Variables	Unit	Obs	Mean	Std
Collateralization	Ratio	861	1.108	0.348
RiskD1	0,1	861	0.129	0.335
RiskD2	0,1	861	0.163	0.369
Age	Years	570	10.218	8.837
Duration	Years	755	10.397	8.784
Scope	Quantity	674	10.792	10.128
Legtype	0,1	861	0.512	0.500
Maturity	Years	860	4.891	3.887
Loan size	Log Ratio	861	5.363	1.305
Industry:				
Agriculture	0,1	861	0.013	0.112
Industrial	0,1	861	0.077	0.266
Electronics	0,1	861	0.005	0.068
Construction	0,1	861	0.182	0.386
Wholesale, retail	0,1	861	0.156	0.363
Hotel, restaurants	0,1	861	0.039	0.195
Transportation	0,1	861	0.042	0.200
Financing	0,1	861	0.017	0.131
Real Estate	0,1	861	0.156	0.363
Other services	0,1	861	0.062	0.240
YD1 (year 1995)	0,1	861	0.118	0.323
YD2	0,1	861	0.134	0.340
YD3	0,1	861	0.132	0.339
YD4	0,1	861	0.144	0.351
YD5	0,1	861	0.172	0.378
YD6	0,1	861	0.151	0.358
YD7	0,1	861	0.149	0.356

"RiskD1" is a reference class for risk rating levels 1 or 2 (the lowest risk). For "RiskD2", the risk rating levels are 3, 4 or 5 (highest risk). "RiskD1" and "RiskD2" are dummy-variables for risk ratings indicating (1) whether the firm belongs to the risk class (otherwise the value is zero).

"Scope" is the number of financial services that the firm currently holds in the bank. Some earlier studies find that scope-measurements are reasonably good proxies for the strength of relationship (Degryse & van Cayseele 2000, Mörttinen 2000). According to the literature, it is a challenging task to find accurate variables that reflect the scope of the relationship. Hence, firms with a wider scope seem to benefit from the relationship through the lower cost of the credit.[13]

13 We provide an additional test in the empirical analysis to verify whether this expectation is supported.

TABLE 3. Summary statistics. Sub-samples 1995–2001.

Variables	Unit	Obs	Mean	Std
Fully secured				
Collateralization	Ratio	668	1.209	0.304
RiskD1	0,1	668	0.111	0.314
RiskD2	0,1	668	0.127	0.333
Age	Years	417	9.446	8.079
Duration	Years	586	10.474	8.923
Scope	Quantity	539	9.974	9.148
Legtype	0,1	668	0.545	0.498
Maturity	Years	667	4.712	3.744
Loan size	Log Ratio	668	5.174	1.215
Partially secured				
Collateralization	Ratio	193	0.756	0.244
RiskD1	0,1	193	0.192	0.395
RiskD2	0,1	193	0.285	0.453
Age	Years	153	12.320	10.372
Duration	Years	169	10.130	8.303
Scope	Quantity	142	13.859	12.747
Legtype	0,1	193	0.399	0.491
Maturity	Years	193	5.511	4.297
Loan size	Log Ratio	193	6.016	1.396
Ltd				
Collateralization	Ratio	420	1.060	0.325
RiskD1	0,1	420	0.212	0.409
RiskD2	0,1	420	0.243	0.429
Age	Years	398	11.020	9.807
Duration	Years	391	8.118	7.354
Scope	Quantity	321	11.324	12.854
Legtype	0,1	420	–	–
Maturity	Years	419	4.846	3.922
Loan size	Log Ratio	420	5.866	1.346
Prt				
Collateralization	Ratio	441	1.153	0.362
RiskD1	0,1	441	0.050	0.218
RiskD2	0,1	441	0.086	0.281
Age	Years	172	8.360	5.619
Duration	Years	364	12.846	9.516
Scope	Quantity	357	10.309	6.741
Legtype	0,1	441	–	–
Maturity	Years	441	4.934	3.858
Loan size	Log Ratio	441	4.884	1.064

Ltd = limited liability, Prt = partnership/proprietorship. A value of "Collateralization" of one or more refers to fully secured loans, and a value of less than one refers to loans that are partially secured.

Loan-characteristics are captured by the maturity of the loan that is measured in years and size of the loan that is measured in thousand FIM. We control the "Maturity" and the "Loan size" for all regressions in this paper. "Maturity" is expected to be negatively related to the collateral requirements. In addition, we control changes over time by setting dummy variables for each year (YD1–YD7). We use YD1 (1995) as the base year in our analysis. We want to point out that we do not use the size of the loan as an explanatory variable, since it is already constructed in the dependent variable.

We test the existence of adverse selection or moral hazard by regressing variables "RiskD1" and "RiskD2" on "Collateralization".[14] In the former case, the relation between "Collateralization" and firm risk should be negative and in the latter positive. Theoretically both approaches are supported. We refer to the literature review in the Section 1 for related articles. Detailed summary statistics can be found in the Tables 2 and 3.

