CREDIT RATIONING FOR SME'S IN THE CORPORATE BANK LOAN MARKET OF A BANK-BASED ECONOMY

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ABSTRACT

Credit rationing is by many Keynesian economists nowadays seen as one of the most important examples of market failure in a modern capitalistic economy. Credit rationing occurs if in equilibrium the demand for loans exceeds the supply at the ruling price (interest rate). Since SMEs in a bank-based financial system like Belgium, heavily rely on bank finance, this restricted access to bank finance could have a negative effect on the investment in new profitable projects and growth of the economy.
We study the empirical significance of credit rationing for SMEs in a Belgian context by means of an extensive panel data set consisting of 2.698 SMEs reporting data over the period 1993-2001. The novelty of our research is twofold. First, we make the distinction between credit rationing for long and short term bank debt, of which the relevance was suggested in a theoretical model by Das (2004). Second, in contrast to the numerous previous studies, pioneered by Fazzari et al. (1988), we opt for an endogenous classification into 'credit rationed' and 'non credit rationed' firms, allowing for switching between both groups throughout time.
Our results, based on an instrumental variable technique being 3SLS, suggest that, over the entire period, more than 50% of the Belgian SMEs are credit rationed. In most years, long term bank debt is being slightly more rationed than short term bank debt, except in 2001. The results reveal that credit rationed firms for short term bank debt are smaller, faster growing firms with less financial strength and much less current assets to offer as collateral. For long term bank debt, credit rationed firms are in general smaller and younger, low growth firms with low cash flow to assets ratios and much less tangible assets to offer as collateral even though they have a higher added value and return on assets ratio than unconstrained firms. We can conclude from both analyses that constrained Belgian SMEs can be mainly characterized as young, small SMEs with little internal financial resources and a lack of assets to guarantee the repayment of debt.

EFM classification codes: 140; 800

1. INTRODUCTION

If all firms would have equal access to capital markets, the financial structure of any firm would not have any effect on the investment decisions. Firms can costlessly substitute external funds for internal capital. Under this assumption of perfect capital markets, investment decisions are made independently of the financial condition of the firm (Modigliani en Miller 1958). The assumption of perfect capital markets is however not applicable to reality, since it is no longer assumed that external and internal capital can be costlessly substituted. According to Fazzari et al. (1988), the assumption of perfect capital markets is certainly not relevant for small firms. For those firms, external capital is not a perfect substitute for internal funds due to information asymmetry.

The majority of firms in Belgium consists of SMEs. Their importance for the economy is substantial. In order to ensure their continuity and realise growth, SMEs need to acquire the necessary financial resources. For SMEs, there is a tendency to adopt labour intensive techniques which involve mainly a large proportion of variable instead of fixed operating costs. This causes a lower operation leverage which reduces the effect of a change in sales on earnings before interest and taxes and thus reduces the variability in earnings and reduces the risk to pay back their debt. From an optimal financing point of view, these firms should rely more heavily on bank debt (Hutchinson 1995). Moreover, when external sources are needed, these small firms have to rely mainly on bank finance since collecting money on the public capital market is no option for SMEs, set up in the Belgian bank-based financial system (Bhattacharya and Thakor 1993, Berger and Udell 2002).

This heavy reliance on banks could have negative consequences for some firms, that can not (no longer) get the necessary finance to keep their firm going or to invest in new projects in order to grow. Credit rationing is by many Keynesian economists nowadays seen as one of the most important examples of market failure in a modern capitalistic economy. Credit rationing occurs if the demand for loans exceeds the supply at the ruling price (interest rate). We would expect that an excess demand for debt would cause the opportunistic suppliers to increase the price, until quantity demanded equals quantity supplied. In reality, this mechanism isn't always working and consequently there are firms coping with credit rationing. Credit rationing can be of great practical importance when reduced bank debt supply for certain firms would reduce their financial resources and prevent the execution of profitable investment projects. Moreover, the impact of financing constraints on investment behaviour tends to increase systematically as firm

size decreases. Audretsch and Elston (2002) find in their study based on German SMEs that smaller firms tend to be more vulnerable to financing constraints than their larger counterparts. Often there is made an implicit assumption that firms act in a neo-classical manner, with a desire to invest in all available projects with a positive discounted net cash flow. Consequently, imperfections in the supply of finance, for example by financial institutions, tend to be highlighted as a contributory cause of any small firm sector tendency to invest sub-optimally, exhibit slower than average growth or experience higher than average bankruptcy rates (Hutchinson 1995). It would be more correct to involve supply for as well as demand for finance in casu bank finance in this discussion, as will be done in the current paper.

Despite the large body of theoretical literature concerning credit rationing, there is little consensus about the economical significance of this phenomenon since the empirical research in this domain is scant. This study is an attempt to fill this gap and empirically investigate the existence of credit rationing for SMEs in the Belgian corporate bank loan market, by estimating the demand-supply disequilibrium model for bank debt and deriving by means of this model, the proportion of credit rationed firms. The model is estimated based on a panel data set of small and medium sized Belgian firms for the period 1993-2001. The novelty of our study is twofold. In this study, we separate firms *endogenously* which is an improvement over previous research using mainly proxies to identify the firms which 'would be expected a priori' to be credit rationed (e.g. Fazzari et al. 1988, Hoshi et al. 1991, Berger and Udell 1992, Petersen and Rajan 1994, Gertler and Gilchrist 1994, Harhoff and Körting 1998, Bopaiah 1998). This classification method was used in recent research by Atanasova and Wilson (2004), Vijverberg (2003) and Ogawa and Suzuki (2000) and allows firms to switch throughout time between the categories of rationed and non rationed firms. Our method of research has the additional advantage of the possibility of linking the phenomenon of credit rationing to changes in the economic situation throughout time or other events arising in an economy e.g. Basel II Capital Accord and consolidation in banking. Moreover, we make a distinction between *long term and short term* bank debt rationing, as was suggested by the theoretical framework of Das (2004). This distinction was never made in previous empirical studies.

