Thema Working Paper n°2012-39
Université de Cergy Pontoise, France

What lies behind credit rationing? A survey of the literature

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SCIENTIFIQUE

June, 2012

What lies behind credit rationing? A survey of the literature

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This version: June 2012

Abstract

Since World War II, the concept of credit rationing (CR) has been a topic of extensive investigations, both theoretical and empirical. From the theoretical point of view, several attempts have been made to define the extent to which a firm can be identified as credit rationed in macroeconomic and microeconomic financial frameworks. In the context of the current financial crisis, CR is strategically important given the financial difficulties faced by small business firms. The first purpose of this article is to provide an historical context for the theoretical frameworks of CR to analyze the existing definitions and typologies. From an empirical point of view, the main obstacle is that a direct measure of CR is not directly observable, considering that the answer is given by the firm and/or the bank. In light of the previously defined typology, the second purpose of this article is to present both the measures of CR and the main driving factors that have been tested in the empirical literature. Special attention is paid to the supply-demand interaction via the impact of the bank relationship on CR.

Key Words: credit rationing, small business, bank relationship

JEL classification: G14, G21, G32

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1. Introduction

Since World War II, the concept of credit rationing has received considerable attention from both macroeconomic and microeconomic points of view. As pointed out by Parker (2002), the availability of credit (in this paper, "availability" means the absence of CR or is bound by availability doctrine) is a necessary requirement for the growth of young firms, especially those dedicated to becoming future industrial giants. In the context of the current financial crisis, one particular concern is access to credit by small business enterprises (SMEs) that cannot access capital markets directly. Thus, CR is a central issue addressed in the literature on financing SMEs. There is broad consensus that firms, especially small ones, may undergo CR. According to the last US Survey of Small Business Finance, almost 10% of credit applications by SMEs were denied in 2003. A more recent study performed by the European Commission[1] highlighted that 45% of SMEs did not receive the exact bank loan that they applied for in 2006. We may wonder how these percentages varied since the emergence of the financial crisis.

In this survey, we investigate what lies behind the concept of CR with respect to the reality of firms' access to financing. To what extent can a firm be identified as credit rationed? More precisely, three strands of theoretical literature can be identified. The first strand stems from a macroeconomic approach (Roosa, 1951). It mainly relies on the supply side to characterize CR, with a focus on the risk of amplifying a credit crunch as a result of crises. A second strand of literature is related to the microeconomic approach. According to Stiglitz and Weiss (1981), the asymmetry of information creates adverse selection and a moral hazard that may lead to CR for firms who apply for funding. However, the microeconomic literature provides several interpretations and models of this supply-demand conceptualization of CR. Finally, the discouragement approach (Kon and Storey, 2003) distances itself from the previous theories by taking not only firms that apply for funding into account but also non-applicant firms that fear rejection. A first contribution of this survey is the establishment of a typology of CR based on the successive definitions provided by both the classical and modern theoretical literature.

Then, we are interested in the CR measure provided by empirical studies. Such studies are based on indirect measures (using *proxies*) or direct measures (using questionnaires) because the only way of identifying the existence of CR is to ask either the firm itself or the bank. Paradoxically, an extensive body of empirical literature addresses driving factors of CR, although there is no consensus about its definition from a theoretical standpoint. The purpose of surveying empirical studies is twofold. First, we present the studies in accordance with the type of CR measured. Moreover, the extent and economic significance of CR will differ strongly according to the type of firm, the period and the country of observation. Second, we provide an analysis of the main driving factors of CR highlighted by recently emerging empirical research in an international context.

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This review article is organized as follows. The second section analyzes the evolution of CR theories and identifies a typology. The third section focuses on the measures of CR and the driving factors of CR highlighted by empirical studies from the supply side, demand side and banking relationship side.

2. Theories of CR and a typology proposal

CR theory is characterized by a constant and dynamic evolution and has been the topic of extensive research that represents the fields of both macroeconomics and financial microeconomics. We survey CR theory from a historical perspective to highlight the contribution of the macroeconomic approach to the microeconomic approach (2.1). This consideration allows us to point out the evolution from a supply-side CR theory to a supply-demand theory based on the asymmetry of information between borrowers and lenders (2.2). Another step is taken with the inclusion of loan contracts and collaterals (2.3). More recently, the demand size became the most important factor in some studies that developed the concept of "self CR". We summarize both traditional and recent contributions to establish a CR typology (2.4).

2.1 From a macroeconomic to a microeconomic approach of CR

The historic references to CR are the usury ceilings (Smith, 1776) and English currency controversies of the 19th century (Viner, 1937). In 1930, Keynes discussed "an unsatisfied fringe of borrowers" that would like to borrow at the prevailing interest rate but are unable to do so. The number of unsatisfied borrowers depends on the disequilibrium between the volume of loans offered by banks - or by alternative sources – and the borrowers' demand. This phenomenon is referred to as disequilibrium CR. Although Keynes did not expand this notion, the availability doctrine developed in the early 1950s is partially based on it. The availability doctrine was originally derived from the monetary control politic of the Federal Reserve in the US. Based on macroeconomic arguments, this doctrine brought forth the subsequent microeconomic approach of CR.

The availability doctrine was first developed by Roosa (1951). Scott (1957a, b), Parker (1972) and Lindbeck (1962) provided a useful explanation of this doctrine. According to this theory, banks are limited by the availability of the funds that they can attract. Due to this supply constraint, credit is always rationed and the credit market balance is purely determined by the supply conditions and real economic activity. In such a context, monetary policy will be a tool to act on the availability of credit. More precisely, changes in the money supply could have direct effects on the credit supply instead of indirect effects channeled via changes in interest rates. Therefore, restrictive monetary policy should significantly reduce resources for business, even if it only induces a small interest rate increase. Finally,

resources are constrained by the availability of credit that was intended for the banks' customers.

As the availability theory is a supply-side theory, it does not consider the characteristics of the demand. Thus, it does not explain why banks cannot increase their interest rates to equate demand with supply and make a greater profit. The availability theory is discussed in Baltensperger and Devinney (1985), Clemenz (1986). The seminal paper by Hodgman (1960) (see also Jaffee and Modigliani, 1969; Smith, 1972; Jaffee and Russell, 1976 about the effects of uncertainty) contributed to CR theory by including the borrower's risk of default. Goulvestre (1980) provided a useful discussion of Hodgman. Given the borrower's credit rating, he posited that the risk of default increases with the loan size; conversely, the expected value of gains increases with the borrower's expected recovery rate. The contributions of Baltensperger (1978), Keeton (1979) and Baltensperger and Devinney (1985) clarified the debate by providing a definition of equilibrium CR. Those first theoretical analyses emphasized the specific shape of the credit supply curve: it is not monotonically increasing; instead, it becomes backward bending. All things being equal, a rise in the lending rate increases the lender's probability of default. Finally, a marginal increase in the lending rate can increase the borrower's costs of bankruptcy to a point that leads to a decrease in the bank's profitability. This trade-off between the costs of bankruptcy and lending rate creates a situation of CR. Baltensperger (1978) defined equilibrium CR as occurring in situations where the "price persistently stays at a level implying an excess of demand over supply can be consistent with rational lender behavior" and whenever "some borrower's demand for credit is turned down, even if this borrower is willing to pay all the price and non-price elements of the loan contract". Two types of CR, defined by Keeton (1979), emerged from this definition (see 1.4).

In addition to the "quoted price" (the interest rate), the non-price dimension is highlighted by Baltensperger (1978) as another characteristic of the supply side. "Non-price elements" exclude the macroeconomic determinants of CR provided in the availability theory (such as ceilings on interest rates, discriminatory pricing or exogenous shocks) to focus on microeconomic aspects, such as collateral requirements. The importance of non-price credit conditions has been stressed by subsequent CR models. As a matter of fact, non-price elements stem from moral hazard and adverse selection problems in the presence of imperfect information.

2.2 Asymmetric information and equilibrium CR

Previous explanatory models did not consider the complexity of the borrower-lender relationship, especially the problems generated by the asymmetry of information. Stiglitz and Weiss (1981) were among the firsts to formalize the origin of equilibrium CR. In a well-known paper about the "market for lemons", Akerlof (1970) showed that an adverse

selection situation can lead to the eviction of sellers offering the better-quality products. The model of Stiglitz and Weiss (1981) (henceforth the SW model) applied similar reasoning to the credit market. Unable to differentiate the risk of the different borrowers, the lender will quote a single interest rate. Due to the limited liability of shareholders (Jensen and Meckling, 1976), this single rate will act as a screening device: when the lending rate increases, low-risk borrowers will no longer apply for credit because they are no longer interested in a loan.

