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# Collateral and credit rationing: a review of recent studies as a guide for future research

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**Abstract.** The relationship between firms and banks often suffers from informational opacity which may result in credit rationing. In theory, providing collateral to the bank can have a mitigating effect on these informational asymmetries and thus solve the credit rationing problem. The aim of this article is twofold. First, we provide a review of recently growing empirical research on collateral as a remedy for credit rationing. Secondly, we would like to pin-point gaps and limitations in current empirical research. Most studies contend with an incomplete research design by excluding other information opaqueness reducing tools such as the strength of the relationship between borrower and lender, loan maturity and covenants. We also discuss the estimation method used and provide suggestions to incorporate interaction effects into the estimation models. Further, we discuss the relevance and need for distinguishing between personal and business collateral which is rarely done. We draw attention to the importance of further exploring the use of collateral since recent trends predict that collateral will become a more important debt contract feature.

**Keywords.** Collateral, credit rationing, information asymmetry, credit markets.

## 1. Introduction

Nowadays, firms are confronted with an increasing globalization and competition on output markets. Competition forces firms to make decisions at top speed: innovations have to be converted to new product-market combinations. However, globalization and fierce competition might also create a lack of sufficient inputs, including financial means. Firm growth is the driving force for the economy and is crucial for the development of prosperity and welfare (Audretsch, 2002). The accomplishment and further development of 'growth' may be hampered by a lack of necessary financial resources.

If the internal financial resources appear to be insufficient, pecking order theory predicts that firms would first prefer debt finance such as bank loans. However, smaller firms often cope with problems signalling their qualities to financial institutions in order to obtain bank finance. Smaller firms are mainly non listed firms, not followed by analysts and lacking any audited financial statements. Moreover, these firms are not always willing to release any information since it is a time-consuming (costly) occupation (Berger and Udell, 1998). This information asymmetry between lender and borrower may give rise to credit rationing.

From a theoretical point of view, credit rationing occurs if, in equilibrium, the demand for loans exceeds the supply at the ruling price of loans (interest rate). In their seminal work, Stiglitz and Weiss (1981) conclude that there are no competitive forces in action to increase the interest rate in order to bring demand and supply together. If the bank would agree on a higher interest rate, its expected return would decrease due to informational asymmetries. First, an adverse selection effect would be introduced: a higher interest rate will attract higher risk borrowers while lower risk borrowers drop out. Secondly, borrowers who receive a loan will prefer higher risk projects to low risk projects. This is the moral hazard effect. Theoretical models predict that this information asymmetry gives rise to credit rationing if the

information problem remains unsolved. Due to asymmetrical information, the expected banks' return increases non monotonously when the interest rate is increased. So, banks prefer rationing credit rather than increasing the interest rate.

In such a situation, providing collateral to the bank might serve as a mechanism mitigating informational asymmetries and thus solving the credit rationing problem. If one of the prices, being the interest rate, does not fulfil its role efficiently due to indirect effects on the average quality of the credit portfolio, the bank could rely on collateral. By taking into account the possibility to pledge collateral in combination with a certain (bank-optimal) interest rate, an equilibrium could prevail *without* credit rationing by demanding collateral.

However, not only collateral can mitigate the information problem. There exists an extensive literature discussing the role of relationship lending in overcoming information opacity between borrower and lender. The proximity between borrower and lender can facilitate ex ante screening and ex post monitoring of the borrower and as such, can reduce informational asymmetries. Also other, under-researched, contractual arrangements like loan maturity and loan covenants can mitigate informational asymmetries. An informationally opaque firm can use each of these informational asymmetry reducing tools as complements or substitutes.

Recently, the empirical literature on collateral has become more widespread. However, results on the use of collateral as an informational asymmetry reducing tool are inconsistent. In some studies collateral seems to play a disciplinary role in the behaviour of the borrower solving the moral hazard problem (e.g. Menkhoff et al., 2006; Hernandez-Cananovas and Martinez-Solano, 2006; Chakraborty and Hu, 2006; Brick and Palia, 2007). However, other empirical studies suggest a signalling value of collateral solving the adverse selection problem (e.g. Lehmann and Neuberger, 2001; Jiménez et al., 2006). This diversity in results may be originated in a deficient research framework. Most studies focus on *one* contractual feature

e.g. collateral disregarding the other informational asymmetry reducing tools e.g. strength of the relationship, loan maturity and covenants. However, these contractual features are often interrelated. Any research set up as well as the econometric estimation method used, should bear this in mind. In addition, little is known about moderating or interaction effects between collateral and other tools that may mitigate informational asymmetries. Nevertheless, the results of recent studies (Jiménez et al., 2006) point to the further examination of interaction effects as a fruitful way to unravel contrasting results in empirical literature.

So, the aim of this article is twofold. First, we would like to provide a survey of recently emerging empirical research on collateral as a solution for credit rationing. A first research avenue considers collateral as a means to reduce the informational asymmetries between borrower and lender. It *indirectly* considers collateral, through its impact on information opaqueness, as a solution for credit rationing. A second research avenue *directly* investigates whether collateral increases the supply of bank debt and thus decreases the probability of credit rationing. However, results are inconsistent concerning the role of collateral as a remedy for credit rationing. Hence, the second aim of the article is to suggest why results may differ across studies and provide suggestions on how future research may be improved, reconcile present findings and add value to the research domain.