The remaining part of the paper is organised as follows. In section 2, we provide a brief overview of the theoretical credit rationing literature which is the foundation of the empirical research. Section 3 describes the empirical methodology, formulating the disequilibrium model of corporate bank lending and the hypotheses to be tested. In section 4, the estimation method of the

model is presented, as well as a description and justification of the dataset used. Section 5 reports and interprets the results of the estimation of the disequilibrium models for short term and long term bank lending. In section 5.2., the sample firms are classified as borrowing constrained and unconstrained for long term and short term bank debt, based on the estimated models. Finally section 6 concludes the paper.

2. CREDIT RATIONING: A LITERATURE REVIEW

Even though not everyone agrees on the relevance of the phenomenon, for many Keynesian economists it's one of the most important examples of market failure in our modern capitalistic economy. Or as Keynes (1930) wrote in 'A treatise on money': *"…So far however, as bank loans are concerned, lending does not (…) take place according to the principles of a perfect market. There is apt to be an unsatisfied fringe of borrowers, … This phenomenon is capable, when it exists, of having great practical importance.'…*"

If demand for bank debt exceeds the supply, we would expect that the applicants for bank debt or the opportunistic suppliers would increase the price. Consequently, in an economy that meets the standard neoclassical assumptions, it is not clear **why** credit rationing exists. Numerous researchers have tried to find a theoretical explanation.

The first explanatory models have tried to explain this phenomenon by means of a full information framework and various market imperfections (e.g. Hodgman 1960, Miller 1962, Freimer and Gordon 1965, Jaffee and Modigliani 1969, Jaffee 1971, Smith 1972, Azzi and Cox 1976, Koskela 1979). The problem with these theories is that they do not take into account the inherent complexity of the borrower-lender relation: in particular the problem of less than perfect information or information asymmetry. Information asymmetry is prevalent if a firm knows the expected risk and return of their project, while the bank only knows the average expected return and risk of an average project in the economy.

Jaffee and Russell (1976) and Stiglitz and Weiss (1981) were the first to introduce asymmetrical information in the analysis of the credit decision. A traditional model within the credit rationing literature is the 'Stiglitz-Weiss-model'. Stiglitz and Weiss (1981) came to the conclusion that banks will rather ration credit than increase the interest rate due to adverse selection (Akerlof 1970) and moral hazard problems (Arrow 1963). The economic theory states that there is an equilibrium in the market when demand equals supply or when the above mentionned Walrasian market clearing level is reached. In the market for bank debt, there seems to be an equilibrium,

different from the point where demand equals supply but instead equilibrium is established when the bank-optimal interest rate is reached. The bank-optimal interest rate is the equilibrium interest rate since at any interest rate above the bank-optimal interest, the expected return for the bank increases at a slower rate than the interest rate and will even decrease after a certain interest rate is exceeded. At the bank-optimal interest rate, the demand for bank debt will exceed the supply. Some applicants for bank debt who will not receive bank debt, will be prepared to pay a higher interest rate. If the bank agrees to this higher interest rate, the interest rate will increase until the point is reached where demand equals supply. The negative consequence is however that higher risk borrowers are attracted and lower risk borrowers drop out (adverse selection effect). In order to avoid this, banks will not charge an interest rate above the bank-optimal rate since higher risk lending is not expected to be rewarded with higher return. The expected return of a loan at an interest rate above the bank-optimal rate will be lower than the expected return of loans at the bank-optimal rate. Moreover, the interest rate will also affect the borrower in his selection of projects to execute. If the bank increases the interest rate, higher risk projects will rather be preferred above low risk projects by the borrower who receives the loan, decreasing again the expected return for the bank (moral hazard effect). Stiglitz and Weiss thus conclude that there are no competitive forces in action, bringing demand and supply together. Since the behaviour of borrowers can not be monitored costlessly, the bank will take into account this behaviour when setting the interest rate. This is an additional reason for the bank to prefer rationing credit rather than increasing the interest rate.

By consequence, the 'Law of Supply and Demand' may not be considered as a law (Stiglitz and Weiss 1981). The existence of credit rationing suggests that, in equilibrium, demand is not always equal to supply. The law is only the result of the underlying assumption that prices do not have adverse selection or moral hazard effects. Prices do not always equilibrate the market, as is often stated in economical models. The model of Stiglitz and Weiss gave rise to many theoretical models trying to explain credit rationing, taking into account the existence of asymmetrical information (e.g. Blinder and Stiglitz 1983, Wette 1983, Gale and Hellwig 1984, Besanko and Thakor 1987a, 1987b, Williamson 1986, 1987, De Meza and Webb 1987, Milde and Riley 1988). Most models came to the conclusion that information asymmetry leads to credit rationing when the information problem remains unresolved. Due to asymmetrical information, the expected return increases non monotonously when the interest rate is increased, which is the foundation for credit rationing.

3. EMPIRICAL METHODOLOGY

3.1. Description of the credit market as a disequilibrium model: demand and supply for bank debt

Models of markets in disequilibrium appear more and more often in recent economic theories and the econometrical area of research. Early economic theory was based on models of market equilibrium: the equilibrium was brought about by the price. Recently however, as well macro as micro models set aside the traditional hypotheses that prices always restore equilibrium on every market (Yang 1987). Numerous studies have studied the significance of the dynamics of a market disequilibrium as well as the methodology of estimating a supply and demand function for those markets in disequilibrium (Fair and Jaffee 1972, Fair and Kelejian 1974, Maddala and Nelson 1974, Maddala 1980, Goldfeld and Quandt 1981).