An increase in the interest rate has two opposite effects on bank profit. The first effect is negative: by increasing the interest rate, the bank increases the risk of its portfolio. The second effect is positive due to the increase in its net interest income. In such a situation, at the interest rate quoted by banks, credit demand may exceed supply. This phenomenon is referred to as equilibrium CR, and it explains the previously defined backward-bending supply curve. In such a situation, applicant borrowers will be credit rationed: they will not have access to credit, even though they are willing to pay the quoted interest rate.

Two complementary explanations of the backward-bending supply curve are provided by the literature. The first one is the existence of a moral hazard problem (Stiglitz and Weiss, 1981; Bester and Hellwig, 1987) related to the borrower's use of credit. In the SW model, banks do not accompany the project that they fund, so it is difficult for them to verify the actual use of the credit granted to the firm or whether the firm can repay. These problems may lead to an equilibrium CR in the same way that adverse selection does, by generating a non-monotonic relationship between the interest rate and the expected rates of return. Williamson (1987) offers a second and alternative theoretical explanation of CR that is based on the costly state verification paradigm of Townsend (1979) and Gale and Hellwig (1985). When failure is costly to the lender, an increase in the nominal rate of a loan may decrease the net return to the bank because it increases the borrower's probability of failure. This explanation justifies the use of loan contracts.

2.3 Loan contracts, collateral and equilibrium CR

Stiglitz and Weiss (1981) posited the inability of banks to overcome their lack of information. However, a bank facing a heterogeneous distribution of potential borrowers may benefit from discriminating among them. The lender can consider sorting devices in such a way that each type of borrower will choose a specific type of contract. Thus, the bank can develop specific loan contracts with different collaterals, maturities or other covenants. The first purpose of loan contracts is to obtain more information about the *ex ante* quality of the borrowers, *i.e.,* before the loan is granted; the second purpose is to limit their incitation to adopt, *ex post*, an opportunistic behavior after the loan is granted.

Collaterals are widely used in loan contracts, but they are indirectly related to CR in the theoretical literature. From a theoretical perspective, the collateral required by a bank

will mitigate the problems of adverse selection and moral hazard *ex ante*. Therefore, the existence of collaterals is expected to increase credit availability and reduce CR. Bester (1985) incorporated a screening mechanism in the SW model and found that equilibrium CR no longer occurs if banks compete by simultaneously choosing collateral requirements and the interest rate. In such a situation, borrowers will choose a contract with respect to their probability of default. Next, the "sorting-by-private information paradigm" is derived from the model of Besanko and Thakor (1987). Following this model, banks propose different contracts with an inverse relationship between collateral and the interest rate. The model predicts that (1) low-risk borrowers will choose contracts with a low lending rate and high collateral, and (2) high-risk borrowers will select contracts with a high lending rate and low collateral. A borrower is willing to pledge more collateral to the bank if (1) he is confident that the collateral will not be implemented or (2) if he wants to limit the compensation paid to the creditors in case of default. Finally, the choice of a contract by the borrower signals its creditworthiness to the bank, and a positive relationship between the amount of collateral and the creditworthiness of the borrower is assumed. In this case, CR will only occur if the amount of collateral is greater than the borrower's wealth.

The second role of collateral is to mitigate moral hazard *ex post, i.e.*, when the loan is granted. With high collaterals, default is costly for the borrower, so as a precaution, he is encouraged to reduce the risk of his project (Bester and Hellwig, 1987) to advance the realization of the project (Boot *et al.*, 1991) and declare the actual revenues of his investment (Bester, 1985). The model developed by Boot *et al.* (1991) assumes a partial substitutability between entrepreneur quality and the entrepreneur's *ex post* action. High-quality borrowers have a greater probability of completing their projects than low-quality borrowers. Then, the greater efforts made by the high-quality borrowers (the marginal productivity of their actions) will have less of an impact on the project's probability of success than efforts made by the poor-quality borrowers. In the presence of a moral hazard without asymmetrical information (*i.e.*, when the lender ignores the *ex post* behavior of the borrower), the optimal credit contract for a good-quality borrower has no collateral requirements because the efforts already provided by this type of borrower do not need to be increased. Conversely, the optimal credit contract for a poor-quality borrower always requires a collateral clause to reduce the risk of a moral hazard. In the presence of both a moral hazard and asymmetrical information (*i.e.,* when the bank ignores the borrower's *ex ante* quality and *ex post* behavior), Boot *et al.* (1991) found that all equilibrium contracts, including those intended for good borrowers, contain collateral requirements because banks are not able to assess the borrower's quality risk or observe the effort made to operate successfully. To complete this overview, Coco (2000) surveyed the explanations given for the bloated use of collateral provided "on a secured basis" by banks. He notes that models with collateral screening borrowers are unable to explain the large amount of required collateral. He suggests that the existence of agency conflicts could provide a better explanation for the widespread use of collateral in loan contracts.

Finally, banks can also modify other contract terms, such as the maturity of the loan (Stiglitz and Weiss, 1983), or impose loan covenants (Berlin and Mester, 1992; Carey *et al.*, 1993) to restrict the borrower's flexibility. A rich theoretical framework considers the determinants of corporate debt maturity. The literature includes four types of hypotheses about the determinants of corporate debt maturity structure: agency cost hypotheses (Barnea *et al.* 1980; Flannery, 1986), signaling and liquidity risk hypotheses (Diamond, 1991), maturity matching hypotheses and tax hypotheses. However, according to Ortiz-Molina and Penas (2008), the link between debt maturity and credit availability remains unclear.

As the theoretical literature previously discussed provided numerous attempts to define and formalize CR, the following section presents the existing classifications to summarize the complete dimensions of CR.

2.4 Thoughts about typologies of CR

Two classifications are proposed in the literature related to equilibrium CR. First, the classification of Keeton (1979) distinguished between two types of CR (called types I and II), while the subsequent classification of Jaffee and Stiglitz (1990) presented four types of CR (from type I to type IV). Finally, the discouragement theory proposed by Kon and Storey (2003) is based only on the demand side and is not yet included in any classification. As those classifications are not actualized and sometimes do not match, the motivation for surveying them is to analyze the differences in CR according to three dimensions: (1) does the definition proposed include the demand size, the supply size or an interaction between demand and supply? (2) What is the magnitude of the asymmetry of information between borrowers and lenders regarding the probability of default? (3) Regarding the demand size, does the definition consider only applicants for lending, or does it include non-applicants (3)?

In Keeton's (1979) first classification, only the applicant borrowers are considered, and two types of CR can be distinguished. A first type of CR—referred to as type I by the author, or size CR—occurs when some or all of the applicants receive a smaller loan than they desire, even if they are willing to pay the quoted price. A second type of CR—type II, or pure CR—occurs when some applicants are denied a loan even though they are willing to pay the quoted price and cannot be distinguished by banks from other applicants who do receive loans (rationed applicants are randomly selected by the banks).

For both types of CR, the most common hypotheses are that *ex ante*, (1) the banks can observe the expected return of the project, but (2) the banks cannot observe the borrower's probability of default. Thus, credit will be denied for reasons other than creditworthiness. Then, the difference between types I and II is the magnitude of CR. In the case of type I CR, all borrowers want to pay the price (the quoted interest rate), but they are size rationed: they receive smaller loans than the amount they desire. This size CR is also

called weak CR (Cieply and Dejardin, 2010). In the case of type II CR, some borrowers are fully financed, and some are credit rationed even though they are willing to pay more than the price and even though they accept the non-price elements (loan contracts): one borrower is rationed, whereas an apparently identical borrower is financed. This type of CR is derived from the hypothesis of the SW model. It is also called pure CR and referred to as "type IV" in the Jaffee and Stiglitz's classification (1990). This type of CR is also referred to as strong CR (Cieply and Dejardin, 2010). Regarding this framework, acting on price from the supply side is not considered a solution to the CR problem. Moreover, the rigidity of prices in the credit market is supported by the disequilibrium theory: for developed countries, in the absence of a law on ceiling rates, the high level of competition among banks will strongly limit the flexibility of the price (Cieply and Dejardin, 2010).