The organization of the paper is as follows. Section 2 provides a brief overview of the theoretical modelling on collateral as a solution for the informational asymmetries between borrower and lender. In section 3, we focus on the empirical research on collateral as a solution for credit rationing distinguishing between two research avenues explained above. Since the results on the role of collateral are inconsistent, we focus on the possible causes. Section 4 discusses the relevance of distinguishing between personal and business collateral and points at future research avenues. In section 5, the future importance of

collateral as a debt contract feature and its implications are discussed. Section 6 concludes the paper with some final considerations.

## 2. Collateral as a remedy for credit rationing

Credit rationing originates from the prevalence of informational asymmetries: the firm knows the expected risk and return of the project for which they want bank finance while the bank only knows the average expected return and risk of an average project in the economy. The lender is not willing to increase the interest rate to bring demand and supply for bank debt together: the lender's expected return would decrease due to informational asymmetries. Since collateral is expected to have a mitigating effect on informational asymmetries, collateral may solve the credit rationing problem. Throughout time, several theories on collateral as an informational asymmetry reducing instrument have been developed[1]. Broadly, theories can be subdivided into two main categories[2], based on the kind of information problem solved (Leland and Pyle, 1977).

A first category of theoretical models views collateral as a screening device, reducing the 'adverse selection' problem. The willingness of the entrepreneur to pledge collateral positively influences the quality of the credit request, as perceived by the bank. Collateral has a 'signalling role': the borrower 'signals' the real value and belief in the quality of the project to the bank (e.g. Chan and Kanatas, 1985; Bester, 1985, 1987; Besanko and Thakor, 1987a, 1987b). Within this strand of theoretical literature, it is concluded that, in equilibrium, low risk borrowers pledge more collateral than high risk borrowers.

A second category of theories views collateral as an incentive device, reducing the 'moral hazard' problem (e.g. Clemenz, 1986; Boot et al. 1991, Boot and Thakor, 1994; Chen, 2006). Compared to the previous strand of literature discussed, these theories predict the

opposite: high risk borrowers pledge more collateral than low risk borrowers. Collateral can be seen as a means to prevent the high risk firm from switching from a lower to a higher risk project after the loan has been granted or do less effort to realize the proposed project (Boot et al., 1991). The risk of loosing the collateral pledged, would prevent any risk shifting behaviour by the (high risk) entrepreneur after receiving the loan.

Collateral could not solve the credit rationing problem if the theoretical models consider the effect of the demand for collateral *separately* from the interest rate. When the interest rate is considered as fixed while introducing the collateral effect, an increased demand for collateral would not monotonously increase the bank's profit due to adverse selection problems created by the collateral demand (e.g. Wette, 1983). Increasing the demand for collateral (analogously to increasing the interest rate) would only attract entrepreneurs applying for finance to execute risky investment projects with a high expected profit. A negative adverse selection effect arises. The positive moral hazard effect of pledging collateral is more than compensated by this negative adverse selection effect.

However, these models were criticized since in reality, banks consider both, the interest rate and collateral, *simultaneously*. According to several theoretical models, determining the interest rate and the demand for collateral simultaneously can prevent the existence of credit rationing (Chan and Kanatas 1985, Besanko and Thakor, 1987a, 1987b, Chan and Thakor, 1987, Bester, 1985, 1987). The borrower 'signals' its quality: the high risk entrepreneur will prefer high interest rates and low collateral requirements. If the project succeeds, the return will be high enough to pay the high interest rates. If the project fails, the firm will not lose any (or little) assets pledged as collateral. The opposite argumentation applies to low risk entrepreneurs. So, the bank considers the willingness to pledge collateral as a signal that the firm will do its utmost to succeed in the projects financed with bank debt. However, based on this reasoning, the firms may only differ in one dimension making it

possible to distinguish by means of only collateral and the interest rate between 'high' and 'low' risk borrowers. However, in reality, firms differ in many dimensions. Only the interest rate and the collateral requirements will not suffice to make a perfect distinction, leading to the persistence of credit rationing (Jaffee and Stiglitz, 1990; Hellmann and Stiglitz, 2000). However, further theory in this research area taking into account the multiple diversity of firms and trying to solve the credit rationing phenomenon is lacking.

## 3. The need for empirical work to go beyond the limit of theoretical modelling

Until recently, the empirical work on collateral was scarce even though it is a widespread, important feature of the credit acquisition process. However, during the past few years, this research domain has gained interest and the number of studies has been growing with an increasing speed. The empirical research in this domain can be subdivided into two research avenues. Within the first avenue (§3.1.), collateral is studied as a tool to reduce the informational asymmetries between borrower and lender, which is the foundation for the existence of credit rationing. This research provides *indirect* evidence on the relationship between collateral and credit rationing. Within the second avenue (§3.2.), collateral is studied as one element in a demand-supply model for bank debt with credit rationing arising when the demand for bank debt exceeds the supply for bank debt. Collateral availability increases the supply of bank debt and thus decreases the probability of credit rationing. These studies provide *direct* evidence on the relationship between collateral and credit rationing. Both research avenues will be discussed in the following paragraphs.