The amount of bank debt received depends on the interaction of the desired demand and the supply of bank debt if the equilibrium interest rate is lower than the bank-optimal interest rate r* from the model of Stiglitz and Weiss (1981). If the equilibrium interest rate exceeds the bank-optimal interest rate, the transaction is determined by the supply of bank debt. The bank would not lend at an interest rate above the bank-optimal interest rate because such a loan is likely to be a worse risk than the average loan at the bank-optimal interest rate. Thus, the expected return to such a loan is lower than the expected return to the loans the bank is presently making. Hence, there are no competitive forces leading supply to equal demand, and credit is rationed.

In our study, credit rationing cán occur in a market in equilibrium as defined by Stiglitz and Weiss (1981). In other words, in *equilibrium*, being the situation in which the bank demands the bank-optimal interest rate, the credit market can, from the traditional Walrasian point of view, be in *disequilibrium.* We assume that the interest rates are 'sticky' and do not equilibrate the market in every period considered. We are thus considering **equilibrium rationing** in our study, being a situation where price persistently stays at a level implying an excess demand which can be consistent with rational lender behaviour (Baltensperger 1978).

In order to take into account the existence of a (permanent) disequilibrium in the market (credit rationing), the simultaneous equation model mentioned below, being a disequilibrium model, will be estimated: (Maddala and Nelson 1974)

$$\mathbf{L^d_t = \beta_1 x'_{1t} + u_{1t}}$$

$$\mathbf{L^s_t = \beta_2 x'_{2t} + u_{2t}}$$

$$\mathbf{L_t = \min (L^d_t , L^s_t)}$$

The model consists of a demand equation L^d_t, a supply equation L^s_t and a transaction equation L_t. The vectors x'_{1t} and x'_{2t} reflect the exogenous, independent variables, β_1 and β_2 their coefficients, and u_{1t} and u_{2t} are the disturbances. L^d_t and L^s_t are in this model the amount of bank debt demanded and supplied, but they are not observed by any external party. Only the amount of bank debt which was actually received, the transaction amount L_t, can be perceived. We do not know if this transaction amount of debt agrees to the amount demanded by the firm or whether there was a limitation set by the bank which was not prepared to offer the demanded amount of bank debt. Put differently, we do not know ex ante which firms in our sample deal with credit rationing. There is '*unknown sample separation'* (Maddala 1987, Perez 1998).

Moreover, we want to estimate this model twice: once for measuring credit rationing concerning long term bank debt and once for measuring credit rationing concerning short term bank debt.
Das (2004) also makes this distinction in his theoretical framework on credit rationing. What makes this distinction relevant, is the fact that the term of the bank loan can be seen as a characteristic of a contract that serves to solve the information problems a SME copes with. It can also reinforce the control on the SME. Moreover, long term loans require a long term judgement of the creditor on the creditworthiness of the debtor. A firm that is financially strong and creditworthy at the moment of a credit acquisition cannot assure that it will remain creditworthy in the future. The chance of occurrence of an adverse event becomes larger, as the time period of the loan is enlarged (Mann 1997). Also, the problem of asset substitution is particularly present when providing long term credit (Jackson and Kronman 1979). The term of the loan gives the debtor enough opportunity to alter the projects in subtle ways or even switch from low-risk to high-risk projects. As loan duration falls, the reputation effect becomes much more important. For firms, which have acquired short term credit and would actually engage in asset substitution, the wealth transfer would be relatively small compared to the reputation cost (higher future interest rates). Moreover, the speed required to substitute assets would raise costs for the debtor. By means of a succession of bank debt contracts of short term, the bank can force the SME to negotiate on a regular basis in order to receive a new short term loan (Hutchinson 1995). That's why we expect that SMEs are more rationed for (more risky) long term bank debt than for short term bank debt.

Short term bank debt is defined as debt with a duration of less than 1 year; long term bank debt is defined as debt with a duration of more than 1 year. We hypothesize that the proportion of SMEs which are credit rationed for long term debt, would be higher than for short term debt (supra). For both kinds of bank debt, we estimate a separate model for the demand and supply of bank debt.

3.2. The disequibrium model for the corporate bank loan market: formulation of hypotheses

Our empirical study can be split up into two phases. First, the disequilibrium model of demand and supply of bank debt is estimated. We make a distinction between the model for long term bank debt and the model for short term bank debt. Then, the estimated models are used to estimate the proportion of credit rationed firms, for long and short term bank debt, for each year between 1993 and 2001.

Before estimating the model, we formulate the hypotheses concerning the demand and supply of long term and short term bank debt. After a profound review of previous scant empirical research, various explanatory variables were selected and combined (Sealey 1979, Perez 1998, Ogawa and Suzuki 2000, Shen 2002, Atanasova and Wilson 2004). These were elaborated by other variables which did not prevail in previous studies but were considered relevant based on the theoretical literature in the finance domain.

3.2.1. Hypotheses concerning the demand for bank debt

a. Level of activity

The desired demand for bank debt is determined by the level of activity or production level of a firm (Atanasova and Wilson 2004). Operating at a higher activity level implies the need for more working capital (Perez 1998) and thus more short term bank debt. Moreover, we expect that firms with a higher production level, also have to invest more in order to replace certain assets (e.g. machines, equipment), and thus need more long term bank debt. We can formulate the hypotheses:

H1: The demand for long term bank debt increases if the activity level of the firm is higher

H2: The demand for short term bank debt increases if the activity level of the firm is higher

b. Internal available resources

The 'pecking order theory' states that firms follow a certain order when choosing their financing resources (Myers 1984). Firms prefer internal financial sources but if these sources appear to be insufficient, they will appeal to external finance, e.g. bank finance. As a firm grows for example, the financial needs and options change. SMEs are characterized as firms with a 'financial growth cycle' (Berger and Udell 1998). Growing firms need more financial resources to fund the growth (Cressy and Olofsson 1997b) and will, according to the 'pecking order' theory have to descend in the financing hierarchy and appeal to bank finance.