Jaffee and Stiglitz (1990) questioned this price rigidity by proposing another CR typology. Their type I CR, referred to as interest rate (or price) CR, differs from Keeton's type I CR on one point: the credit-rationed borrower can obtain a larger loan if he is willing to pay a higher rate. In such a context, even if an individual borrower's probability of default is unobservable by banks, it makes sense to link it with the size of the loan: the bankruptcy costs increase with the size of the loan because larger loans involve higher repayment than smaller ones (Jaffee and Russel, 1976). Thus, a borrower must pay a higher price on a larger loan because his probability of default increases with the size of the loan, *ceteris paribus*. Their type II CR, called "divergent views rationing CR" has no equivalent in Keeton's classification, which posited that "some individuals cannot borrow at the interest rate they consider appropriate based on what they perceive to be their probability of default". The evolution of the definition of CR is due to the inclusion of the demand size, more precisely by considering the perception of the borrower with regard to the probability of default. Another step is taken with the definition of type III CR, or "redlining".[2] In this type of CR, the asymmetry of information is weaker because the banks know both the applicant's probability of default and the return of the project. The credit decision of the bank will rely on the observance of the risk-return relationship: given its specific level of risk, the borrower will be rationed when the bank does not obtain the required return of the project. Conversely and finally, type IV CR is the previously defined pure CR (Keeton's type II) in the presence of a strong asymmetry of information.

In previous typologies, the effects of asymmetric information in terms of adverse selection and moral hazard problems are experienced by the credit applicants. In the SW model, non-applicants are considered via the screening process (the low-risk borrower will not apply for credit at the quoted interest rate), but the application costs are not included. A more recent strand of CR theory focused on the demand size, positing that when the information is too asymmetric, the borrower will take application costs into account in its decision process and could decide not to apply for a loan. This self-rationing approach to CR is also referred to as to the theory of "discouraged borrowers". The first mention of "discouraged borrowers" was made by Levenson and Willard (2000) when describing the

reality of SMEs' access to credit in the US market. The authors underlined one limit of the previous equilibrium CR models related to the absence of duration: an applicant who is denied a loan at time t is credit rationed. However, if lenders impose a great delay in the treatment of the application, CR may emerge in two forms: applicants that are waiting for a response may experience economic difficulties (the investment project is on standby), or other firms that anticipate this delay will be discouraged from applying. The expression "latent demand for bank debt" is then used by Freel *et al.* (2010) to characterize the group of non-applicant firms who need a loan. The theory of discouraged borrowers was subsequently formalized by Kon and Storey (2003). Contrary to previous equilibrium CR models, their model incorporated both the application costs for borrowers and imperfect screening by banks. The main results of the model are that the number of discouraged borrowers falls with increasing information, lower application costs and increasing alternative sources of funding.

Table 1 presents a summary of the existing CR classifications by differentiating between the supply-side and demand-size dimensions. Further focus should be placed on the potential empirical implications of these different types of CR. More precisely, the interest of this typology is to link the theoretical contributions related to CR with the strand of existing empirical studies devoted to the driving factors of CR. The next section is dedicated to this presentation of the empirical tests of CR, including its measures to its main driving factors.

Insert Table 1

3. Measures and determinants of CR

During recent decades, an increasing amount of empirical work has been dedicated to CR despite the fact that, paradoxically, measuring CR is difficult because it is not a directly observable variable. Thus, studies can be divided according to several criteria. A first criterion is the type of CR measure (3.1). A second criterion of distinction is the nature of the variables used to identify the determinants of CR. In section 2, we highlighted the evolution of the definition of CR from the supply side to supply-demand and pure demand approaches (discouraged borrowers). In this section, we present the studies based on CR: several studies have concentrated on the supply side, mainly focusing on the effects of loan contracts (3.2). Other studies have concentrated on the demand side, using variables that provide rich information about the creditworthiness of the borrower, the firms' characteristics (3.3) and the managers' characteristics (3.4). Lastly, the impact of the banking relationship on CR has been deeply analyzed as a primary factor of interaction between demand and supply (3.5).

3.1 Measures of CR

The empirical literature has used three different measures of CR (see Table 2). An indirect measure is provided by the disequilibrium CR approach. Another one relies on the use of proxies for CR. Finally, a direct measure is provided by the implementation of a data survey based on the diffusion of a questionnaire addressing the demand size (borrowers) and/or the supply side (banks).

A rich strand of literature has used the econometric method for estimating models of disequilibrium credit markets that was first developed by Fair and Jaffee (1972) and Maddala and Nelson (1974). The simplified model of Maddala and Nelson (1974) relies on three equations: demand and supply equations are estimated using a set of explanatory variables, and a subsequent transaction equation represents the amount of bank credit received by the borrowers. This methodology identifies the gap between supply and demand of credit using an appropriate maximum likelihood estimation procedure. Many empirical studies have used this methodology to measure CR in different countries and at certain periods in time (in this survey, we will only present the studies using this measure that focused on the determinants of CR). Prior studies (Gilchrist and Zakrajsek, 1995; Hoshi *et al.*, 1993) have separated firms exogenously into those that are more likely to be credit rationed and those that are less likely to be credit constrained, a priori. Various determinants, such as dividend policy, corporate structure, collateral or banking relationship, are used to identify the two groups. One problem is that those determinants do not allow firms to switch between the two groups over time, and as some of them depend on the firms' policy decisions, they are not suitable for the CR measures. Therefore, the selected studies presented in Table 2 use endogenous classification.

A second indirect measure of CR used in the empirical literature is a *proxy*. The type of CR assessed by *proxies* is rarely specified in the studies, but it appears to be pure CR via the denial of an application or size CR when the firm is quantity rationed. Trade credit is the first proxy of CR to be proposed by Petersen and Rajan (1994) and Harhoff and Korting (1998). The use of trade credit as a proxy for CR is supported by the *pecking order theory* (Myers and Majluf, 1984), which posits that the second financing source of investment projects after internal financing is bank financing. If firms are credit rationed by banks, then they will switch to alternative external sources of financing, such as trade credit even if they are among the most expensive (Elliehausen and Wolken, 1993). In such a framework, trade credit acts as a substitute for bank credit, and the volume of trade credit will be positively correlated with CR. An extensive use of trade credit suggests that the firm is potentially credit rationed. However, the use of trade credit as a *proxy* for CR remains controversial, and many firms that have easy access to bank loans use trade credit to reduce transaction costs (Ferris, 1981; Elliehausen and Wolken, 1993; Petersen and Rajan, 1994, 1997). In this context, an extensive use of trade credit does not mean that the firm is credit rationed. Cosci

and Meliciani (2002) proposed the utilization ratio of a credit line as another proxy for CR. This ratio is defined as the relationship between the amount of credit offered by banks and the amount used. The higher the ratio, the more an SME is rationed.

The third measure of CR is a direct measure based on a microeconomic approach: individual answers to a questionnaire are compiled and analyzed in survey data. What type of CR is measured by data surveys? The banks are reluctant to disclose the process that they use to grant loans. Both the scoring models and profitability implications of the financing remain confidential, and CR is a delicate topic. Thus, among the previously defined types of CR, the equilibrium CR models associated with the type III "redlining" have limited the testable implications. Jaffee and Stiglitz consider rightly that redlining is not really CR because "redlined borrowers cannot provide the bank its required rate of return". Conversely, the use of questionnaires (data survey) makes it possible to assess type II CR, type I CR and self CR. According to the previous typology, type II pure CR posits that the credit is denied even though the applicant borrower is ready to pay the price and non-price elements of the loan contracts. The questionnaire asks the firm if a credit application has been denied by the bank. Following Levenson and Willard (2000), some of the studies took the duration into account. CR is short term when the loan is initially denied but eventually granted; CR is long term when the loan is eventually denied. Even in the case of long-term CR, the process of negotiation is not captured by the questions (did the firm offer to pay a higher interest rate or give more collateral?). Thus, pure CR, as defined by the theory, is not measurable *per se*. Following Cieply and Dujardin (2010), the denial or refusal rate is the best proxy for pure CR. To summarize, the measures of CR used in data surveys are the following: first, the application rate (did they apply for credit); second, for applicants, the refusal rate when the credit is denied is a proxy for pure CR; third, the partial approval rate is a measure of size CR (when the granted credit is lower than the requested amount); finally, the rate of non-applicants that needed credit but feared a rejection is a measure of self CR.