*3.1. First research avenue: collateral as a remedy for informational asymmetries between borrower and lender*

Looking at the current empirical work, we can conclude that in the majority of studies, collateral seems to play a disciplinary role in the behaviour of the borrower as it seems to solve the moral hazard aspect of the informational asymmetries between borrower and lender (Berger and Udell, 1990; Berger and Udell, 1995; Harhoff and Körting, 1998; Dennis et al., 2000; Menkhoff et al., 2006; Hernandez-Canovas and Martinez-Solano, 2006; Chakraborty and Hu, 2006; Brick and Palia, 2007). However, empirical studies by Lehmann and Neuberger (2001) and Jiménez et al. (2006) show contrasting results. The results of these studies suggest a signalling value of collateral, solving the adverse selection problem: low risk borrowers pledge more collateral to signal their quality. Lehmann and Neuberger (2001) find that borrowers with a high credit rating (i.e. a higher risk) have a lower percentage of their loan collateralized. Jiménez et al. (2006) find that, among young 'borrowers' who cope with information asymmetries, the likelihood of pledging collateral is positively associated with the credit quality. Nevertheless, Cressy and Toivanen (2001) do not confirm any of both theoretical views: they find no significant relationship between risk and the pledging of collateral.

We could question why the results are inconsistent across different studies. In our opinion, there are three possible explanations: a deficient research design (§3.1.1.), the single equation estimation method used (§3.1.2.) and ignoring possible interaction/moderating effects (§3.1.3.).

### 3.1.1. Research design

In search for an explanation for these contrasting results, we first discuss the research design. Collateral is just *one* contractual arrangement, that aims at reducing the information opaqueness between borrower and lender. Other contractual arrangements as well as other features that characterize the relationship with the lender can have an informational asymmetry reducing impact. Within this respect, we need to consider relationship lending, loan maturity and restrictive covenants. In most studies on collateral, especially the impact of loan maturity and covenants is omitted.

Moreover, turning again to the theory in this field, only collateral and interest rate did not suffice to perfectly distinguish between high risk and low risk firms since firms differ in many dimensions. Since the information opaqueness would persist, credit rationing could not be solved. However, these other contractual arrangements, besides collateral and interest rate, being the strength of the relationship between borrower and lender, loan maturity and inclusion of restrictive covenants, could allow lenders to make a better distinction between high and low risk firms. This reduced information asymmetry could solve the credit rationing problem. However, theoretical literature on the effect of using other informational opaqueness reducing tools besides collateral is limited (e.g. Baas and Schrooten, 2007).

Each of these potential informational asymmetry reducing tools that can be used instead of or complementary with collateral, will be discussed in the following paragraphs.

#### A. Relationship lending

Relationship lending focuses on improving the banks' revenues by maximising the profitability of the entire relationship with the firm throughout time. The financial institution

invests in obtaining private and confidential information on the borrower that is generally not shared with other financial institutions ('proprietary information'). The information gathering allows the financial institution to better assess the qualities and weaknesses of the firm and entrepreneur. An extensive literature (for an overview see e.g. Boot, 2000) discusses the role of relationship lending in solving asymmetric information problems between borrower and lender. The close relation between borrower and lender should facilitate the ex ante screening and ex post monitoring and thus mitigate any informational opaqueness.

In the respective literature, the strength of the relationship is measured in several ways. A widespread measure is the *duration* of the relationship with the bank. A longer relationship duration allows the lender to gather more information on the capacities and the character of the entrepreneur and thus reduces the informational opaqueness. So, relationship duration should be a substitute for collateral pledging. However, previous empirical research focusing on the effect of relationship duration on collateral pledging, has revealed contrasting results. Some studies find no significant effect (Menkhoff et al., 2006) or report a positive effect (Hernandez-Canovas and Martinez-Solano, 2006). However, the majority of results of previous studies confirms that relationship duration and collateral pledging can be considered as substitutes (e.g. Berger and Udell, 1995; Harhoff and Körting, 1998; Degryse and Van Cayseele, 2000; Chakraborty and Hu, 2006; Jiménez et al., 2006; Brick and Palia, 2007), as theoretically predicted by the model of Boot and Thakor (1994). As time goes by, the entrepreneur establishes a good reputation and the moral hazard problem will diminish (Diamond, 1989). Since the firm values a good reputation, a low risk project will be preferred above a high risk project, reducing the probability of repayment difficulties and keeping the value of the reputation asset intact.

Instead of the duration of the relationship, an alternative measure for the relationship strength is the *number* of banks a firm negotiates with before agreeing on a certain credit

contract. A firm, which does not exclusively deal with one bank, is not able to provide a bank with exclusive 'proprietary information'. The information on the firm will be shared among multiple financial institutions. So, working with only one bank could more effectively reduce the informational opaqueness and be a substitute for collateral as an informational asymmetry reducing tool. Empirical research is inconclusive on the impact of the number of banks on the probability of pledging collateral. Studies by Harhoff and Körting (1998), Chakraborty and Hu (2006) and Jiménez et al. (2006) confirmed that working with more banks increases the probability of pledging collateral.

On the contrary, in studies by Menkhoff et al. (2006) and Voordeckers and Steijvers (2006), results suggest that working with multiple banks lowers the probability of collateral pledging. These studies seem to suggest the existence of a hold-up problem: the bank can extract a rent from a firm that exclusively deals with this bank (e.g. by demanding a higher amount/degree of collateral) from its ex post superior bargaining power (Menkhoff et al., 2006). The firm gets 'locked in' in the relationship. Being able to negotiate with multiple banks avoids the monopolization of information on the borrower's quality as well as any kind of rent extraction (Baas and Schrooten, 2007; Hernández-Cánovas and Martínez-Solano, 2007). Moreover, it implies a threat for a bank of loosing a certain firm as borrower to a competitor. This may diminish the banks initial demand concerning the pledging of collateral. In addition, when many banks lend to the same borrower, the incentive for each bank to thoroughly screen the firm before granting a loan, increases. Informational rents will be diluted (Jiménez and Saurina, 2004).