The empirical analysis is conducted by using Tobit-models.[15] We find that the Tobit-models are the most appropriate choice because of the dependent variable, "Collateralization", cannot have negative values. This indicates that the distribution of "Collateralization" does not satisfy the assumption of normality.[16] Hence, by applying the Tobit approach, we can standardize the distribution of the dependent variable, and thus the estimated results become more reliable. We refer to Greene (2000) and Heckman (1979) for econometric details.

The regressions include two full-data estimations and four sub-sample estimations. The first sub-sample includes, separately, regressed secured and partially secured loan samples.[17] The second sub-sample contains regressions for limited liabilities and partnerships. The motivation for splitting the sample into two sub-samples (secured and partially secured) emerges from two main sources. First, Machauer & Weber (1998) shortly discuss in their study that the risk exposure differs between fully secured and partially secured loans. Second, if the risk exposure is related to the collateral, then the decision patterns between fully and partially secured loans may differ, which in turn, was the main motivation for analyzing these two sub-samples separately.

3. RESULTS

Our main emphasis is based on lies on two main themes; the relationship between (i) firm risk and collateralization and (ii) relationship-characteristics and collateralization. Both have been

14 We assume random samples for available observations of the existence of the risk class. We report approximately 30 percent of observations containing this measure.
15 Tobit-models are designed to deal with estimation bias associated with censoring.
16 Thus, the traditional OLS-models are not applicable, because the assumption of a normally distributed dependent variable is rejected.
17 When the loan is partially secured, total level of collateralization is less than the total bank responsibilities of the firm.

TABLE 4. Collateral requirements, borrower risk and relationship characteristics.

Explanatory variables	(1)	*(std)*	(2)	*(std)*	(3)	*(std)*	(4)	*(std)*
Intercept	1.132***	(0.062)	1.037***	(0.071)	1.138***	(0.087)	1.4012***	(0.104)
RiskD1	*Reference*		*Reference*		*Reference*		*Reference*	
RiskD2	–0.108***	(0.035)	–0.092***	(0.035)	–0.092**	(0.039)	–0.078**	(0.038)
Duration			0.011	(0.018)	0.020	(0.025)	0.014	(0.025)
Scope					–0.099***	(0.025)	–0.078***	(0.025)
Legtype	0.054*	(0.032)	0.043	(0.032)	0.040	(0.036)	–0.002	(0.037)
Age	–0.009	(0.016)	–0.015	(0.021)	0.032	(0.026)	0.039	(0.025)
Maturity	–0.009**	(0.004)	–0.009**	(0.004)	–0.012***	(0.004)	–0.006	(0.005)
Loan size							–0.063***	(0.014)
YD1	*Reference*		*Reference*		*Reference*		*Reference*	
YD2	–0.008	(0.066)	0.049	(0.073)	0.118	(0.079)	0.101	(0.077)
YD3	0.0003	(0.064)	0.049	(0.071)	0.119	(0.077)	0.110	(0.075)
YD4	0.063	(0.060)	0.114*	(0.067)	0.139*	(0.075)	0.141*	(0.073)
YD5	0.035	(0.058)	0.087	(0.065)	0.130*	(0.071)	0.125*	(0.070)
YD6	0.030	(0.059)	0.091	(0.066)	0.122*	(0.071)	0.143**	(0.070)
YD7	–0.015	(0.059)	0.048	(0.065)	0.118*	(0.072)	0.137**	(0.070)
Obs.	562		526		424		424	
LogL	–181.708		–152.698		–114.452		–105.113	

Whole sample estimates 1995–2001. Dependent variable: "Collateralization". We refer to Table 1 for detailed variable definitions. Standard error in parentheses. Industries are controlled in the estimations, parameter values not reported. Following variables are logarithms: "Duration", "Scope", "Age", "Maturity" and "Loan size". *, **, * Significance at the 10%, 5%, and 1% levels, respectively.**

analyzed with three full-data regressions in Table 4 and with two sub-sample regressions in Tables 5 and 6. The sub-samples contain separation of secured and partially secured loans as well as the separation of two legal forms, limited liabilities and partnerships. We begin the analysis with the full-data regression results.