Survey data first used public questionnaires. In the US market, a widely used questionnaire is the National Survey of Small Business Finance (NSSBF) inquiry, which was performed in 1987, 1993, 1998 and 2003 and addressed to more than 3,000 US firms, or the similar Credit Banks and Small Business Survey (CBSB), which was conducted in 2001 with 2 223 respondents. Outside the US, the Business Environment and Enterprise Performance Survey (BEEPS) was administrated to firms in 34 countries of Eastern Europe and Central Asia from 1999 to 2008, the World Business Environment Survey (WBES) was addressed to firms in 80 countries (from Asia, Europe, Latin America and Africa), and the World Bank Data Survey was dedicated to Asian countries. Specifically in Europe, the Capitalia survey was implemented in Italy, and the Biennial Survey of Small Business and the SMEs Survey of Enterprise were conducted in northern Britain in UK. Survey data also relied on private questionnaires, and henceforth the scope is restricted to one country: Italy, Argentina, Vietnam and/or to one type of firm: Dutch start-ups (Parker and Van Praag, 2006), microentrepreneurs in Ecuador (Baydas *et al.*, 1994)*.* Lastly, two data surveys focused on the

supply side by administrating a questionnaire to the bank's credit officers, represented by Lehmann and Neuberger, 2001 in the German market and Cosci and Meliciani, 2002 in the Italian market.

What is the reality of CR according to previous measures? The difference in techniques makes it difficult to compare the magnitude of CR between disequilibrium techniques, proxies or data surveys. Focusing on the "data survey" technique, if the questions dedicated to assessing the reality of CR are rather similar from one survey to another, the heterogeneity of the samples in terms of their size, location and the period of inquiry does not allow consistent comparisons. However, the reality of pure CR is highlighted by all the studies: the US studies that relied on NSSBF and CBSB provided a refusal rate between 15% and 33%, whereas the refusal rate appears to be lower in the BEEP study (7.6%) conducted in Europe and Asia, and it was higher in Asia (from 55.61% and 67.26%). All of these studies agreed on the reality and magnitude of self CR: discouraged borrowers appear to be a significant fringe of SMEs that need financing, with the self CR rate varying from 7.8% to 35%.

In addition to the magnitude of CR, the empirical studies also focused on its determinants using variables derived from the supply side and/or from the demand side. The next section surveys the determinants of CR from the supply side.

Insert Table 2

3.2 Supply-side determinants of CR

From a supply-side point of view, banks use different tools for CR. These tools were highlighted in section 2 and include increasing the price, *i.e.,* the quoted interest rate, and imposing non-price elements in loan contracts, such as shortening the maturity of the debt or requiring collateral. However, those elements are not treated equally in the empirical literature. The interest rate, debt maturity[3] and volume of granted/denied loans remain rather untested as determinants of CR in empirical studies that use the microeconomic approach to CR, possibly due to the difficulty of accessing these variables on an individual basis (confidentiality). Therefore, the studies that incorporate a supply-side dimension relied on disequilibrium models of CR, whereas this measure gives insufficient information regarding the determinants of CR. In addition, choosing the set of significant variables in the supply and demand equations is complex. For example, as pointed out by Sealey (1979) and Pruteanu (2004), some variables, such as the quoted interest rate, affect both the supply and demand of credit.

While many primary drivers of CR from the supply side remain rather unexplored, the impact of collateral on CR has been the topic of a more extensive body of empirical literature. Steijvers and Voordeckers (2009) provided a detailed literature review on the recent empirical research as a remedy for CR. Contrary to this survey, we propose to briefly present the studies according to the measure of CR and to actualize it.

A first strand of studies focused on the relationship between credit risk and the amount of collateral. These studies did not provide direct evidence for the link between CR and collateral. However, an indirect relationship between the borrower's credit quality and CR is assumed. According to the theoretical framework on collateral (2.3), high-risk borrowers will pledge more collateral than low-risk borrowers. Studies conducted by Lehmann and Neuberger (2001), Degryse and Van Cayseele (2000), Berger and Udell (1990) successfully tested the "sorting by private information" hypothesis of Besanko and Thakor (1987). Degryse and Van Cayseele (2000) used a private database from a large Belgian bank composed of a set of SMEs' granted loans over the period from 1995 to 1997. They obtained direct evidence for a negative link between the collateral amount and loan rate. Using a questionnaire addressed to German banks, Lehmann and Neuberger (2001) developed a Tobit estimation to determine the amount of collateral required. They found that low-risk borrowers are likely to pledge more collateral to signal their good quality. The same results are highlighted by Berger and Udell (1990), who used a dataset from the Federal Reserve's Survey of Terms of Bank Lending composed of 340 banks in the US between 1977 and 1988. Credit risk is measured by the risk premium in the interest rate of the loan. Their results showed that a high level of credit risk generated a higher amount of required collateral. From an empirical test with a sample consisting of 550,000 loans granted by Spanish banks between 1984 and 2002, Jiménez *et al.* (2006) identified variables affecting collateral requirements and found the same relationship, i.e., low-quality borrowers provide more collateral to obtain a loan. They tested the model of Boot *et al.* (1991) using a proxy of default risk. The bank knows the quality of the borrower *ex ante. Ex-ante* credit risk is determined by the variable ($DEFAULT_{t-1}$), which takes the value of 1 if the borrower had a loan in default in the previous year; otherwise, the value is 0. The link between this variable and the use of collateral allows one to dispel or confirm the sorting by the observed risk hypothesis. *Ex post* credit risk is defined by the variable ($DEFAULT_{t+1}$), which takes the value 1 if the loan defaults in the first year after being granted but not in t-1; otherwise, the value is 0. The empirical results showed that the use of collateral increased with ($DEFAULT_{t-1}$) and ($DEFAULT_{t+1}$) and confirmed that the observed risk hypothesis is the dominant mechanism for detecting borrowers who are at risk of default when the loan is issued.

A second strand of studies used the indirect measure of CR proposed by Maddala *et al.* (1974) to highlight the impact of collateral on credit availability. Ogawa and Suzuki (2000) and Shikimi (2011) in Japan, Atanasova and Wilson (2004) in the UK and Carbo-Valverde *et al.* (2009) in Spain used this approach to measure the supply and demand of

bank credit. The availability of bank loans supplied to firms is based mainly on the collateral extended. The second step was to classify firms as financially constrained or unconstrained. All of these studies found that collateral has a significant impact on CR. Using Japanese firm-level data, Ogawa and Suzuki (2000) showed that a 1-Yen increase in the land assets held by borrowers reduced the credit constraints by 1.3 Yen for the group firms[4] and by 0.68 Yen for the independent firms. Capital stock appears to be less significant than land assets, as 1 Yen of capital stock relieved the borrowing constraints by 0.39 Yen for the group firms and by 0.15 Yen for the independent firms. Similarly, Atanasova and Wilson (2004) reported that an increase of £1 raises the credit availability by £0.2193. Shikimi (2011) used data from small- and medium-sized Japanese firms over the period from 2000 to 2002 and highlighted that firms with more collateral obtained more credit and that these collaterals attenuated the credit constraints. In the same vein, Carbo-Valverde *et al.* (2009) observed that a 1% increase in collateral (measured by tangible fixed assets over total assets) increased the availability of loans by 0.45% based on 30897 Spanish SMEs over the period from 1994 to 2002.

In section 2, we highlighted the evolution in the definition of CR from a supply-side framework to a supply-demand-side approach. The next section is dedicated to the firms' characteristics as determinants of CR from the demand side.

3.3 Firms' characteristics and CR

In the empirical literature, three firm characteristics have been tested as potential determinants of CR, both for the credit applicants (size CR and pure CR) and the discouraged borrowers (self CR). These characteristics are firm size, firm age and firm credit risk.

3.3.1. Firm size

It is widely agreed that SMEs encounter greater difficulties than larger firms in the credit market. Firm size is commonly estimated by the total assets or net sales and, less recently, by employment. Some studies have taken the impact of size on CR into account. Petersen and Rajan (1994) observed that credit constraints become more severe as firm size (book value of assets) decreases because the effects of adverse selection and moral hazards are larger when the company is smaller. Using the NSSBF inquiry, Levenson and Willard (2000) found that the smallest SMEs are both more discouraged (self CR) and more rationed (pure CR and size CR) than other firms, using the total sales and the number of full-time employees as proxies for firm size. Contrary to previous studies, Bebczuk (2004) found no effect of firm size (net sales) on CR in Argentina, but his sample was only composed of SMEs; therefore, he could not conclude that financial discrimination took place. More recently, Hashi and Toci (2010) evaluated the determinants of both CR and self CR with a direct measure of CR provided by the BEEPS data survey. The determinants consist of firm characteristics, including firm age, size ownership and performance. Their study

demonstrated that SMEs are more discouraged than larger firms to apply for a loan (self CR) and have a higher probability of being denied credit (pure CR). In their investment decisions, small firms begin by looking at internal funds rather than relying on bank loans. By comparing large firms with SMEs in Italy, Agostino *et al.* (2008) found that larger firms (total assets) are less credit rationed than small firms because they have a lower risk level.