Additionally, we can also categorize the *exclusivity* or the *scope* of the relationship under the relationship header. If a financial institution operates as the main banker for a firm, the firm mostly communicates with this particular bank since this bank delivers most financial products or services for the SME. Obviously, through this broad scope of the relationship and

the intense communication between both parties, the banks' risk involved in granting credit is reduced. It diminishes the information asymmetry and improves the banks' knowledge of the firm. As such, obtaining a loan from the main banker should reduce the necessity to pledge collateral as an opaqueness reducing instrument. However, most empirical studies suggest that the probability of pledging collateral increases when the loan is granted by the main bank (e.g. Machauer and Weber, 2000; Degryse and Van Cayseele, 2000; Elsas and Krahnen, 2000; Lehmann and Neuberger, 2001; Menkhoff et al., 2006; Hernández-Cánovas and Martínez-Solano, 2006; Voordeckers and Steijvers, 2006). Again, the hold-up problem seems to prevail: the intense communication generates superior information for the main banker compared to other banks. The main bank can exploit this market power by demanding even more collateral than necessary. The main banker wants to keep competing banks away from the client in the future and uses collateral as a barrier-to-entry for other banks (Voordeckers and Steijvers, 2006). By asking collateral protection - even if it is not necessary – banks try to build up a 'quasi-monopoly' position for each individual client.

B. Loan maturity

Engaging in short term loans instead of long term loans may also provide the lender with additional information and reduces the information opaqueness. A long term loan gives the debtor enough opportunity or time to alter the projects in subtle ways or even switch from low-risk to high-risk projects. This asset substitution problem is less prevalent when granting short term loans. As the term of the loan becomes shorter, the reputation effect of any risk shifting behaviour is more important. So granting short term loans reduces the moral hazard problem.

On the other hand, short term loans can also be used as a signalling instrument (e.g. Flannery 1986, Barclay and Smith, 1995). By entering into short term loans, the borrower allows the lender to generate information on the firm without engaging into any long term contracts. The entrepreneur shows his belief in the firm: he demonstrates to the lender that he believes that positive information on the firm will be released in the future. This information can, throughout time, lead to a strong reputation of the borrower and will cause more favourable contractual conditions on future loans (Diamond, 1991). Hence, short term loans minimize the adverse selection problem.

The results of the empirical study by Ortiz-Molina and Penas (2007) support the proposition that shorter loan maturities serve to mitigate the problems associated with asymmetric information. Also Leeth and Scott (1989), Degryse and Van Cayseele (2000), Dennis et al. (2000) and Voordeckers and Steijvers (2006) confirmed that short term loans would reduce the probability of having to pledge collateral due to less informational problems, indicating that loan maturity and collateral can be substitute mechanisms.

C. Restrictive covenants

In addition, agreeing to restrictive covenants (Smith and Smith, 2000; Berger and Udell, 2005) can generate information for the lender and reduce any informational problems. It can, throughout time, lead to a strong reputation of the borrower. By including restrictive covenants into the credit contract, the borrower is obliged to turn to the lender to renegotiate these covenants in case of radical changes in the financial condition of the firm (Berger and Udell 2005, Carey et al. 1993). Hence, covenants can reduce the informational asymmetries between borrower and lender. Covenants can reduce the moral hazard problem: the covenants included increase the control over the firm by the lender and prevents the borrower from any

risk shifting behaviour. Moreover, firms accepting restrictive covenants signal their belief in being able to comply with these covenants, reducing the adverse selection problem.

Rajan and Winton (1995) also indicate that covenants stimulate the monitoring of the firm. The usefulness of including covenants in the debt contract depend on the efficiency of the control on the compliance with these covenants. This increased effort of the bank in monitoring the firm and reducing any informational opaqueness, may decrease the necessity to ask for collateral. Consequently, covenants and collateral could be considered as substitutes. Empirical results by Niskanen and Niskanen (2004) suggest that loans with real estate collateral are less likely to contain covenants. However, loans with accounts receivable or inventories as collateral require more monitoring and thus are more likely to contain covenants. As such, covenants could also be a reinforcement of the demanded collateral which makes both complements. Unfortunately, except for the study by Niskanen and Niskanen (2004), empirical evidence concerning the role of covenants as a means to help solving the information problem is lacking, which makes it a fruitful avenue for future research.

### 3.1.2. Estimation method

Pledging collateral, engaging in relationship lending, reducing the loan maturity as well as including restrictive covenants can reduce the informational asymmetries between borrower and lender. Berger et al. (2007a) provide empirical evidence that a reduction in informational asymmetry would lower the incidence of collateral. Consequently, we could reason that a firm should consider each of these tools as substitutes for collateral. If so, why do the empirical results, as described above, not always support this? Besides looking

critically at the research design and pointing at the necessity to include *all* opaqueness reducing tools in empirical research, other elements need to be accounted for.

Indeed, the reason for the inconsistency in results might go beyond the disregard of relevant informational asymmetry reducing tools. The existence of a possible endogeneity problem may bias the results. Borrowers who provide more collateral receive a better rating which may explain why high risk borrowers have a lower percentage of their loan collateralized as in Lehmann and Neuberger (2001). Prior studies have often ignored the endogeneity problem as well as possible simultaneity problems that may lead to potentially biased and inconsistent estimates of the relationships. Loan maturity, the use of restrictive covenants, the characteristics of the relationship with the lender, the demand for collateral as well as the interest rate are *interrelated* debt contract features. The determinants of each contract feature may not be unique nor exogenous which may require the use of a simultaneous system of equations approach. The simultaneous use of more than one instrument might influence the individual impact of each instrument.