Full data results. Regression (1) in Table 4 shows that the financial risk class "RiskD2" for high-risk firms is negatively and significantly related to the "Collateralization". We use the lowest risk class, "RiskD1", as a reference group. We find that "RiskD2" lowers the "Collateralization" by 0.078 to 0.108 units compared to the lowest risk reference class, "RiskD1" (fully collateralized loan is equal to 1 unit). The interpretation, with the assumption of normally distributed variables, is that if the secured collateralization requirement for low-risk firm is 90,000 euros for the loan amount of 100,000 euros, the collateralization requirement for high-risk firm would be approximately 9,000 euros less (with parameter value of 0.090 for "RiskD2"), thus equal to 81,000 euros.[18] Our measurement of the collateral level indicates the coverage of the pledged total col-

18 Econometrical interpretation does not strictly allow linear analysis for parameter values in Tobit-models. Even assuming normality, the interpretation of the level of parameter values is only descriptive.

lateral over the firm's responsibilities in the bank. The result of a negatively related risk class ("RiskD2") and collateral level ("Collateralization") implies that high-risk firms pledge less collateral than low-risk firms. This implication seems to reflect adverse selection, where firms are willing to signal their quality to the lender bank, being consistent with theoretical studies by Chan & Thakor (1987) and Boot, Thakor & Udell (1991).

Hence, according to the theory, high-quality firms are more motivated and capable of pledging more collateral because they know their true quality, and they will make a higher level of effort to succeed with the project and have a lower probability of failure (Chan & Kanatas 1985). For high-risk firms, pledging more collateral increases the probability of default and thus decreases the willingness to provide a higher collateral level.[19] This implication remains the same after adding relationship-characteristics to the model, in regressions (2) and (3) and after adding the "Loan size" in regression (4).

We find that the relationship between "Scope" and "Collateralization" is negative. However, we do not find any evidence that the duration of the relationship and collateral requirements are related. For "Scope", the statistically significant parameter value is between –0.078 and –0.099. This means that firms with more financial services with the bank pledge less collateral. This indicates that firms with stronger relationships (broader scope of relationship) benefit by facing fewer collateral requirements in loan contracts with the bank. As an additional test, we analyze whether the interaction term, "R3-5" * Log ("Duration"), is an important factor in the context of collateral requirements (reported in Appendix II). The interaction term indicates that there is a joint effect of the length of relationship with the high-risk class. Thus, it can measure the potential magnitude of the length of the relationship on the cost of the credit within a risk class. We find that the parameter value is statistically insignificant for the interaction term, i.e. the level of "Collateralization" is indifferent for risk rating levels when the duration of the relationship is controlled.

To confirm our results, we test whether low risk borrowers are able to pledge more collateral than high-risk borrowers, simply due to having better financial capability to do so. The results are reported in Appendix II. In the first regression we construct a model, where a dependent variable measures the capability to pledge collateral, i.e. ratio of total assets per total debt. The larger value for this variable indicates a larger size of assets, thus better capability to pledge more assets. We find that low risk borrowers tend to have slightly more capability to pledge collateral, but the parameter value is not statistically significant. Thus, this alternative explanation is not supported.

19 We also test whether the capability of collateral affects the result by using the ratio of total assets per total debts. However, the parameter value was negative and insignificant. Moreover, we tested whether this variable is related to different risk classes but did not find any significant correlation. Regression results are not reported here. For the firm owner's capability of pledging personal wealth, our data does not account for available measurements.

In the second regression in Appendix II, we test whether the level of "Collateralization" affects the level of loan rate. We find that the level of "Collateralization" is slightly negatively related to the level of loan rate. This leads us to test further whether the level of "Collateralization" is actually related to the risk type of the firm, i.e. do low risk firms have an incentive to pledge more collateral in exchange for receiving lower loan rates. We construct an interaction term "RiskD2" * "Collateralization" in order to test this hypothesis. According to the results in regression three in Appendix II, we find that high-risk firms seem to pay higher interest rates than low risk firms, but low risk firms do not receive benefits for pledging more collateral. In fact, the results show that high-risk firms are able to obtain lower loan rates if they pledge more collateral. To control this result, we test identical regressions with sub-samples of fully and partially secured loans in regressions four and five. We report that the results remain consistent. Thus, the hypothesis of beneficial incentive for low risk firms is not supported according to this analysis.

Further, to check the robustness of main result of negatively related collateralization and relationship scope measurements, we analyze whether the scope of relationship affects the level of the loan rate. This test confirms that potentially profitable customers, who use large number of bank services, do not benefit through a lower loan rate. This confirmation could explain the lower collateral requirements for high-level users of bank services (insignificant parameter value for "Scope" in regression two in Appendix II). As there may be concerns for endogenous suspects between "Collateralization" and loan rate (or "Loan size" and loan rate), we provide diagnostic tests that required that "Collateralization" is not an endogenous variable, i.e. not affecting in the process of loan rate. This result confirms that the level of "Collateralization" is independently set (by the bank) from the loan rate decision (endogenous tests are reported in Appendix III).