The pecking order was confirmed by numerous empirical studies (e.g. Shyam-Sunder and Myers 1999, Fama and French 2002). Even studies particularly aimed at SMEs confirm the pecking order theory (Norton 1991, Holmes and Kent 1991, Van der Wijst and Thurik 1993, Chittenden et al. 1996, Hamilton and Fox 1998). Durinck et al. (1997) report indirect evidence in support of the pecking order hypothesis, related to growth. Their study, based on industrial Belgian SMEs, revealed that the level of growth had a statistical significant influence on the choice of financing. The faster the growth, the less firms use retained earnings as their most important source of finance and more firms appeal to external financing.

On the other hand, the possession of sufficient internal finance (due to a high profitability), could also increase the demand for external bank debt. The firm knows that the probability of acquiring additional debt is increased at that moment and will demand for more bank debt to insure itself against the need for more bank debt when the firm experiences a period of lower profitability. This reasoning is in accordance with the 'static trade off theory', based on the idea that every firm has an optimal debt ratio determined by a trade off of the costs and benefits of debt finance (Modigliani and Miller 1963, Jensen and Meckling 1976, Harris and Raviv 1990, Stulz 1990).

Based on the several empirical confirmations of the 'pecking order theory', we formulate the hypotheses:

H3: The demand for long term bank debt increases if a firm has less internal resources available

H4: The demand for short term bank debt increases if a firm has less internal resources available

c. Trade credit as a substitute for bank finance

Trade credit is for many SMEs the only substitute for bank finance, even if it may be an expensive financing source if cash discounts for early payment are given (Duca 1986). Other alternative equity sources of finance mostly are not available for small (Belgian) firms. Financing theory links the use of trade credit to the existence of market imperfections and

asymmetrical information causing credit rationing by financial institutions towards certain (considered risky) firms. This excess demand for bank debt can be compensated by the use of trade credit. Suppliers ask for higher implicit interest rates in order to grant trade credit. Thus trade credit can be *a substitute* for the unsufficient bank finance they received, as was empirically confirmed by Atanasova and Wilson (2004). The results of the empical studies of Petersen and Rajan (1994, 1995) and Biais et al. (1995) also suggest that certain categories of SMEs that have a lower probability of being credit rationed, appear to appeal less to trade credit.

Other theories/models consider trade credit and bank debt to be *complements*. Market imperfections (e.g. information costs and transaction costs) can bring about the use of trade credit without necessarily being credit rationed (Lewellen et al. 1980). Suppliers can generate benefits in information costs if they extend credit to customers with whom they have regular contact. Moreover, the cost of evaluation in determining the probability of default is lower since the supplier is often working in the same or related industry as the customer and is more familiar with the customer (Emery 1984). Moreover, in case of default, collection costs for trade credit are lower because the inventories can be resold and thus have a higher value for the seller. In addition, suppliers may have greater incentive in offering credit because it can help to increase their sales. Petersen and Rajan (1997) and Wilner (2000) also argue that a supplier may want to protect the value of its implicit equity stake in the customer being the present value of profits he makes on the current and future sales to the firm by providing it with sufficient short term financing. Biais and Gollier (1997) add that receiving trade credit acts as a signal and reveals private information to the bank.

We formulate our hypotheses based on the complementary view of trade credit and bank debt. In this model, two simultaneous effects take place: firms use trade credit because they are credit constrained (substitution effect) but this use of trade credit also facilitates access to bank debt (complementary effect). Constrained access to bank debt or the desire to exploit the signaling effect of trade credit, causes the use of trade credit. We formulate the following hypotheses:

H5: The demand for long term bank debt increases if the use of trade credit increases

H6: The demand for short term bank debt increases if the use of trade credit increases

d. Intragroup finance as a substitute for bank finance

Belgium is a small country consisting of many small firms. A lot of these small firms form part of a group of firms, tied together by equity shares (Deloof 1995). Internal capital markets are a major channel of capital allocation in modern industrial economies. These internal capital

markets would be more efficient than external capital markets. They have an information advantage over banks and incur lower transaction costs when supplying finance. Within a group structure, it can be expected that the scarce financial resources they possess, are allocated optimally at group level (Stein 1997). A firm belonging to a group could obtain the necessary external finance within the group, without having to appeal to financial institutions and bank debt. Consequently, intragroup finance can be a substitute for bank debt. We formulate the hypotheses:

H7: The demand for long term bank debt decreases if a firm is tied together to other firms by means of equity shares

H8: The demand for short term bank debt decreases if a firm is tied together to other firms by means of equity shares

3.2.2. Hypotheses concerning the supply of bank debt

a. Firm risk

The risk degree of a firm has an influence on the willingness of banks to offer bank debt: firms for which the repayment of the loan is more uncertain, are more risky for the bank. The risk for the bank implies the default risk, being the risk that the firm can not fulfill its obligations versus the bank. The main reason for default of a firm is mismanagement (Ooghe et al. 1995). This mismanagement can be related to the lack of technical ability and personality of the management, the quality of the management policy, organization of the firm, experience and motivation of management and personnel, reputation… Mismanagement leads to a worsening of the financial condition of a firm, being reflected in financial ratios. Due to the lack of data on quantitative elements related to mismanagement, traditional default prediction models are based on the financial structure of firms, although this is only an intermediate variable. Firms characterized by a worsening of their financial structure and a decline of their financial ratios, represent a bad risk for financial institutions. We formulate following hypotheses:

H9: The supply of long term bank debt decreases if a firm is characterized by a higher risk degree