3.3.2. Firm age

Several empirical studies (Cole, 1998; Harhoff and Korting, 1998; Beck *et al.*, 2006; Hashi and Toci, 2010) have shown that CR decreases when the age of the firm increases for two primary reasons.

The first reason is the reduced amount of asymmetric information between the lender and borrower when the age of the firm increases. Young firms are the more financially constrained: the empirical results of Cole (1998) demonstrate that younger and smaller SMEs were the most likely to be denied credit in the NSSBF sample. The second reason is that the age is a reputation indicator, as pointed out by Harhoff and Korting (1998)**.** Start-ups and young companies have a recent reputation on financial markets, and therefore, banks lack time to obtain public information through the business lifecycle and to obtain private information through the lending relationship (Berger and Udell, 1995). More recently, Freel (2007) performed a postal survey on SMEs in the UK and pointed out that small innovative start-ups appeared to be more credit rationed.

Beck *et al.* (2006) employed a survey-based approach to determine the financing obstacles to firms using the World Business Environment survey (WBES) on 10,000 firms in 1999. They considered both firm and country characteristics and reported that size, age and ownership are the most valuable factors in distinguishing between financially constrained and unconstrained firms: older, larger and foreign-owned firms were less credit rationed. More specifically, firm age seemed to be the most powerful driver of CR in *developing countries*.

3.3.3. Credit risk indicators

The previous characteristics of firms—age and size—are not independent from the firms' level of credit risk. However, not all empirical studies have access to credit risk indicators, which are derived from credit default studies (following the seminal work of Altman, 1968 and 1984) and, more recently, from the Basel framework. This framework imposed capital requirements for financial institutions, leading banks to develop models based on internal ratings or to rely upon external credit assessment institutions, such as rating agencies. Contrary to a scoring method, a rating model is not only derived from financial variables; instead, it also includes qualitative indicators of default risk. These techniques aim to reduce asymmetric information and provide guidance to banks in evaluating borrowers. The reduction in information asymmetry between borrowers and

lenders is expected to have a positive effect on credit availability. Empirically, this interaction has been tested in few studies.

Berger *et al.* (2005) studied the bank's behavior from the supply side using the Small Business Credit Scoring (SBCS). Their sample contained a large US banking organization and approximately 300 other banks for the period from 1995 to 1997. The results of their regressions indicated that credit scoring increased lending to "marginal borrowers" that were informationally opaque. Frame *et al.* (2004) examined large banking organizations in the southeastern US and also confirmed that the use of a credit scoring technology increased credit availability for small business because it allowed the bank to decrease its underwriting costs. More recently, Becchetti *et al.* (2010) tested the impact of the score on both pure CR and price CR using the Capitalia data survey on Italian firms. In addition to the traditional determinants (age, size, accounting variables), the authors used credit score indicators derived from Altman (1968, 1984). Their results showed that the most credit-rationed firms had the lowest credit scores (high credit risk). However, when adding traditional determinants to the score in the model, they remained significant driving factors of CR.

Some previous studies have focused on applicant firms, but other studies have taken the credit score into account to measure self CR. These studies employed the Dun and Bradstreet (D&B) score and credit history as measures of credit quality. Coleman (2002), Han *et al.* (2009) and Chakravarty and Yilmazer (2009) used a direct measure of CR via the 1998 NSSBF and confirmed that self CR is positively related to the borrower's poor credit quality. In addition, Chakravarty and Yilmazer introduced the refusal rate (proxy for pure CR) and found that applicant firms with a high credit risk were more likely to be denied a loan.

In summary, the previous studies highlighted the primary role of credit risk indicators in both CR for applicant firms and self CR. However, even if the firm has a high credit risk, the bank will not systematically deny credit to the applicant firm if it trusts the business model of the firm's manager. The following section is devoted to the relationship between managers' characteristics and CR.

3.4 Managers' characteristics and CR

For many SMEs, the manager of the firm is also the controlling shareholder, i.e., the owner. Therefore, when the manager is also the owner of the firm, the bank will pay more attention to his personal characteristics as components of his reputation. Empirical studies conducted in developed countries have used personal characteristic of the firm's owner-manager as a measure of its reputation and credibility. The tested characteristics of the owner-manager include age, professional experience, educational level, race, ethnicity, gender and credit quality. In some countries (for example, in France), race or ethnicity do not affect credit decisions, while there is abundant evidence that they do in the US and the

UK. A possible explanation is that ethnicity statistics have been at the center of controversies and have been prohibited by law (French case).

Becker (1957) defines financial discrimination as over-charging loan rates to the discriminated minority. According to Storey (2004), non-economic discrimination occurs when the distribution of loans is influenced by factors that are irrelevant to the transaction, especially when these factors are not correlated with indicators of credit risk. As pointed out by Marlow and Patton (2005), non-economic discrimination regarding the lending decision is difficult to prove due to the existing interference with other possible determinants of CR.

The ethnic minority discrimination thesis is supported by Cavalluzzo and Cavalluzzo (1998), Coleman (2003), Blanchflower *et al.* (2003) and Park and Coleman (2009). Cavalluzzo and Cavalluzzo (1998) tested the existence of non-economic discrimination in market credit regarding gender and ethnicity (1987 NSSBF). They found that (1) businesses owned by Blacks and Hispanics are more likely to be denied credit than businesses owned by Whites and that (2) even after controlling for differences in firm and other owner characteristics, Asians and Hispanics pay higher interest rates than other groups. Coleman (2003) demonstrated that Black-owned firms are less likely to apply for credit because they are expected to be denied (self CR) and that in general, minority-owned firms are less likely to be financed (size or pure CR). Park and Coleman (2009) also documented the existence of non-financial discrimination against minority-owned firms, especially black-owned firms. However, the higher CR could be due to credit risk, as Coleman (2003) also provided evidence that Black- and Hispanic-owned firms were more likely to have poor credit histories and significantly higher credit risk than others. Blanchflower *et al.* (2003) found that African-American owners paid higher interest rates than others, even if they had good credit.

A second non-economic discriminating criterion is gender. Buttner and Rosen (1988) studied the impact of gender discrimination on CR. The distinctive feature of this study is the direct measure of CR from the supply side. A questionnaire was addressed to 106 loan officers based on the following human characteristics or attributes: leadership, autonomy, propensity to take risks, readiness for change, endurance, lack of emotionalism, low need for support, low conformity and persuasiveness. In sum, the answers showed that loan officers are more confident in male business owners because they perceive women entrepreneurs to be less successful than men. Several empirical studies have investigated gender as a determinant of CR using a data survey from the demand side, and they compared the results. In the US, Cavalluzzo and Cavalluzzo (1998) used the NSSBF 1998 inquiry and reported no difference in refusal rates, no difference in application rates and no financial discrimination between men and women. Coleman (2003) also rejected the existence of discrimination against female entrepreneurs but pointed out that financed female owners had more restrictive loan covenants. Cavalluzzo *et al.* (2002) used the NSSBF 1993 inquiry and found evidence of higher CR (refusal rate) for women applicants and higher self CR

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among women (discouraged female borrowers). However, for the granted loans, they found no evidence of financial discrimination regarding the interest rate. In Europe, Muravyev *et al.* (2009) reported a higher refusal rate for female applicants, but contrary to the US study, their results suggested financial discrimination as a factor in the granted loans (the quoted interest rate was 0.6 points higher for females than males). Lastly, Blanchflower *et al.* (2003) and Zimmerman-Treichel and Scott (2006) used the CBSB 1987, 1995 and 2001 inquiry attempted to control for gender discrimination by using the Dunn and Bradstreet score as a direct measure of credit risk. They found no evidence that gender could affect CR.

Regarding the educational level of the manager, a positive relationship with credit availability (and thus a negative relation with CR) is expected. Highly educated managers are supposed to reduce the asymmetry of information by providing clearer and more detailed financial information and business plans to their banks compared with managers with a lower level of education. However, similar to the results for gender, the results of empirical studies are inconsistent. Krasniqi (2010) found a positive relationship between educational level and credit approval for Kosovan SMEs. More precisely, Parker and Van Praag (2006) provide evidence that each additional year of schooling decreased the capital constraints by 1.18 percentage points for 461 Dutch start-ups. Conversely, Hartarska and Gonzalez-Vega (2006) found no empirical evidence for this relationship, while Rand (2007) found an opposite relationship, i.e., a negative effect of education on credit availability for a sample of Vietnamese firms. For this author, highly educated managers are more likely to anticipate a possible rejection, so they might belong to the fraction of self CR borrowers. Baydas *et al.* (1994) conducted a survey among microenterprises in Ecuador in 1990 to test the effect of human capital on CR. In addition to educational level, the professional experience and the age of the manager were included. The results confirm the findings of Rand (2007): highly educated managers were more likely to be discouraged borrowers. When applying for loans, these managers also had a higher probability of being size rationed than being pure rationed. The study of Baydas *et al.* (1994) also showed that highly experienced entrepreneurs were more likely to be size rationed or discouraged. However, the age of the entrepreneur is insignificant. If the impact of education on CR is ambiguous, Coleman (2002) revealed that the age of the manager plays a role. According to the results, young entrepreneurs are more likely to apply for a loan, and this may be explained by their low aversion to risk or by a greater growth orientation.