Sub-sample results. Regressions (1) and (2) concerning the sub-samples are reported in Table 5. We have separated fully- and over-collateralized loans from partially secured loans in these regressions. As with the full-data regressions, the results show that a firm's financial risk class is negatively related to the "Collateralization" level. The variable "RiskD2" has statistically significant parameter values of –0.108 (in regression 1) and –0.314 (in regression 2) in Table 5. Also "Scope" is negatively related to the "Collateralization" level, as reported above in the full-data regressions. We want to point out that the parameter value for "RiskD2" in partially secured regression (2) is smaller when compared with the fully secured estimate in regression (1). This could refer to the explanation that the signaling effect may be even stronger when loans are not fully secured. Hence, low-risk firms tend to put up more collateral in cases where full collateralization is finally not met. We find that year dummies are significant only in the partially secured loans. During our data period 1995–2001, the interest rate changes at the aggregate level and may be an important factor that explains the significance of year dummies for partially secured loans. For fully secured loans, the effect of the interest rate variation may not be so strong because these

loans do not have such a risk exposure for interest rates as in the case of partially secured loans. Thus, our results imply that the level of collateralization is sensitive to the interest rate changes at the aggregate level only if the loan is not fully secured.

TABLE 5. Collateral requirements, borrower risk and relationship characteristics in different collateralization levels.

Explanatory variables	Fully secured		Partially secured	
	(1)	*(std)*	(2)	*(std)*
Intercept	1.533***	(0.132)	3.017***	(0.344)
RiskD1	*Reference*		*Reference*	
RiskD2	–0.108**	(0.049)	–0.314***	(0.111)
Duration	0.024	(0.031)	0.069	(0.077)
Scope	–0.118***	(0.031)	–0.297***	(0.081)
Legtype	–0.018	(0.046)	–0.104	(0.115)
Age	0.038	(0.032)	–0.004	(0.080)
Maturity	–0.006	(0.007)	–0.015	(0.014)
Loan size	–0.084***	(0.019)	–0.168***	(0.044)
YD1	*Reference*		*Reference*	
YD2	0.136	(0.099)	0.565***	(0.217)
YD3	0.137	(0.097)	0.501**	(0.208)
YD4	0.188**	(0.094)	0.596***	(0.207)
YD5	0.186**	(0.089)	0.673***	(0.202)
YD6	0.189**	(0.090)	0.602***	(0.194)
YD7	0.168*	(0.090)	0.549***	(0.194)
Obs.	322		102	
LogL	–222.317		–219.890	

Sub-sample estimates 1995–2001. Dependent variable: "Collateralization". We refer to Table 1 for detailed variable definitions. Standard error in parentheses. Industries are controlled in the estimations, parameter values not reported. Following variables are logarithms: "Duration", "Scope", "Age", "Maturity" and "Loan size". *, **, * Significance at the 10%, 5%, and 1% levels, respectively.**

In separating the legal forms in regressions (1) and (2) in Table 6, we do not find statistically significant parameter values for the risk class ("RiskD2"), as in earlier regressions. However, the sign of the parameter is consistently negative with earlier regression results. With relationship characteristics, we find consistent results only for limited liabilities. The scope of relationship is negatively related with collateral requirements.

In controlling the loan size, we find a significantly negative relationship between "Loan size" and "Collateralization". A larger loan size seems to be associated with lower collateral requirements.

TABLE 6. Collateral, borrower risk and relationship characteristics in different legal forms of the firm.

Explanatory variables	Limited liabilities		Partnerships	
	(1)	*(std)*	(2)	*(std)*
Intercept	1.500***	(0.121)	1.185***	(0.199)
RiskD1	*Reference*		*Reference*	
RiskD2	–0.053	(0.044)	–0.115	(0.077)
Duration	0.017	(0.029)	–0.002	(0.046)
Scope	–0.094***	(0.029)	–0.060	(0.045)
Age	0.043	(0.031)	0.016	(0.048)
Maturity	0.0004	(0.006)	–0.005	(0.011)
Loan size	–0.067***	(0.016)	–0.030***	(0.036)
YD1	*Reference*		*Reference*	
YD2	0.069	(0.104)	0.185	(0.118)
YD3	0.088	(0.095)	0.161	(0.124)
YD4	0.054	(0.091)	0.291**	(0.124)
YD5	0.055	(0.087)	0.248**	(0.121)
YD6	0.050	(0.089)	0.289***	(0.112)
YD7	0.072	(0.086)	0.268**	(0.130)
Obs.	292		132	
LogL	–67.021		–31.977	

Sub-sample estimates 1995–2001. Dependent variable: "Collateralization". We refer to Table 1 for detailed variable definitions. Standard error in parentheses. Industries are controlled in the estimations, parameter values not reported. Following variables are logarithms: "Duration", "Scope", "Age", "Maturity" and "Loan size". *, **, * Significance at the 10%, 5%, and 1% levels, respectively.**

4. CONCLUSIONS

The role of collateral is extremely important in corporate loan contracts between banks and firms. Still, the empirical literature in this field is still rather lacking. The paucity of research studies can mainly be explained by the data restrictions. Usually, studies have been able to explore collateral requirements based only on information, whether loans have been collaterized or not. Our study is one of the first attempts to document empirical results using a continuous measurement of the level of collateralization. Hence, we are able to examine not only whether the loan is collaterized or not, but how much collateral an individual small business pledges, either in the cases of over- or under-collateralization.