H10: The supply of short term bank debt decreases if a firm is characterized by a higher risk degree

b. Collateral offered by the firm

The amount of debt offered by the bank can also be influenced by the value of the collateral that can be offered by a firm (Calcagnini and Iacobucci 1997). In case of default, the bank can sell the collateral obtained and recover (part of) the loan. Collateral is a powerful instrument that

allows financial institutions to offer bank debt at more favorable terms to SMEs who might otherwise, due to their information asymmetry, be credit rationed (Berger and Udell 1998). A lot of theories concerning the role of collateral have been developed throughout the years. Collateral reduces the information asymmetry between the SME and the financial institution (Chan and Kanatas 1985). The applicant receives, in exchange for the collateral, the advantage of a lower interest rate but can loose the collateral when the return of the project is too low. If the probability of a low return is too high, the costs of providing collateral will exceed the benefits of a lower interest rate. Consequently, the applicant will refuse the loan. The reverse is true if a project with a high probability of a high return is being considered. Thus, the applicant can signal the real value of a project by offering collateral. This signaling role is certainly important when the financial institution has limited information on the firm and the value of the project is estimated lower (Rothschild and Stiglitz 1971). Thus collateral could have a *signaling value* for the bank when considering the creditworthiness of the firm (Bester 1985, 1987). Also ex post, after obtaining the loan and offering the collateral, credit applicants wish to fulfill their obligations and repay on a timely basis in order to avoid loosing the collateral. Thus, giving collateral can also solve the 'moral hazard' problem by reducing the motives to switch to a higher risk project or do less effort to realize the proposed project (Boot et al. 1991). This implies that firms with a lot of intangible assets, which are difficult to monitor, and thus are informationally very opaque, might incur difficulties in obtaining bank finance. They have more risk shifting opportunities and these firms do not have much collateral to offer in order to ensure repayment of debt (Longhofer and Santos 2000).

Stiglitz and Weiss (1981) also studied if a higher demand for collateral could reduce the risk and increase the return for the bank. In their model, they came to the conclusion that there is a positive 'moral hazard' effect, causing collateral to increase the return for the bank. On the other hand, there is also a negative 'adverse selection' effect working when an increasing demand for collateral makes the average and marginal borrower become more risky. Stiglitz and Weiss show that the negative adverse selection effect more than compensates the positive moral hazard effect. So contrary to the signaling theory, Stiglitz and Weiss (1981) conclude that increasing the demand for collateral will decrease the expected return for the bank, so that offering more collateral will not increase the supply of bank debt to firms.

Theoretically, there is no consensus on the influence of collateral on the supply of bank debt. Empirical studies (Atanasova and Wilson 2004, Ogawa and Suzuki 2000, Alphonse et al. 2004) mainly confirm the signaling theory. We thus formulate the following hypotheses:

H11: The supply of long term bank debt increases if a firm can offer more assets as collateral

H12: The supply of short term bank debt increases if a firm can offer more assets as collateral

c. Use of trade credit

This variable was never included in previous studies on this subject although Biais and Gollier (1997) show in their model that the reliance on trade credit increases the availability of bank debt. They show that trade credit reveals private information of the supplier to the bank which can update its beliefs about the customer's default risk. It might alleviate the information asymmetry which might otherwise have prevented the financing of a NPV project. Bank debt and trade credit can be considered as two complementary sources of financing. This was empirically confirmed by Cook (1999) and Alphonse et al. (2004). This might explain why SMEs who cope more often with credit rationing, due to asymmetric information, appeal to trade credit. This would affect the availability of bank debt in a positive way: trade credit may appear to be a means to obtain bank debt. Trade credit can work as a signal about the firm's quality, reducing the adverse selection problem, and thus facilitating access to bank debt.

On the other hand, relying heavily on trade credit, could give a negative signal to the bank, indicating that the firm can not obtain enough (cheaper) bank debt at any bank (Kohler et al. 2000, Petersen and Rajan 1997). This could lead to a reduced bank debt supply. This is consistent with the financing theory concerning trade credit which states that suppliers will lend more to their customers since they have a comparative advantage in the collection of information on the financial strength and future of their buyers and the possibility to liquidate the goods in case of default. Moreover, suppliers have an interest in the survival of their customers on the long term. Consequently, they offer firms extension of payment if they can no longer rely on banks for additional bank debt (Asselbergh 2002, Wilson and Summers 2002).

We formulate our hypotheses, based on the positive signal of trade credit:

H13: The supply of long term bank debt increases if a firm uses more trade credit

H14: The supply of short term bank debt increases if a firm uses more trade credit

d. Intragroup finance

If a firm forms part of a group of firms that are interrelated by means of cross equity holdings, this might have a positive influence on the supply of bank debt. Deloof and Jegers (1996) point at the fact that excesses of financial resources can be transferred to other group members by means of investment in financial fixed assets in order to avoid limitations on obtaining additional external bank debt. Being part of a group of firms may also avoid default of repayment of debt by means of intragroup transfers of money. The group firms also have an interest in the survival of each firm that belongs to the group. This is important to retain its reputation as being creditworthy as a group and thus avoid problems in obtaining bank debt in the future. Moreover, firms of a group can guarantee the repayment of bank debt for another firm belonging to the group. This interconnectedness makes that firms of a group can, if needed, rely on the other firms belonging to the group (Mayer 1988). Gertner et al. (1994) also state that a firm which acquires intragroup financial resources, will be more subject to monitoring. The mother company possesses eventually the assets or the majority of the assets of each firm of the group and thus has the residual control over the assets causing a surplus for the mother company when monitoring the firms of the group. Since the financial institution knows that each group firm is heavily internally monitored, the financial institutions will have more trust in those firms. This might also reduce the liquidity constraints for firms within a conglomerate (Lamont 1997, Scharfstein and Stein 2000), which was empirically confirmed by Shin and Stulz (1998) and Deloof (1998).