Freel *et al.* (2010) investigated the characteristics affecting self CR and discouraged borrowers in greater depth using the traditional characteristics of the firm (age, size, industry sector) and more original characteristics of the manager. In addition to the age of the owner, his or her gender and education level, the link between his or her personal wealth invested in the business and the strategy focus (innovation, quality and cost) were tested. The data were drawn from the 2005 Biennial Survey of Small Business in the UK. Their results revealed the impact of family ownership and gender on the nature of CR: self CR firms, compared to pure CR firms, were non-family owned or female-owned. In addition,

managers in self CR firms tend to be higher educated and professionally experienced. However, these variables were no longer significant when the authors compared self CR firms to non CR firms, and it should be noted that these variables were no longer significant.

In sum, the studies focusing on the manager's characteristics report less consistent results than those focused on the firm's characteristics. Lastly, determinants of CR cannot be provided only by the demand side's characteristics but must also take the interaction between the supply and demand of credit into account. The next section is devoted to studies that explored the impact of the banking relationship on CR.

3.5 Relationship between lending and CR

The bank-firm relationship is the primary method by which the bank gathers information about a borrower, reducing the amount of asymmetric information. As a consequence, a significant correlation is expected between the bank-firm relationship and credit availability. Boot (2000) surveyed the theoretical insights associated with the banking relationship and provided the following definition: "*the provision of financial services by a financial intermediary that i) invests in the acquisition of customer-specific information, often propriety information, and ii) evaluates the profitability of its investments through multiple interactions with the same customer over time and/or across products*". Another definition is provided by Elsas (2005): relationship lending is "*a long-term contract implicit between a bank and the debtor. The bank will therefore search private information about borrower through cyclical relationships*". Based on these definitions, the banking relationship is a form of "soft" information, in contrast with hard information (Petersen, 2004). Soft information is qualitative in nature, whereas hard information is purely quantitative, derived from financial reports. Hard information is available to any agent in the credit market, whereas soft information is subject to confidentiality requirements. Thus, firms will supply unobserved information to banks more easily than to financial markets (Bhattacharya and Chiesa, 1995). In addition, differences in the expertise of banks may lead to different interpretations and different loan policies. Many empirical studies that have been performed since the 1990s have tested the association between the bank relationship and CR and found inconsistent results. Three proxies (see Table 3) have been used to determine the strength of the banking relationship: the duration of the bank-firm relationship (3.5.1), the concentration of the lenders (3.5.2) and the scope of the relationship (3.5.3).

3.5.1. Duration of the banking relationship and CR

Empirical studies have tested the assumption that an increase in the duration of the banking relationship will reduce CR. A longer relationship is supposed to increase bank monitoring and reduce asymmetric information between the lender and borrower: hence, a longer duration allows for a better assessment of the borrower's credit quality. Petersen and Rajan (1994), Elsas and Krahnen (1998), Lehmann and Neuberger (2001), Akhavein *et al.* (2004) successfully tested this assumption. Angelini *et al.* (1998) and Cole (1998) refined the analysis by distinguishing between a short-term banking relationship (defined as a relationship where the duration is less than 3 years) and a long-term relationship (the duration is greater than 3 years). They found that duration is a determinant of CR for firms with a short-term banking relationship but not for firms with a long-term relationship. Cole (1998) also demonstrated that beyond the first year, duration has no effect on credit availability. These studies concluded that banks capture private information at the outset of the lending relationship, but above a certain threshold (one year for Cole and 3 years for Angelini *et al.*), the length of the relationship does not provide any new added value for the bank. This result is of course debatable, particularly regarding Cole's result, which is constrained by the very short duration of the relationship.

3.5.2. Multiple banking relationships and CR

The second factor that seems to affect credit availability is the existence of multiple banking relationships. From a theoretical standpoint, this phenomenon has two opposite effects on the availability of credit to borrowers. According to the *Single-Bank Firm-Opacity Hypothesis* (Thakor, 1996; Berger *et al.*, 2001)**,** multiple banking relationships increase CR, in contrast to the *Multiple-Bank Bank-Distress Hypothesis*, which claims that the use of multiple lenders reduces CR (Detriagache *et al.*, 2000)

Thakor (1996) supports the *Single-Bank Firm-Opacity Hypothesis*. In a competitive situation, multiple banking relationships are a double-edged sword for the borrower. On the one hand, a borrower with high credit quality will apply to several banks to increase the probability of being identified as a good borrower and not being subjected to CR. On the other hand, the bank decides whether or not to screen the borrower. Screening fees are costly and irrecoverable if the borrower chooses another bank as the lending bank. Thus, the bank will have less incentive to screen borrowers because the probability of recovering the fees is lower than in a monopoly situation. This probability of screening decreases when the number of banks approached by the borrower increases. Finally, the model shows that CR occurs for unscreened borrowers because banks have less incentive to screen the borrower in the presence of multiple banking relationships.

The majority of previous empirical studies support this theoretical finding**:** borrowers with single or fewer banking relationships appear to be less likely to experience CR (e.g.

Petersen and Rajan, 1994; Harhoff and Korting, 1998; Angelini *et al.*, 1998; Cole, 1998; Machauer and Weber, 2000; Jiangli *et al.*, 2004). These studies attribute the positive effect of having a single (or fewer) banking relationship(s) on credit availability to the theory that private information about a firm generated by a financial institution is less valuable when the firm has multiple sources of financial services,[5] and they support the idea that additional information about a borrower will reduce the adverse selection problem during a crisis period. Machauer and Weber (2000) also found that the proportion of loans granted by the principal bank was higher for firms with 1 to 3 banks than for those with more than 3 banks.

Detragiache *et al.* (2000) have developed an alternative theoretical model based on the *Multiple-Bank- Bank-Distress Hypothesis.* Their model addresses the specific context of refinancing an investment project. At the initial stage, the borrower is granted a loan by his single bank. At the intermediate stage, he needs more financing to refinance his profitable project. In a credit crunch, the single bank faces a risk of illiquidity (Diamond, 1991 defines it as the risk that an illiquid but solvent borrower is unable to refinance an investment project) and may be reluctant to refinance the project despite the creditworthiness of the borrower. Thus, at the time of refinancing, the borrower, who is subjected to CR by his single bank, seeks financing by approaching non-relationship banks. An adverse selection problem appears because these uninformed banks question the project's creditworthiness. If the adverse selection problem is strong, the borrower will be subjected to CR and unable to refinance his project. If the adverse selection problem is weak, multiple banking relationships increase the probability that at least one informed bank will be able to refinance the project, reducing the likelihood of the investment project being prematurely liquidated. The borrower will be able to refinance the debt from the non-relationship bank by providing an additional risk premium. In sum, when the adverse selection is strong, multiple banking can reduce CR and the probability of an early liquidation of the project caused by the illiquidity problem of the single bank. Empirically, Detriagache *et al.* tested the determinants of multiple banking relationships on a sample of more than 4 000 Italian SMEs. They used two proxies for bank fragility: liquidity shocks and nonperforming loans. By definition, a bank that is deemed financially weak encounters problems with ensuring refinancing investment. The empirical evidence suggests that bank fragility is associated with a larger number of relationships. Cosci and Meliciani (2002) also successfully tested the *Multiple-Bank- Bank-Distress Hypothesis.* They used the utilization ratio (this ratio compares the amount of credit used to the amount of credit available for the firm) as a proxy of CR and found that high-multiple-banking firms (more than 7 banks) have a lower utilization ratio and are thus less subjected to CR.