Empirical studies on collateral, looking at the jointness of several debt contract features are scant (e.g. Brick and Palia, 2007; Dennis et al., 2000; Cressy and Toivanen, 2001). Instead of assuming that collateral is exogenous, this approach endogenizes for collateral using instrumental variables. Brick and Palia (2007) compare the results of single equation models and simultaneous equation models. They find that when collateral is assumed exogenous in a single equation regression, there is no correlation between loan rates and the probability of posting collateral. However, when using a simultaneous equation system and endogenizing for collateral use, collateral pledging does have a significant positive effect on the loan interest rate. However, the interest rates do not have any significant effect on the probability of pledging collateral. These comparative results show that lenders do not consider each contractual agreement as an isolated debt contract feature.

Instead, lending institutions simultaneously seem to consider the whole set of contract features they can rely on. Thus, each research setting should bear this in mind and take into account the jointness in the terms of lending.

### 3.1.3. Interaction effects

In addition, in a vast majority of current studies on collateral, diversity in empirical results on collateral may originate from the lack of including moderating or interaction effects between the different tools that mitigate the informational asymmetries. For example, empirical studies show contrasting results on the relationship between collateral and the strength of the relationship. However, whether collateral is a complement or a substitute for relationship lending can depend on a moderating variable e.g. the creditworthiness of the borrower. Jiménez et al. (2006) found a positive relationship between relationship duration and the likelihood of collateral pledging *for borrowers with known low credit quality*, giving support to the hold-up proposition. They also found that if a firm works with multiple banks, it increases the probability of pledging collateral *for long term loans* while it decreases the probability of pledging collateral when acquiring *short term loans.* Considering interaction effects accompanying the use of informational asymmetry reducing tools e.g. loan maturity and relationship strength leaves us with new insights on the value of each tool. Moreover, the relative importance of each tool in reducing informational asymmetries, becomes more obvious. Degryse and Van Cayseele (2000) formally tested the interaction effect between relationship duration and scope of the relationship when studying the relationship between collateral and relationship lending. They did not find any significant effect suggesting that the impact of the relationship duration on collateral does not depend on the scope of the relationship. However, introducing this interaction term into the model did reveal that the

impact of relationship duration has *no* significant impact on collateral while the model excluding any interaction effects does show a negative significant impact. Thus, even though the interaction effect does not generate a significant impact on the dependent variable, it may affect the significance of other variables included in the model.

Both studies (Jiménez et al., 2006; Degryse and Van Cayseele, 2000) are unique in this field and point to the further examination of moderating/interaction effects as a fruitful way to unravel contrasting results in the empirical literature.

To conclude, we can summarize that future research within this first strand of empirical literature may benefit from including other informational asymmetry reducing tools besides collateral such as relationship lending, loan maturity and loan covenants. Given the fact that these debt contract features are interrelated, the use of a simultaneous system of equations may add value to the current knowledge in this domain. Despite the growing number of studies investigating the use of collateral, little is known about possible interaction effects among informational asymmetry mitigating tools even though interaction terms are hardly new to social science research.

### *3.2. Second research avenue: collateral as a tool to increase the supply of bank debt*

Based on the empirical studies in §3.1., collateral can be indirectly viewed as a solution for credit rationing, through its informational opaqueness reducing capacities. Within this paragraph, we present an overview of those empirical studies that consider collateral as a tool that *directly* reduces the probability of being credit rationed.

This second research avenue, considering collateral as an element of the demand-supply disequilibrium model[3] for bank debt, is still in its infancy. Credit rationing is

considered as the result of the interaction between supply and demand for bank debt. In equilibrium, when the bank demands the bank-optimal interest rate, the credit market can, from the traditional Walrasian point of view, be in disequilibrium: the demand for bank debt can exceed the supply of bank debt for a certain firm. Credit rationing prevails.

A demand-supply model for bank debt consists of three equations: demand equation, supply equation and transaction equation. The amount of bank debt received depends on the interaction of the desired demand and the supply of bank debt. In order to estimate the model, the determinants of both the demand and supply of bank debt have to be selected. Collateral is often considered as part of the supply function for bank debt (Ogawa and Suzuki, 2000; Shen, 2002; Atanasova and Wilson, 2004). A higher availability of collateral is expected to increase the supply of bank debt since collateral can mitigate the informational asymmetries between borrower and lender. Increasing the supply of bank debt for a certain firm decreases the probability of creating an excess demand and thus decreases the probability of credit rationing. Hence, collateral can help solving credit rationing for any specific firm.