This study contributes to the current literature, firstly, by analyzing the relationship of borrower quality and collateral requirements, and secondly, by analyzing the differences between the strength of the relationship and collateral requirements in both secured and partially secured small business loan contracts. In addition we analyze the legal types of the firms separately. We examine these collateral terms by using unique Finnish credit-file data from 1995 to 2001. The original data contain over 1400 small business loans. In the analysis, variables are divided into

three groups: firm-, relationship- and loan-specific characteristics. Within these groups, the estimations were conducted in order to test the effects of collateral terms. Three hypotheses are tested: (i) if moral hazard is the primary concern, there should exists an expectation of a positive relationship between borrower risk and collateral requirements, (ii) if adverse selection is the primary concern, there should exists an expectation of a negative relationship between the strength of relationship and collateral requirements, (iii) the strength of relationship is negatively associated with pledged collateral level.

Our results do not support the first hypothesis, concerning the conventional banking community wisdom. Instead, we find evidence supporting the second hypothesis, where higher borrower quality is connected to higher collateral requirements. We document that this empirical finding might be related to the existence of adverse selection rather than moral hazard. According to the theoretical framework in the literature, adverse selection usually implies the signaling effect, where firms are willing to signal their quality to the bank. We suggest that the signaling effect tends to occur because high-risk borrowers are not willing to pledge more collateral. The explanation is that pledging more collateral may be too costly for high-risk firms (default risk increases).

The third hypothesis has not been tested in earlier studies concerning the similar scope measurement that we use. We find that firms with stronger relationships with the bank receive lower collateral requirements. After examining the effect of the strength of relationship on collateral terms in secured and partially secured loans as well as with separated legal types, we find a similar result. Also, after testing the potential effect of customer profitability on collateral, our main result of relationship scope is supported. We measure the strength of relationship using the duration and scope of relationship-based variables. Our proxy for the scope of the relationship is the number of financial services that a firm has in the bank. Earlier studies have documented that the scope is an important factor of the strength of relationship between a bank and firm.

In general, the progression of the availability of potential information in current databases provides researchers with increasingly more and more accurate details of the loan contracts. It is highly probable that current, mixed research results of collateral based studies will begin to convergence as databases for research purposes are further enriched. ■

REFERENCES

BERGER AN & UDELL GF (1990) Collateral, loan quality and bank risk. Journal of Monetary Economics 25: 21–42.

BERGER AN & UDELL GF (1995) Relationship lending and lines of credit in small business finance. Journal of Business 68: 351–381.

BERGER AN & UDELL GF (2003) Small business and debt finance. In: Acs Z & Audretsch D (eds) Handbook of Entrepreneurship. Kluwer Academic Publishing.

BESANKO D & THAKOR AV (1987) Collateral and rationing: sorting equilibria in monopolistic and competitive credit markets International Economic Review 28: 671–689.

BESTER H (1985) Screening vs. rationing in credit markets with imperfect information. American Economic Review 75: 850–855.

BESTER H (1994) The role of collateral in a model of debt renegotiation. Journal of Money, Credit and Banking 26: 72–86.

BLACKWELL D & WINTERS D (1997) Banking relationships and the effect of monitoring on loan pricing. Journal of Financial Research 20: 275–289.

BODENHORN H (2003) Short-term loans and long-term relationships: Relationship lending in Early America. Journal of Money, Credit and Banking 35: 485–506.

BOOT AW & THAKOR AV (1994) Moral hazard and secured lending in an infinitely repeated credit market game. International Economic Review 35: 899–920.

BOOT AW, THAKOR AV & UDELL GF (1991) Secured lending and default risk: Equilibrium analysis and policy implications and empirical results. Economic Journal 101: 458–472.

CAPRA CM, FERNANDES MO & RAMIREZ I (2001) The separating role of collateral requirements in credit markets with asymmetric information. Lineex Working Papers 23/01: 1–33. [cited 27.9.2007]. Available from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=283179

CAREY M, POST M & SHARPE SA (1998) Does corporate lending by banks and finance companies differ? Evidence on specialization in private debt contracting. Journal of Finance 53: 845–878.

CHAN Y & KANATAS G (1985) Asymmetric valuations and the role of collateral in loan agreements. Journal of Money, Credit and Banking 17: 84–95.

CHAN Y & THAKOR AV (1987) Collateral and competitive equilibria with normal hazard and private information. Journal of Finance 42: 345–364.

COLE RA (1998) The importance of relationships to the availability of credit. Journal of Banking and Finance 22: 978–982.

DEGRYSE H & VAN CAYSEELE P (2000) Relationship lending within a bank-based system: Evidence from European Small Business Data. Journal of Financial Intermediation 9: 90–109.