Jiangli *et al.* (2004) tested the two models (single bank and multiple bank) and found that the benefit of a single bank relationship varied among the sample countries (i.e., Indonesia, Philippines, Korea, Thailand). Although, this relationship had no impact on CR in Indonesia, the use of a lower number of lenders had a positive effect on credit availability in Korea and Thailand. In contrast, Philippine firms received an advantage when dealing with

multiple banks to increase credit availability, as predicted by Detragiache *et al.* (2000). However, the authors explained this result differently. Jiangli *et al.* (2004) attributed this result to the state of the economy and banking sector during a macro crisis and considered that multiple lending relationships will benefit credit availability only when the banking system is healthy and well capitalized (the case of the Philippines). In contrast, Detriagache *et al.* (2000) revealed that a multiplicity of creditors provides an advantage in periods of credit crunch.

3.5.3. Scope of the banking relationship

The last dimension of the banking relationship is assessed by the scope, which is defined by all of the financial services obtained from one bank. These services include cash management, foreign exchange services, check clearing and deposits and investment activities (Harker and Zenios, 2000). The scope of the banking relationship is supposed to increase credit availability by reducing the asymmetry of information between the firm and the bank. Indeed, valuable information can be extracted by the bank from savings accounts and from the characteristics of the financial services provided to its customer. According to empirical evidence, financial services offered by a principal bank provide a more accurate view of a firm's creditworthiness (e.g., Petersen and Rajan, 1994; Cole, 1998; Berlin and Mester, 1998). However, the scope of the banking relationship is not widely used in empirical studies as a key determinant of the strength of the relationship when compared with duration or single/multiple banking relationships.

Insert Table 3

4. Conclusions and research avenues

The purpose of this survey was to improve our understanding of the link between the rich theoretical framework on CR and the various strands of empirical studies seeking to understand the determinants of CR. More specifically, the first part of this survey provides a synthesis of the theoretical framework based on a typology of CR. Then, the second part identifies the measures of CR used in the empirical studies and which type of CR is measured, according to the typology. In addition, a set of driving factors of CR is analyzed, following the historical approach of CR, from a supply-side to a demand-side perspective.

This review provides several interesting insights into the connections—and disconnections—between the CR theories and the empirical tests of CR. With regard to the measurement of CR, the disequilibrium theory, which is the oldest theory, remains highly relevant in terms of the empirical studies. A recent and growing strand of literature has used Maddala and Nelson's methodology to analyze both the magnitude of CR and its determinants in different countries. Second, we considered the development of survey data to provide a direct measure of CR. This direct measure is necessary to test the different

types of CR derived from the microeconomic equilibrium CR theory, especially Keeton's types (CR I and II) and Levenson and Willard's self CR. An interesting research direction for future empirical works is the measure of the "divergent views CR" defined by Jaffee and Stiglitz (1990). Surveys addressed to both a bank and its customers would allow for a comparison of the perception of credit risk, which the studies cite as one primary determinant of CR. Lastly, if the credit risk is assumed to be a primary driver for CR in both theoretical and empirical studies, then profitability (return on equity or assets) is rarely included in empirical studies. Thus, even if "redlining" is not considered to be a form of CR, we are left with the question of the link between CR and the profitability of the borrower given the fact that the profitability of the project is a recurrent variable in equilibrium CR models. This subject has promising testable implications.

Looking at the determinants of CR, the empirical literature review highlighted the growing trend of empirical studies towards a more refined analysis of the demand-size characteristics. First, given the difficulty of accessing confidential data about the quoted interest rate, studies have relied upon proxies or direct measures of borrowers' credit risk to asses both CR for applicant firms and self CR. One strand of recent studies includes scores and a detailed estimate of the probability of default, consistent with the implementation of the Basel reform. Beyond the pure economic dimension of credit risk, another strand of studies is devoted to the impact of the manager's personal characteristics on CR, ranging from gender and education to more behavioral considerations. However, these empirical tests provided inconsistent results. We suggest three important research avenues regarding the search for the determinants of CR. First, corporate governance literature suggests that the risk aversion of the manager is linked to the shareholder base of the firm: more precisely, when a firm is owned by its managers, a strong risk aversion of the owner-manager could lead him to more self CR. A more detailed analysis of the shareholder structure of both applicant and discouraged firms could shed some new light on the demand-side characteristics of CR. Second, the supply-side analysis of CR should be improved through the implementation of survey data addressed to banks: the quoted interest rate, the type of collaterals or maturity of the debt and the impact of CR lack empirical tests. Lastly, we suggest the use of case studies to provide more depth on the interesting concept of the scope of the banking relationship.

Notes

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[1] Access to finance, Analytical report performed by the Directorate General for Enterprise and Industry of the European Commission (9063 interviewed SMEs), September 2009.

[2] The term redlining originally referred to the cross-hatched maps used by urban mortgage lenders to designate neighborhoods in which they would not lend (Jaffe and Stiglitz, 1990).

[3] To our knowledge, one study examined the impact of debt maturity on CR using Maddala and Nelson's (1974) indirect measure. Steijvers (2004) estimated the disequilibrium model of 2698 Belgian SMEs for the period from 1993 to 2001, making a distinction between long-term and short-term CR. Both long-term and short-term CR affect SMEs that offer less collateral than non-CR firms. However, long-term CR is only insignificantly higher than short-term CR (53.43% of Belgian SMEs are long-term credit rationed, and 52.67% are short-term credit rationed).

[4] The "group firms" are defined as those that were affiliated with six major bank-centered industrial group in 1994.

[5] This finding was only confirmed when Cole introduced two measures of firm size as control variables in his regression.

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Table 1 - Typologies and definition of credit rationing (CR)

Type of CR	Typology and seminal paper	Supply side	Demand size and asymmetry of information hypotheses	Definition
Disequilibrium CR	Roosa (1951) Availability theory	Restrictive monetary policy	Not included	Credit availability is determined by the supply conditions and real economic activity
Size CR (weak CR)	Type I Keeton (1979)	Price = the quoted interest rate is rigid, i.e., unique	Population: applicant borrowers Probability of default of the borrowers is not observable by the lenders	Borrowers want to pay the price and are size rationed → they receive a smaller loan than the amount that they applied for
Price CR (Interest rate CR)	Type I Jaffee and Stiglitz (1990)	Price is flexible		Borrowers want to pay the price and are size rationed → they receive a smaller loan than the amount that they applied for → if they want a larger loan, they have to pay a higher price
Pure CR (strong CR)	Stiglitz and Weiss (1981) Type II Keeton (1979) Type IV Jaffee and Stiglitz (1990)	Non-monotonic backward-bending curve based on - price element: the quoted interest rate is rigid - non-price elements in loan contracts	Return of the investment project is observable by the lenders	Some borrowers are fully financed, and some are credit rationed, even if they are willing to pay a higher price and accept the non-price elements (loan contracts) → a borrower is rationed, whereas an apparently identical borrower is financed.

			Population: applicant borrowers	Some individuals cannot borrow at the price that they consider appropriate based on what they perceive to be their probability of default"
Divergent views CR	Type II Jaffee and Stiglitz (1990)		Probability of default of the borrowers is not observable by the lenders	→ Some "good" firms will not apply because the quoted interest rate is too high
			Return of the investment project is observable by the lenders	
Redlining	Type III Jaffee and Stiglitz (1990)	Price is flexible	Population: applicant borrowers Probability of default of the borrowers is observable by the lenders Return of the investment project is observable by the lenders	The borrower is credit rationed when the lender cannot obtain its required return at any price → CR based on the observance of the risk-return relation
Self CR	Levenson and Willard (2000)	Not included	Population: applicant AND non-applicant borrowers	Some firms will not apply for credit because they anticipate a rejection

| | Kon and Storey (2003) | | Inclusion of application costs undertaken by borrowers

Imperfect screening process: the bank can imperfectly distinguish good firms from bad firms by using observable characteristics of the applicants (included their probability of default) | |