Thus we formulate the following hypotheses:

H15: The supply of long term bank debt increases if a firm forms part of a group of firms characterized by cross equity ownership

H16: The supply of short term bank debt increases if a firm forms part of a group of firms characterized by cross equity ownership

3.3. Measuring the variables

The demand and supply equations are expressed in terms of financial ratios, log or ratios of firms' (end of previous year) total assets rather than levels. This specification alleviates the problem of heteroskedasticity that might be present in the sample data.

DEPENDENT VARIABLE

The dependent variable $\mathbf{L^t}$ in our study, is the obtained amount of bank debt by a certain firm i in period t. Short term bank debt is defined as debt with a duration of less than 1 year; long term bank debt is defined as debt with a duration of more than 1 year.

EXPLANATORY VARIABLES IN THE DEMAND FUNCTION

a. Level of activity

Sales can measure the production level of a firm (Perez 1998). Due to lack of data on sales figures, we opt for an alternative measure being the *ln(added value)*.

b. Internal available resources

This variable can be measured by means of different indicators. We opt for three measures. First, we use profitability, measured by *Return on Assets*, as a proxy for the internal resources a firm possesses (Shen 2002, Ogawa and Suzuki 2000, Ito and Ueda 1981). Secondly, we use the *internal cash flow,* measured as the net income plus depreciation (Atanasova and Wilson 2004, Sealey 1979, Laffont and Garcia 1977). Thirdly, we incorporate the growth rate in our model in order to check whether a higher growth rate increases indeed the demand for bank debt. The growth rate will be measured by *asset growth,* calculated as the difference between the end of this year assets and the end of previous year assets, divided by end of previous year assets (Titman and Wessels 1988). We also add a fourth measure which is only relevant when considering the demand for short term bank debt being the *quick ratio* (Perez 1998). The quick ratio is calculated as the short term assets in proportion to the short term debt. This ratio measures to which degree a firm can finance its own production level. If the short term debt is not sufficient to finance the short term assets, there is a need for additional short term (bank) debt. A high quick ratio indicates that the firm does not need much external short term (bank) credit, indicating an expected negative sign for this parameter.

c. Trade credit as a substitute for bank finance

We use two indicators for measuring this variable, being *accounts payable* and *net accounts payable*. 'Net accounts payable' is defined as the difference between the accounts payable and accounts receivable at the end of the year (Atanasova and Wilson 2004). Minimization of accounts receivable and delaying the payment of accounts payable are used as alternative modes of financing (Winborg and Landström 2000).

The results of a study by Deloof and Jegers (1999) suggest that trade credit with a term of less than one year can be a substitute for short term bank debt but also for long term bank debt, although this seems to contradict with the 'matching principle'. This can however be explained by the existence of a permanent component in the short term assets. According to Van Horne (1995), this component has to be financed by means of long term debt.

d. Intragroup finance as a substitute for bank finance

The data allow us to make a distinction between shareholdings and participations. We create two dummy variables: a shareholder dummy indicating if a firm has a shareholder or not and a participation dummy indicating if a firm has a participation or not.

e. Control variables

*Cost of capital

Based on the availability of data and the use of non-price contract terms (e.g. covenants), we are unable to estimate *individual* firms'interest rate premiums (capital cost) for bank loans. However, within a given year, similar interest rates are observed for all the firms. Therefore, we choose for an alternative variable. We take the interest rate of a safe investment with a long term (obligation of the state (called 'OLO') with a term of 10 year) which is the foundation for the *interest rate* on a *long term* loan for each individual firm. We opt for the LIBOR interest rate with a term of one year, which is the foundation for the *interest rate* on a *short term* loan for each individual firm. We expect a negative relationship between the cost of capital and the demand for bank debt: a higher interest rate would reduce the demand for bank debt.

Compared to other studies (Sealey 1979, King 1986, Kim 1999), we don't consider the cost of capital of alternative financing sources relevant because SMEs cannot rely on other equity financing sources (e.g. commercial paper, obligation, IPO…). A Belgian SME can not consider these financing sources as possible alternatives.

*Business outlook

The state of the economy can have an influence on the individual demand for bank debt by firms (Shen 2002, Kim 1999, King 1986, Sealey 1979, Laffont and Garcia 1977). In a period of decline, there are less opportunities to invest or firms choose to postpone their investment. This would decrease the demand for long term bank debt. Investing less also decreases the activity increase and thus the need for working capital and short term bank debt. We expect that in boom periods, firms would like more bank debt. The inclusion of dummy variables for the years 1993-

2001 is expected to give us the opportunity to take into account these time effects (Atanasova and Wilson 2004).

*Industry

Rajan and Zingales (1998) establish the fact that there are industries which need more (external) finance e.g. bank finance. They suppose this could be due to technological reasons. The scope of the investment projects, the time needed to develop a project or become known to the public, the period to be financed before cash can be collected from a project and the need for continuous investment can also differ between industries (Beck and Levine 2002). Cressy and Olofsson (1997b) indicate in their study that manufacturing firms face larger investment needs in fixed assets while the needs of firms in the service industry are limited to product and market development. This has an influence on the demand for short and long term bank debt. We distinguish between four industries (dummy variables): production, building, retail and services.

EXPLANATORY VARIABLES IN THE SUPPLY FUNCTION

a. Firm risk

As far as the qualitative elements in evaluating the risk degree are concerned, we have no data available for including them in our study. The technical ability, the quality and experience of the management can be proxied by the *age* of the firm, expressed in years. For most small firms, the use of equity in the early stages of development is limited to an individual and/or his family's contributions. Moreover, young firms are often run by novice entrepreneurs which increases the financial risk for any potential financier (Egeln et al. 1997). Moreover, a firm which is already in operation for many years has a proven track record (Jankowicz and Hisrich 1987).