ELSAS R & KRAHNEN JP (2002) Collateral, default risk and relationship lending: An empirical study on financial contracting. Working paper. [cited 27.9.2007]. Available from http://www.wiwi.uni-frankfurt.de/schwerpunkte/finance/wp/461.pdf.

HARHOFF D & KÖRTING T (1998) Lending relationships in Germany – Empirical evidence from survey data. Journal of Banking and Finance 22: 1317–1353.

HECKMAN J (1979) Sample selection bias as a specification error. Econometrica 47: 153–161.

HEMPEL G, COLEMAN A & SIMONSON D (1986) Bank management. Wiley, New York, NY.

HESTER D (1979) Customer relationships and terms of loans: Evidence from a pilot survey. Journal of Money, Credit and Banking 11: 349–357.

INDERST R & MÜLLER HM (2006) A Lender-based theory of collateral. CEPR Discussion Paper No. 5695.

GREENE WH (2000) Econometric analysis. Prentice Hall, 4th edition.

JAFFEE D & RUSSELL T (1976) Imperfect information, uncertainty and credit rationing. Quarterly Journal of Economics 90: 651–666.

JAMES C (1988) The use of loan sales and standby letters of credit by commercial banks. Journal of Monetary Economics 22: 395–422.

JENSEN MC & MECKLING WH (1976) Theory of the firm: Managerial Behavior, agency costs, and ownership structure. Journal of Financial Economics 3: 305–360.

LEETH JD & SCOTT JA (1989) The incidence of secured debt: evidence from the small business community. Journal of Financial and Quantitative Analysis 24: 379–394.

LONGHOFER D & SANTOS J (2000) The importance of bank seniority for relationship lending. Journal of Financial Intermediation 9: 57–89.

MACHAUER A & WEBER M (1998) Bank behavior based on internal credit ratings of borrowers. Journal of Banking and Finance 22: 1355–1383.

MORSMAN E (1986) Commercial loan structuring. Journal of Commercial Bank Lending 68: 2–20.

MYERS S (1977) Determinants of corporate borrowing. Journal of Financial Economics 5: 147–175.

MÖRTTINEN L (2000) Essays on loan pricing and the credit channel of monetary policy. Research Reports, Kansantaloustieteen laitoksen tutkimuksia 85: 1–117. Department of Economics, University of Helsinki.

ORGLER Y (1970) A credit scoring model for commercial loans. Journal of Money, Credit and Banking 2: 435–445.

PETERSEN M & RAJAN R (1995) The effect of credit market competition on lending relationships. Quarterly Journal of Economics 110: 407–433.

RAJAN R & WINTON G (1995) Covenants and collateral as incentives to monitor. Journal of Finance 50: 1113–1146.

RAMÍREZ COMEIG I (1998) Determinantes de la insolvencia en las operaciones avaladas por las sociedades de garantía recíproca: una aplicación del análisis discriminante y del análisis logit. Revista Europea de Dirección y Economía de la Empresa 7: **149–166.**

REIG PÉREZ A & RAMÍREZ COMEIG I (1998) Efecto de la información asimétrica sobre el riesgo y el comportamiento de las sociedades de garantía recíproca: un análisis empírico", Revista Española de Financiación y Contabilidad XXVII: 469–497.

RILEY JG (1979) Information equilibrium. Econometrica 47: 331–359.

SCOTT JA & DUNKELBERG WC (2003) Bank mergers and small firm financing. Journal of Money, Credit, and Banking 35: 999–1017.

SHARPE S (1990) Asymmetric information, bank lending, and implicit contracts: a stylized model of customer relationship. The Journal of Finance 45: 1069–1089.

STIGLITZ JE & WEISS A (1981) Credit rationing in markets with imperfect information. American Economic Review 71: 393–410.

STULZ R & JOHNSON H (1985) An analysis of secured debt. Journal of Financial Economics 14: 501–522.

WELCH I (1997) Why is bank debt senior? A theory of asymmetry and claim priority based on influence costs. Review of Financial Studies 10: 1203–1236.

APPENDIX I

Review of the essential studies of the role of collateral and borrower risk.