Table 2 - Measures of credit rationing

Measure of CR	Study	Sample, country period test and data sources	CR-type	Model	Results
Disequilibrium model	Ogawa and Suzuki (2000)	517 firms from the database of Japan Development Bank, 1980-1993	Disequilibrium CR	Disequilibrium model of corporate bank lending	Not available
Disequilibrium model	Atanasova and Wilson (2004)	639 UK SMEs from Dun and Bradstreet International, 1989-1999	Disequilibrium CR	Disequilibrium model of corporate bank lending	Disequilibrium CR: 47.9% of the firms during the recession years of 1991 and 1992; only 35.1%-41.5% during the period from 1993-1999.
Disequilibrium model	Carbo-Valverde *et al.* (2009)	30 897 Spanish SMEs from the Bureau-Van-Dijk Amadeus database, 1994-2002	Disequilibrium CR	Disequilibrium model of corporate bank lending. Information hypothesis vs. market power hypothesis	Disequilibrium CR: 33.9%
Disequilibrium model	Shikimi (2011)	74 367 SMEs from the JADE (Japanese Accounts and Data on Enterprises), 2000-2002	Disequilibrium CR	Disequilibrium model of corporate bank lending	Not available
CR proxy	Petersen and Rajan (1994)	3404 SMEs in the USA (1987 NSSBF)	Pure CR	Trade credit: % of delayed payment on	% of credit rationed firms by business sector : - retail: 12.8%

				more than 50% of the trade credit	- mining: 23.1% - construction: 22.5% - manufacturing: 24.6% - wholesale trade: 19.8% - utilities and transportation: 0% - insurance and real estate: 15% - services: 12%
CR proxy	Harhoff and Korting (1998)	994 German SMEs, 1997	Pure CR	Proxy for non CR: fast payment discounts taken as a share of fast payment discounts offered to the firm	64.13% of non-credit rationed firms % of credit rationed firms by number of lenders: - > 2: 15.21% - 2: 11.61% - 1: 11.01%
CR proxy	Machauer and Weber (2000)	260 German SMEs, credit files from 6 major banks, 1992-1996	Pure CR	Credit line ratio: (credit lines/total assets)	Not available
CR proxy	Cosci and Meliciani (2002)	393 Italian firms, mostly SMEs, data from one Italian large bank, 1997	Pure CR	Utilization ratio of the credit line: (amount of credit used/amount granted)	CR proxy (utilization ratio) by number of lenders: > 7: 0.68 < 7: 1.55
CR proxy	Park and Coleman (2009)	NSSBF 2003 (conducted in 2004 and 2005)	Pure CR	Proxy for credit supply: line of credit granted	Not available

				Proxy for credit demand: amount of credit used	
Public survey	Cavalluzzo and Cavalluzzo (1998)		Pure CR Short-term CR (initially denied and eventually obtained) vs. long-term CR (eventually denied)	Creditworthiness is unobservable Equation using Maddala's model Last loan and last period (1 year)	3 103 SMEs 616 applicants Pure CR rate for applicants: global 33.4% of which were short-term CR (22.1%) and long-term CR (11.1%)
Public survey	Levenson and Willard (2000)	NSSBF* 1987 (conducted in 1988-1989) 3 404 US SMEs**	Pure CR Size CR Self CR (estimation) Distinction between short-term and long-term CR	Last loan and last period (1 year)	3 404 SMEs 721 applicants Pure and size CR rates for applicants: global 20.3% of which were short-term CR (10.2%) and long-term CR (10.2%) Estimation of self CR rate: 4.22%
Public survey	Cole (1998)	NSSBF 1993 (conducted in 1994-1995) 5 353 US SMEs	Pure CR Size CR	Last loan Proxies for bank relationship	2 007 applicants Pure and size CR rate for applicants: 15.5%
Public survey	Cavalluzzo et al. (2002)		Pure CR	Creditworthiness is included via the	Pure CR rate for applicants: - on the last loan: 18.45%

				Dunn and Bradstreet score Last loan and last period (within 3 previous years)	- on the period: 28.7%
Public survey	Blanchflower *et al.* (2003)	NSSBF 1993 and NSSBF 1998	Pure CR	Creditworthiness is included via the Dunn and Bradstreet score Last period (1 year)	Pure CR rate for applicants: - 28.7% in 1993 - 26% in 1998
Public survey	Coleman (2003)		Pure CR Self CR	Last period	
Public survey	Han *et al.* (2009)	NSSBF 1998 (conducted in 1999 and 2000) 3 561 US SMEs	Self CR	Creditworthiness is included via the Dunn and Bradstreet score Last period (1 year)	1 449 SMEs needing credit - 926 applicants - 500 discouraged Pure CR rate: 26% for applicants Self CR rate: 34%
Public survey	Chakravarty *et al.* (2009)	NSSBF 1998 (compared with 1993 and 2003)	Pure CR Self CR	Proxies of bank relationship are included Last period (3 years)	
Public survey	Agostino *et al.* (2008)	4005 Italian firms Capitalia survey 1997, 2000, 2003	Pure CR		Pure CR rate: 8% for applicants
Public survey	Zimmerman-	1921 US SMEs in	Pure CR	Last loan	Pure CR rate: between 22.5% (1987) and 20.2%

	Treichel and Scott (2006)	1987, 3642 in 1995 and 2223 in 2001, CBSB**** survey			(1995 and 2001)
Public survey	Muravyev et al. (2009) Hashi and Toci (2010)	5 534 SMEs BEEPS***2005 34 countries from Europe and Asia	Pure CR Self CR	Last loans Long-term approach (loan eventually approved or denied)	3243 SMEs needing credit Pure CR rate: 7.6% of the 2 042 applicants Self CR rate: 37% of 3243 firms
Public survey	Freel (2007)	256 UK SMEs Survey of Enterprise in Northern Britain, 1998-2001.	Size CR	Analysis of variance	Not available
Public survey	Freel et al. (2010)	10 942 UK SMEs Biennial survey of small business by FSA (Federation of Small Business Administration), 2005	Self CR	Last period (2 years)	5 204 SMEs needing credit Self CR rate: 17.1%
Public survey	Becchetti et al. (2010)	3 840 Italian firms Capitalia survey, 1992, 1997, 2000	Pure CR Price CR	One year (2000)	3853 observations Pure CR rate: 4.62% Price CR rate: 1.97%
Public survey	Jiangli et al. 2004	697 Indonesian firms, 849 Korean	Pure CR		Pure CR rate for applicants: 55.61% for Thailand, 52.97% for Korea, 55.96% for Philippines, 67.26% for Indonesia

		firms, 550 Philippine firms and 633 Thai firms, World bank data Survey, 1998			
Public survey	Krasniqi (2010)	600 Kosovian SMEs, Riinvest Institute for Development Research's survey, 2006	Pure CR		Pure CR rate: 17.4% for applicants
Private survey	Angelini *et al.* (1998)	1858 Italian SMEs, 1995	Pure CR Self CR		Self CR rate: 7.4% Pure CR rate: 2.6% of firms failed to obtain additional credit
Private survey	Baydas *et al.* (1994)	601 microentrepreneurs in Ecuador, 1990	Pure CR Size CR Self CR	2 groups of entrepreneurs: the beneficiaries group represents entrepreneurs who received assistance from a formal institution program, and the control group consists of entrepreneurs who applied for a loan without any type of	Pure CR rate: 18.1% for the beneficiaries group and 10.4% for the control group Size CR rate: 30.6% for the beneficiaries group and 5.9% for the control group Self CR rate: 32.4% for the beneficiaries group and 79.8% for the control group

					special assistance	
Private survey	Lehmann and Neuberger (2001)	389 SMEs in Germany (1997 Survey)	Pure CR	Credit approval	Not available	
Private survey	Bebczuk (2004)	665 Argentine SMEs, 1998	Pure CR Self CR		Pure CR rate for applicants: 8.8% Self CR rate: 29.5%	
Private survey	Parker and Van Praag (2006)	461 Dutch start-up, 1995	Size CR	OLS	Not available	
Private survey	Rand (2007)	1106 Vietnamese firms, 2002	Self CR Pure CR		Pure CR rate: 14% Self CR rate: 25%	

*NSSBF: National Survey of Small Business Finance

**SME: Small Business Enterprise: < 500 employees according to the definition provided by the Small Business Administration

*** BEEPS: Business Environment and Enterprise Performance Survey performed jointly by World Bank and ERBD

**** CBSB: Credit, Banks and Small Business Survey

Table 3- Bank relationship and credit rationing (CR).

Study	Duration in years	Impact of relationship on credit rationing CR		
		Duration	Scope	Concentration
Petersen and Rajan (1994)	10.8	The duration decreases CR	The scope decreases CR	Multiple bank relationships increases CR
Cole (1998)	7.03	After the first year, the duration has no effect on CR	The scope decreases CR	Multiple bank relationships increases CR
Angelini *et al.* (1998)	14	Beyond 3 years of the banking relationship, the duration has no effect on CR	n/a	Concentrated relationship decreases CR
Cosci and Meliciani (2002)	n/a	n/a	n/a	Multiple bank relationships decreases CR
Lehmann and Neuberger (2001)	4.8	The duration decreases CR	n/a	n/a
Harhoff and Korting (1998)	12	No impact	n/a	Multiple bank relationships increases CR
Machauer and Weber (2000)	n/a	n/a	n/a	Concentrated relationship decreases CR