Although this strand of literature is very promising in order to estimate the existence of credit rationing and to verify the role of collateral as a solution for credit rationing, empirical studies in this area are scant (e.g. Atanasova and Wilson, 2004; Shen, 2002; Ogawa and Suzuki, 2000). Moreover, comparable to the deficiencies reported in the first research avenue, existing empirical studies often cope with an incomplete research design or they exclude possible interaction effects. Most studies do not take into account other mitigating instruments for informational asymmetries e.g. loan maturity and the strength of the relationship between borrower and lender. Results of the demand-supply disequilibrium model for bank debt, estimated by Atanasova and Wilson (2004), indicate that collateral is an important determinant of loan supply. However, no distinction is made between long and short term bank debt. In debt maturity literature, several theoretical arguments have been

developed which point to the existence of a demand-supply market for *short term* bank debt and one for *long term* bank debt, which are interrelated markets. Credit rationing may occur in one market but not in the other. As far as we know, this distinction was never made in existing empirical studies concerning credit rationing. Collateral as a tool to solve credit rationing is expected to have a more important effect in the demand-supply model for *long term* bank debt. The longer term of the loan would give the debtor enough time to engage in risk shifting behaviour (Jensen and Meckling, 1976). The risk of loosing the collateral pledged would prevent the borrower to switch to a higher risk project. Hence, collateral pledging is expected to increase the supply of long term debt. For short term bank debt, the impact of collateral on the loan supply is expected to be lower. Entrepreneurs applying for *short term* bank loans signal their belief in the firm that future positive information will be revealed. Moreover, the reputation effect of any risk shifting behaviour is more important to the firm ( see §3.1.1. on loan maturity).

Incorporating several informational asymmetry reducing tools to mitigate the informational opaqueness (e.g. loan maturity and strength of the relationship with the lender) or even taking into account moderating/interaction effects in the supply function may be a productive avenue for further research. It would enrich our knowledge on how a particular firm may solve credit rationing and to what degree collateral helps solving credit rationing.

**4. Does the distinction between business and personal collateral matter?**

Chan and Kanatas (1985) consider business collateral as an asset belonging to the borrowing firm, that will be transferred to the lender in the event of default. As such, business collateral (or inside collateral) does not increase the assets that the borrower would lose in case of default, since all the borrower's assets are attachable. Personal

collateral/guarantee refers to assets *not* belonging to the legal entity of the firm but provided by an external party or owner/manager of the firm. Personal collateral (or outside collateral) concerns the pledging of one specific asset while personal guarantees are general claims on the wealth of the guarantor.

Few theoretical studies (e.g. Chan and Kanatas, 1985) explicitly make the distinction between business and personal collateral. Most theoretical models implicitly assume full inside collateralization. If they do distinguish between both, they conclude that business and personal collateral are very similar. Also empirical studies rarely distinguish between business and personal collateral. However, the 'implicit value' of personal collateral as a disciplining device that limits the borrower's risk preference incentives is higher than for business collateral (Mann, 1997b). The lender receives explicit claims on personal assets and/or future wealth of the borrower (Ang et al., 1995), which he cannot rely on in the case of business collateral. Moreover, the likelihood that the borrower will feel any losses personally is higher when granting personal collateral.

As far as our knowledge, only Ang et al. (1995), Avery et al. (1998), Hernandez-Canovas and Martinez-Solano (2006) and Voordeckers and Steijvers (2006) specifically examine the topic of personal collateral. These empirical studies suggest that both kinds of collateral differ in their use. The use of business vs. personal collateral seems to depend on several elements such as the kind of loan, strength of the relationship, firm age. These empirical studies distinguishing between business and personal collateral point to the relevance and specific use of both kinds of collateral.

However, the knowledge concerning the link between business and personal collateral and how/to what extent both solve the informational asymmetry problem as the foundation for credit rationing needs to be further expanded. The higher implicit value of personal collateral as a disciplining device makes us eager to believe that it would be more effective in reducing

any informational opaqueness on the borrower. Entrepreneurs that are willing to put their private assets at stake, signal their belief in the project reducing the adverse selection problem. Moreover, the risk of loosing their personal assets minimizes the risk that the entrepreneur would shift from a low risk to a higher risk project. Thus, personal collateral seems to reduce the moral hazard problem.

It would also be interesting to know what the impact is of the use of other opaqueness reducing tools on business collateral on the one hand and personal collateral on the other hand. As previously discussed, debt terms are interrelated. Research on the determinants of the debt terms, including the distinction between personal and business collateral, in a simultaneous equation framework would add value to current knowledge in the field. In addition, the impact of possible interaction/moderating effects might differ for business and personal collateral.

## 5. The future role of collateral in the bank debt acquisition process

Even though collateral is not the only informational asymmetry reducing tool, as discussed in this article, it is an important feature of the credit acquisition process (Berger and Udell, 1990; Leeth and Scott, 1989). Moreover, two recent trends, the consolidation of the banking industry and the introduction of the Basel II Capital Accord, seem to predict that the role of collateral as a debt contract feature between informationally opaque firms[4] and banks will become even more important.

5.1. Consolidation of the U.S. banking industry

The consolidation of the banking industry may indirectly lead to an increase in the use of collateral. This consolidation wave has reduced the number of small banks (e.g. Bonaccorsi di Patti and Gobbi, 2001; Jayaratne and Wolken, 1999; Berger et al., 1998; Berger et al., 1995). While large institutions may have a comparative advantage in transactions lending technologies, smaller banking institutions have an advantage in relationship lending (Berger and Frame, 2007). However, this does not imply that large banks are disadvantaged in lending to opaque firms (Jayaratne and Wolken, 1999; Berger et al. 2007b).

Transactions based lending involves a heterogeneous group of lending techniques which are suitable for serving transparent as well as opaque firms (Berger and Udell, 2006; Berger et al. 2007b). According to Inderst and Mueller (2007), these technological innovating transaction based lending techniques lead to a greater use of collateral. Besides financial statement lending mainly based on hard information and reserved primarily for informationally transparent firms, large banks also rely on small business credit scoring, asset based lending and fixed-asset lending. Small business credit scoring technology may be applied to very opaque firms given that much of the information is based on the personal history of the owner rather than the SME. The personal assets of the owner can be demanded as collateral. Asset based lending is a monitoring intensive lending technique that focuses on the firm's assets (i.e. accounts receivable and inventory) that can be pledged as collateral, and can be the source of repayment. In fixed-asset lending, the fixed assets pledged to the lender as collateral, require less monitoring. Failure to repay the loan according to a fixed schedule, triggers a default of the loan. Consequently, the consolidation of banks can be accompanied by an increase in the use of collateral. Opaque firms will experience an increase in the use of business and personal collateral.