Those firms with a track record are also in most cases larger than young start-up firms. That's why we also include the size of the firm as an indicator of the risk degree and/or opacity, being ***ln(assets).*** Hooks (2003) argues that size of the firm is a rough proxy for the reputation of the firm. Moreover, the assets are an indication of the financial vulnerability of a firm (Fazzari et al. 1988). Consequently, the risk of default is reduced for those firms. It is a fact that many firms fail in their first years of operation.

Also the *industry* in which a firm is active, can be an indicator for the risk degree. Certain industries are more sensitive to the tendency of the market or to changes in market conditions than others or are characterized by a local market. A bank considers some industries as being more risky than others, based on a proportional higher past percentage of default in those industries (Cowling and Mitchell 2003). We create four dummyvariables for the four industries.

As far as the quantitative elements in evaluating risk are concerned, we consider the *interestcover* as most important indicator (Atanasova and Wilson 2004, Shen 2002, Perez 1998). It reveals how well a firm can pay back its interest costs to the bank by means of its operating income. For banks, this ratio would be important as it indicates how much margin a firm has in order to keep satisfying its obligations versus the banks. In other words, this ratio indicates the probability that the firm can repay the interest on a new loan demanded.

For the supply of long term bank debt, we also consider the *solvency* as being an important ratio. This ratio indicates how much of its assets are financed with equity and measures the financial power of the firm. It interacts with the financial situation of the firm and is connected with the profitability by means of the financial leverage and with the liquidity by means of the coverage of debt. Solvency is particular important in determining the supply of long term debt because it indicates how long a firm can cope with a situation of a negative evolution in profitability which is related to its ability of paying off its debt on the long term. For the supply of short term bank debt, we consider the *cash flow* as being a more important measure for the risk of paying off the debt. The cash flow of a firm is used to pay off short term debt.

b. Collateral offered by the firm

When considering the measures for collateral offered, we use different measures for short and long term debt (Calcagnini and Iacobucci 1997). For long term debt, used to finance mainly tangible assets, we use the amount of *tangible assets* a firm has, as a measure. The more labour intensive a production process is, the more liquid the assets are and thus less tangible assets and less collateral is available. For short term debt, used to finance mainly working capital, we add up 50% of accounts receivable and 50% of inventories, shortly noted *as 'acc receiv + inv'* as a measure. We do not use accounts receivable and inventories for 100% as collateralizable, since banks consider these categories of collateral as not fully recoverable in case of default. Inventories can already have become obsolete or partly 'disappeared'. Accounts receivable are often already collected before default or have become doubtful.

c. Use of trade credit

Beside a measure of trade credit we used for the demand for bank debt (*net accounts payable),* we add an additional measure that compares the use of trade credit by a firm with the use of trade credit by other firms active in the same industry. We consider this additional measure as being important for a bank when considering whether they should offer additional bank debt. We create a dummy variable (*accounts payable industry dummy*) that is assigned the value '1' if the firm

uses more trade credit (accounts payable) than the average of the industry. Otherwise, if it uses less trade credit than the average of the industry, it is assigned the value '0'. If a firm uses less trade credit than the average of all the firms in the industry, it indicates that suppliers who possess private information, have less confidence in this firm compared to the other firms in the industry.

d. Intragroup finance

Similar as in the demand function, we create two dummy variables: a shareholder dummy and a participation dummy.

Thus, following **disequilibrium models** for long and short term bank debt have to be estimated:

For long term bank debt:

$$\frac{L^{d}_{i\,t}}{TA_{i,t-1}} = \beta_0 + \beta_1 \frac{\text{cash flow}_{it}}{TA_{i,\,t-1}} + \beta_2 \ln(\text{added value})_{it} + \beta_3 \text{Return On Assets}_{it} + \beta_4 \text{asset growth}_{it} + \beta_5 \frac{\text{net accounts payable}_{it}}{TA_{i,\,t-1}}$$

$$+ \beta_6 \frac{\text{accounts payable}_{it}}{TA_{i,\,t-1}} + \beta_7 \text{participation dummy} + \beta_8 \text{shareholder dummy} + \beta_9 \text{long term interest rate} + \sum_{j=1993}^{2001} \varphi_j \text{year}_j$$

$$+ \sum_{j=1}^{4} \psi_j \text{industry}_j + \nu_{1,\,it} \qquad (1)$$

$$\frac{L^{s}_{it}}{TA_{i,t-1}} = \gamma_0 + \gamma_1 \text{age}_{it} + \gamma_2 \frac{\text{tangible assets}_{it}}{TA_{i,\,t-1}} + \gamma_3 \text{interestcover}_{it} + \gamma_4 \text{solvency}_{it} + \gamma_5 \text{Ln(assets)}_{it} + \gamma_6 \frac{\text{net accounts payable}_{it}}{TA_{i,\,t-1}}$$

$$+ \gamma_7 \text{Accounts payable industry dummy} + \gamma_8 \text{participation dummy} + \gamma_9 \text{shareholder dummy} + \sum_{j=1}^{4} \xi_j \text{industry}_j + \nu_{2,\,it} \qquad (2)$$

$$L_{it} = \min (L^{d}_{t}, L^{s}_{t}) \qquad (3)$$

For short term bank debt:

$$\frac{L^{d}_{i\,t}}{TA_{i,t-1}} = \beta_0 + \beta_1 \frac{\text{cash flow}_{it}}{TA_{i,\,t-1}} + \beta_2 \ln(\text{added value})_{it} + \beta_3 \text{Return On Assets}_{it} + \beta_4 \text{asset growth}_{it} + \beta_5 \text{quick ratio}$$