Author(s)	Issue	Methodology	∂ Collateralization / ∂ Borrower risk
Stiglitz & Weiss (1981)	Credit rationing in imperfect markets and the role of collateral as a screening device.	Theoretical model of equilibrium outcomes when interest rate and riskiness of the loan concerned.	Credit rationing exists in order to achieve optimal loan contracts. Collateral can not be used as a screening device. Higher collateral requirements increase the riskiness of the loan.
Chan & Kanatas (1985)	Collateral and bank loans. Asymmetric valuation.	Theoretical model of the valuation of borrower quality.	Lower borrower risk – higher collateralization. High-quality borrowers will indicate their creditworthiness by pledging more collateral. Signaling too costly for low-quality borrowers.
Besanko & Thakor (1987)	Collateral and competition under asymmetric information.	Theoretical model of monopolistic and competitive cases.	Lower borrower risk – higher collateralizaion in competitive market. Incentive compatible contracts: optimal borrower quality sorting.
Chan & Thakor (1987)	Collateral and competition under moral hazard and private information.	Theoretical model of borrower quality and effort level / collateral.	Lower borrower risk – higher collateralization. Credit rationing of high-quality borrowers may exist.
Boot, Thakor & Udell (1991)	Collateral requirements under moral hazard and adverse selection.	Theoretical and empirical models of borrower risks under asymmetric information.	Higher borrower risk – higher collateralization under moral hazard. Relationship either positive or negative under moral hazard and adverse selection.
Bester (1994)	Ex-post monitoring of borrower by higher initial collateral requirements.	Theoretical. Renegotiation model of relationship lending.	Higher borrower default risk – higher collateral requirements. Firms are more likely to be financed by contracts which include collateral.
Boot & Thakor (1994)	Model of relationship lending as an infinitely repeated moral hazard.	Theoretical model of relationship lending.	As bank observes borrower success, collateral requirements are lower.
Rajan & Winton (1995)	Collateral decision observed by public, but inside bank has senior debt position.	Theoretical model of inside bank / relationship lending.	Higher borrower risk – higher collateralization. Borrower risk is larger, when firm is facing financial distress and/ or poor business conditions at the aggregate level.
Welch (1997)	Ex-ante seniority bank position, ex-post bargaining power. Accumulated collateral by the bank.	Theoretical model of relationship lending.	Senior bank has superior information privilege already ex-ante. Support in distress situations.

APPENDIX I (cont.)

Author(s)	Issue	Methodology	∂ Collateralization / ∂ Borrower risk
Longhofer & Santos (2000)	Bank debt seniority and collateral. Accumulated collateral by the bank.	Theoretical model of relationship lending.	Bank debt seniority – higher collateralization. Buffer for future bad states. Support in distress situations.
Inderst & Müller (2006)	Collateral requirements – point of view of banks.	Theoretical model of banks' collateral requirements based on subjective credit assessment.	High-quality borrowers pledge less collateral than low-quality borrowers, under conditions where no assumptions of moral hazard or adverse selection is made.
Hester (1979)	Collateral, relationship lending and terms of bank loans.	Empirical.	Higher borrower risk – higher collateral requirements.
Hempel, Coleman & Simonson (1986)	Collateral and bank loans. Bank management.	Empirical.	Higher borrower risk – higher collateralization.
Morsman (1986)	Collateral and commercial loan structuring.	Empirical.	Higher borrower risk – higher collateralization.
Berger & Udell (1990)	Collateral and bank loan quality.	Empirical.	Higher borrower risk – higher collateral requirements.
Harhoff & Körting (1998)	Relationship lending, collateral and bank loans.	Empirical.	Higher borrower risk – higher collateral requirements.
Machauer & Weber (1998)	Collateral, bank loan terms and borrower risk.	Empirical.	Lower borrower risk – higher collateral requirements. 'Housebanks' obtain more collateral and provide more funding.
Capra, Fernandez & Ramirez (2001)	Incentive compatible contracts and collateral requirements under asymmetric information.	Empirical.	Ex post low-risk borrowers choose contracts with lower interest rate and higher collateral.
Elsas & Krahnen (2002)	The use of collateral and the relation to borrower quality. Financial contracting.	Empirical.	No relation with collateral and borrower risk. 'Housebanks' require more collateral.

APPENDIX II

Robust tests of firms' capability to pledge collateral, and relationship between loan rates and collateralization