## 5.2. Introduction of Basel II Capital Accord

It can be expected that collateral based lending will occur more often with the Basel II Capital Accord coming into force. The Basel I Capital Accord was criticized for quite a while: it prescribed that banks should hold at least 8% of their risk-weighted assets with all high and low risk corporate credits treated alike (Carey, 2000). The Basel II Capital Accord is expected to align the risk of lending with the amount of capital a bank has to hold. This international standard should help protect the international financial system from the types of problems that might arise in case a major bank or a series of banks collapse. In practice, these rules mean that the greater risk to which the bank is exposed, the greater the amount of capital the bank needs to hold to safeguard its solvency and overall economic stability (Von Thadden, 2004). A collateralized loan represents less risk concerning the recovery of the loan and thus less equity has to be reserved by the financial institution (Bank for International Settlements, 2004). The banks equity is limited and has to be used in the most cost effective way. Consequently, banks would prefer collateralized loans since it would decrease the amount of reserved equity for bank lending.

## 5.3. What if collateral appears to become a major tool to obtain finance ?

Firms are not eager to pledge collateral. Besides the risk of losing the collateral pledged in case of default, they incur other costs (for an extensive overview of the costs see Coco, 2000). Entrepreneurs have to make additional reports to financial institutions and agree on more restrictive asset usage. The entrepreneur incurs a loss of welfare due to the restricted possibility to sell the business assets pledged in order to invest the selling value in new projects or to use it for perk consumption. Moreover, according to Mann (1997a, 1997b),

pledging business collateral limits the firms' ability to obtain future loans from other lenders which creates a position of power for the lending bank. Moreover, by even asking more collateral than necessary, banks can try to build up a 'quasi-monopoly' position for each individual client. The main bank could take more collateral than necessary what works as a barrier-to-entry for other banks (Voordeckers and Steijvers, 2006; Lehmann and Neuberger, 2001).

However, we can question whether all firms possess *sufficient* business collateral or are willing to pledge personal collateral. Some firms do cope with a lack of sufficient business collateral. Small firms, start-ups, fast-growth firms, high tech firms and firms with a very labour-intensive production process are often not able to offer the necessary business collateral (Himmelberg and Petersen, 1994; Binks and Ennew, 1995; Guiso, 1998; Carpenter and Petersen, 2002). Moreover, not all banks accept accounts receivable or inventories as valuable business collateral due to high monitoring costs (Berger and Udell, 1995). In addition, fast-growth and high tech firms often possess more intangible assets, that can not be pledged as collateral (Scholtens, 1999). However, especially these firms are often characterized by more informational asymmetries, increasing the need to pledge collateral in order to avoid credit rationing. When there is a lack of business collateral, the entrepreneur will have to put his personal assets at stake. By giving personal collateral, the risk of the entrepreneur increases. In case of default, he may not only lose his firm but also his private assets.

As a consequence, entrepreneurs of firms lacking the necessary business collateral, are confronted with a dilemma: obtaining bank finance provided that personal collateral is pledged or minimizing the risks of owning a firm without obtaining bank finance (Ang et al., 1995). For entrepreneurs opting to reduce their personal risks, the odds are that certain projects with a positive net present value can not be carried out due to a lack of funds which

leads to an underinvestment problem. Another firm possessing the same intrinsic qualities and with an entrepreneur who has sufficient business assets to pledge can obtain bank finance while a similar firm lacking sufficient business collateral and unwilling to risk a personal ruin, will not be granted a loan. This demand for (personal) collateral pledging might even discourage firms to apply for bank debt even though they are searching for finance to execute valuable investment projects.

The National Survey of Small Business Finance (NSSBF)[5] shows that the importance of the use of business collateral in order to obtain loans seems to have decreased in the period 1987-1998: from 56.9% in 1987, to 44.7% in 1993 and to 30.3% in 1998. However in 2003, the use of business collateral seems to have increased again to 45% of the loans granted. For personal collateral, we see that in the NSSBF of 2003, for more than half of the loans granted (53%) personal collateral was pledged while in the NSSBF of 1987, only for 27.9 % of the loans, personal collateral had to be provided. This trend of banks relying more and more on collateral, might not only affect the entrepreneur and the risks he has to take but also the entire economy. Besides the underinvestment problem cited above, changes in the values of the assets to be collateralized would enormously affect the access to credit. Recently, the values of real estate collateral in Japan decreased to a large extent. According to Gan (2007), this played an important role in reducing debt capacity and investment in Japan. So external shocks can amplify the business cycle through procyclical changes in availability of debt finance (Berger et al., 2007a; Bernanke and Gertler, 1989, 1990; Kiyatoka and Moore, 1997). In addition, Manove et al. (2001) criticized the unrestricted reliance on collateral by banks and argued that this might have a negative impact on credit-market efficiency. Banks have superior expertise in judging the different aspects of project quality in comparison to a sometimes unrealistic optimistic entrepreneur. Collateral will weaken the bank's incentives to do so and induces banks to be 'lazy'. It reduces their screening efforts below socially

efficient screening levels. From the point of view of banks, collateral and screening can be considered as substitutes.