Explanatory variables	(1)	*(std)*	(2)	*(std)*	(3)	*(std)*	(4)	*(std)*	(5)	*(std)*
Intercept	0.067	(0.132)	3.005***	(0.144)	2.956***	(0.146)	2.654***	(0.162)	3.105***	(0.318)
RiskD1	*ref*		*ref*		*ref*		*ref*		*ref*	
RiskD2	–0.036	(0.057)	0.081*	(0.047)	0.337**	(0.142)	0.093*	(0.053)	0.877***	(0.247)
RiskD2*Collat.					–0.003*	(0.001)			–0.011***	(0.003)
Duration	–0.054	(0.036)	–0.075***	(0.030)	–0.074**	(0.030)	–0.064**	(0.031)	–0.070	(0.062)
Scope	–0.039	(0.036)	0.035	(0.030)	0.034	(0.030)	0.044	(0.031)	0.001	(0.066)
Collateralization			–0.002***	(0.0006)	–0.002**	(0.0006)	–0.00004	(0.0008)	0.003*	(0.002)
Age	0.119***	(0.035)	0.005	(0.029)	0.006	(0.029)	–0.005	(0.032)	–0.003*	(0.061)
Legtype	–0.033	(0.055)	–0.048	(0.047)	–0.050	(0.047)	–0.019	(0.048)	–0.084	(0.108)
Maturity	0.019***	(0.006)	–0.057***	(0.006)	–0.057***	(0.006)	–0.044***	(0.007)	–0.071***	(0.011)
Log(Captal)			–0.197***	(0.018)	–0.199***	(0.018)	–0.194***	(0.020)	–0.240***	(0.038)
YD1	*ref*		*ref*		*ref*		*ref*		*ref*	
YD2	0.035	(0.125)	–0.068	(0.099)	–0.060	(0.099)	–0.044	(0.102)	–0.031	(0.220)
YD3	–0.045	(0.122)	–0.163*	(0.098)	–0.158	(0.097)	–0.143	(0.100)	–0.195	(0.217)
YD4	0.009	(0.121)	–0.264***	(0.096)	–0.255***	(0.096)	–0.276***	(0.100)	–0.140	(0.211)
YD5	0.043	(0.116)	–0.418***	(0.092)	–0.409***	(0.092)	–0.402***	(0.094)	–0.414**	(0.208)
YD6	0.001	(0.112)	–0.449***	(0.090)	–0.437***	(0.091)	–0.429***	(0.094)	–0.450**	(0.200)
YD7	–0.027	(0.113)	–0.495***	(0.092)	–0.480***	(0.092)	–0.539***	(0.095)	–0.379*	(0.202)
Obs.	627		603		603		391		212	
Adj. R^2	0.026		0.463		0.466		0.504		0.477	

Whole sample estimates 1995–2001. Dependent variable: (1) "Collateral capability" (=total assets/total debt), (2)–(5) "Loan rate" (=Log(loan rate-reference rate)). Standard error in parentheses. Industries are controlled in the estimations, parameter values not reported. *, **, * Significance at the 10%, 5%, and 1% levels, respectively.**

APPENDIX III

Endogeneity tests for loan size and collateralization.

	Endogeneity test for Collateralization				Endogeneity test for Loan size			
	First stage		Second stage		First stage		Second stage	
Explanatory variables	(1)	(t)	(2)	(t)	(3)	(t)	(4)	(t)
Intercept	2.705***	(11.47)	1.835*	(1.78)	2.705***	(11.47)	2.583***	(10.04)
Log (Duration)	–0.094**	(–2.22)	–0.106**	(–2.19)	–0.094**	(–2.22)	–0.100***	(–2.30)
Log (Financial Services)	0.031	(0.76)	0.038	(0.83)	0.031	(0.76)	0.031	(0.78)
Loans	0.045**	(2.46)	0.041**	(2.18)	0.045**	(2.46)	0.042**	(2.32)
Multiple	0.034	(0.69)	0.059	(0.99)	0.034	(0.69)	0.051	(0.97)
Liabilities	–0.002	(–0.29)	–0.004	(–0.58)	–0.002	(–0.29)	–0.002	(–0.38)
Collateralization	–0.001	(–1.59)	0.003	(0.46)	–0.001	(–1.59)	–0.001	(–1.62)
Personal Guarantee	0.181***	(3.21)	0.285*	(1.69)	0.181***	(3.21)	0.178***	(3.08)
Non-bank Guarantee	–0.040	(–0.57)	–0.004	(–0.05)	–0.040	(–0.57)	–0.024	(–0.35)
Log (Leverage)	–0.018	(–0.55)	–0.014	(–0.41)	–0.018	(–0.55)	–0.011	(–0.36)
Log (Total Assets)	0.057	(1.30)			0.057	(1.30)		
Log (Firm Age)	–0.017	(–0.68)	0.039	(0.85)	–0.017	(–0.68)	0.049	(1.13)
Legal Form	0.011	(0.19)	0.042	(0.65)	0.011	(0.19)	0.020	(0.33)
R3-5	0.333***	(2.62)	0.376**	(2.10)	0.333***	(2.62)	0.296**	(2.35)
R3-5 * Log (Duration)	–0.124**	(–2.12)	–0.141*	(–1.88)	–0.124**	(–2.12)	–0.111	(–1.91)
Maturity	–0.040***	(–4.68)	–0.042***	(–3.69)	–0.040***	(–4.68)	–0.033***	(–3.34)
Log (Loan Size)	–0.201***	(–6.78)	–0.189***	(–4.00)	–0.201***	(–6.78)	–0.237***	(–5.72)
Obs.	279		279		279		279	
Adj. R^2	0.529		0.470		0.529		0.525	

Dependent variable is the effective loan rate (marginal interest rate including the arrangement fees of the loan). Two Nonlinear 2SLS tests are regressed separately for potential endogenous variables "Collateralization" and Log("Loan Size"). The instrumental variable is Log("Total Assets") in both independent regressions.