The NSSBF seems to indicate that collateral indeed seems to become a major tool to obtain bank finance. Nowadays, one out of two loans granted seems to be collateralized. Future research should try to fine-tune these general thoughts by solving the question whether other informational asymmetry reducing tools discussed in this article, may substitute for the increased need for collateral that the firm lacks or the owner does not want to pledge.

## 6. Conclusion

SME's often cope with problems signalling their qualities to financial institutions to obtain bank finance. This information asymmetry between lender and borrower may give rise to credit rationing. In theory, providing collateral to the bank might serve as a mechanism mitigating informational asymmetries and thus solving the credit rationing problem. However, only collateral may not suffice to become perfectly informed on the qualities and intentions of the firm or to make a perfect distinction between high and low risk entrepreneurs. Consequently, more contractual arrangements have to come into play in order to solve the information problem in which credit rationing is originated. Besides collateral pledging, investing in a good relationship with a financial institution, shortening the loan maturity and agreeing to (restrictive) covenants can all contribute to a lower degree of information asymmetry between borrower and lender.

The aim of this article is twofold. First, a review of recent research on collateral as a remedy for credit rationing is provided. Recently, the empirical literature on collateral as a solution for credit rationing has become more widespread. We can distinguish between two research avenues: (1) an indirect approach considering collateral as an informational

asymmetry reducing tool and thus indirectly solving credit rationing; (2) a under-researched direct approach considering collateral as a tool that increases the supply of bank debt and thus directly reduces the probability of being credit rationed. However, our knowledge on this topic is still in its infancy and struggles with inconsistencies. Secondly, we would like to pin-point gaps and limitations in current empirical research that may cause these inconsistencies in results. In addition, suggestions are provided for future fruitful research avenues that would fill these gaps and enrich the current knowledge on how to solve the asymmetrical information problem in which credit rationing originates.

Looking at the empirical work on collateral, we see that the results on the use of collateral as an informational asymmetry reducing tool are inconsistent. In some studies collateral seems to play a disciplinary role in the behaviour of the borrower solving the moral hazard problem while in other empirical studies, collateral seems to solve the adverse selection problem. In our opinion, several reasons may account for this diversity in results. Empirical research on collateral as a solution for credit rationing often fails to combine each of the informational asymmetry reducing tools, cited above. Moreover, given the fact that these debt contract features are interrelated, the use of a simultaneous system of equations may add value to the current knowledge in this domain. The determinants of each contract feature may not be unique nor exogenous which may require the use of a simultaneous equations approach. The simultaneous use of more than one instrument might influence the individual impact of each instrument. In addition, despite the growing number of studies investigating the use of collateral, little is known about possible interaction effects among informational asymmetry mitigating tools.

Current empirical research also rarely distinguishes between business and personal collateral even though the implicit value of personal collateral as a disciplining device is higher. Our knowledge concerning the link between business and personal collateral and

how/to what extent both solve the informational asymmetry problem as the foundation for credit rationing needs to be further expanded. Moreover, research on the impact of the use of other opaqueness reducing tools (e.g. strength of the relationship between lender and borrower and loan maturity) on business collateral vs. personal collateral is also lacking.

Consolidation of banking industry leading to new transaction based lending technologies (e.g. small business credit scoring) and the introduction of the Basel II Capital Accord, seem to predict that the role of collateral will become even more important for opaque firms. However, not all opaque firms possess sufficient business collateral or are willing to put their private assets at stake by pledging personal collateral. As discussed in this article, further research should indicate whether this lack of collateral may be compensated by other informational asymmetry reducing tools in order to avoid credit rationing and the accompanying underinvestment problem.

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**Notes**

[1] For an extensive overview, see Coco (2000).

[2] In literature, the classification in ex ante and ex post information asymmetry is often made. Ex ante information asymmetry consists of the existence of adverse selection and moral hazard. Theories focussing on ex post information asymmetry view collateral as a means to reduce the costly state verification problem since there is an asymmetry concerning the returns of the project. Again, we refer to Coco (2000) for an elaborate discussion of the theories. We only briefly discuss the content of the mainstream literature. We do not discuss ex post information asymmetry theories due to the minor practical applicability. They state that in case of a large probability of default (non repayment), the motivation of the entrepreneur increases to report a failure of the project and not repaying the loan. This induces a higher demand for collateral.

[3] For a more extensive review of disequilibrium models, we refer to Maddala (1986, 1987). For more insights on the estimation of disequilibrium models in order to estimate the existence of credit rationing, we can refer to Fair and Jaffee (1972), Fair and Kelejian (1974), Maddala and Nelson (1974), Goldfeld and Quandt (1981), Hartley and Mallela (1977), Gersovitz (1980), Lee (1983).

[4] Informationally transparent SME's can qualify for financial statement lending, a technique based on hard information. The borrower must have a strong financial condition based on the financial statements, reducing the risk of lending to the SME and thus reducing the need for collateral pledging. The lender views the expected future cash flow as the main source of repayment (Berger and Udell, 2006).

[5] The National Survey of Small Business Finance (NSSBF) is conducted five-yearly by the Board of Governors and the U.S. Small Business Administration and collects information on small businesses (fewer than 500 employees) in the U.S. This survey collects data from a sample of 4,637 firms which can be considered representative of the 5.3 million non-farm, non-financial SME's in the U.S.

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