$$+ \beta_6 \frac{\text{net accounts payable}_{it}}{TA_{i,\,t-1}} + \beta_7 \frac{\text{accounts payable}_{it}}{TA_{i,\,t-1}} + \beta_8 \text{participation dummy} + \beta_9 \text{shareholder dummy}$$

$$+ \beta_{10} \text{short term interest rate} + \sum_{j=1993}^{2001} \varphi_j \text{year}_j + \sum_{j=1}^{4} \psi_j \text{industry}_j + \nu_{1,\,it} \qquad (1)$$

$$\frac{L^{s}_{it}}{TA_{i,\,t-1}} = \gamma_0 + \gamma_1 \text{age}_{it} + \gamma_2 \frac{\text{cash flow}_{it}}{TA_{i,\,t-1}} + \gamma_3 \frac{\text{acc receiv+inv}_{it}}{TA_{i,\,t-1}} + \gamma_4 \text{interestcover}_{it} + \gamma_5 \text{Ln(assets)}_{it}$$

$$+ \gamma_6 \frac{\text{net accounts payable}_{it}}{TA_{i,\,t-1}} + \gamma_7 \text{accounts payable industry dummy} + \gamma_8 \text{participation dummy}$$

$$+ \gamma_9 \text{shareholder dummy} + \sum_{j=1}^{4} \xi_j \text{industry}_j + \nu_{2,\,it} \qquad (2)$$

$$L_{it} = \min (L^{d}_{t}, L^{s}_{t}) \qquad (3)$$

with i= firm i, t = year t and TA= total assets

4. ESTIMATION OF THE DISEQUILIBRIUM MODEL

4.1. Econometric method

The observed (obtained) amount of credit can equal the demand for credit or equal the supply of credit (with a higher amount of bank debt desired or demanded). To solve the problem of estimation of a model of a market in disequilibrium, there are several econometric techniques available (Askari 1986). If a model serves to analyse complex relationships with more than one dependent or endogenous variable, we have a simultaneous equation model. When estimating a simultaneous equation model, the relationships in a system of equations have to be estimated taking into account the fact that the dependent variables are conceptually or mathematically interdependent.

Our model can not be estimated by means of an Ordinary Least Squares **(OLS**) regression since this would produce biased and inconsistent estimates (simultaneous equation bias). One of the fundamental assumptions of OLS is violated: for each equation, the independent variables are not distributed independently of the disturbance term[1] (Greene 1997). This correlation between independent variables and disturbance term was found for the demand as wel as for the supply equation.

When the OLS assumptions are violated, a simultaneous equation model can be estimated by means of an instrumental variable technique being 3Stage Least Squares (**3SLS**). 3SLS is a system method or a full information method: all the equations are estimated simultaneously, taking due account of all restrictions on such equations by the omission or absence of some variables. A full information technique is superior compared to a limited information technique like OLS or 2Stage Least Squares. These techniques only estimate one equation at a time and do not allow for correlations *between* the disturbances of the different equations. When checking for correlation of the disturbances of the demand and supply equation, we found there was a significant correlation. By consequence, we applied 3SLS to our model in order to obtain an efficiency gain in the estimates of the parameters of our model (Greene 1997).

[1] This correlation was tested by the Hausman specification test (Hausman 1976). It showed a high Chi^2 statistic and thus lead to a rejection of the null hypothesis of no correlation.

4.2. Credit rationing: calculation of the probability of excess demand for corporate bank loans

After estimating the demand and supply model for corporate bank lending, we can derive the probability that any observation, being firm i in period t, is credit rationed (Gersovitz, 1980, Maddala, 1986).

Following Gersovitz (1980), Maddala (1986) and Atanasova and Wilson (2004), we take into consideration the two most important concepts of the probability that a certain observation corresponds to excess demand (credit rationing): the unconditional probability $P(L^d_t > L^s_t)$ and the probability conditional on the observed transaction $P(L^d_t > L^s_t \mid L_t)$.

The **unconditional probability** that an observation t belongs to the demand function $\mathbf{L^d_t}$, and consequently there is no credit rationing, is:

$$\lambda_t = P\,(L^d_t < L^s_t) = P\,(u_{1t} - u_{2t} < \beta_2 x_{2t} - \beta_1 x_{1t}) \qquad (3.2.)$$

Let $f(u_1, u_2)$ be the joint density of (u_1, u_2) and $g(L^d, L^s)$, the cumulative density function of L^d and L^s, derived from $f(u_1, u_2)$.

If observation t belongs to the demand function, we know that $L^d_t = L_t$ and that $L^s_t > L_t$.

Thus,

$$h\,(L_t \mid L_t = L^d_t) = \int_{L_t}^{\infty} g\,(L_t\,,\, L^s_t)\; d\, L^s_t / \lambda_t \qquad (3.3.)$$

The denominator λ_t is the normalizing constant. It is equal to the numerator integrated over L_t over its entire range.

Similarly, we can say that if observation t belongs to the supply function, we know that $L^s_t = L_t$ and that $L^d_t > L_t$.

Thus,

$$h\,(L_t \mid L_t = L^s_t) = \int_{L_t}^{\infty} g\,(L_t\,,\, L^d_t)\; d\, L^d_t / (1-\lambda_t) \qquad (3.4.)$$

The **unconditional density** of L_t is:

$$h\,(L_t) = \lambda_t\, h\,(L_t \mid L_t = L^d_t) + (1-\lambda_t)\, h\,(L_t \mid L_t = L^s_t)$$

$$= \int_{L_t}^{\infty} g\,(L_t\,,\, L^s_t)\; d\, L^s_t + \int_{L_t}^{\infty} g\,(L_t\,,\, L^d_t)\; d\, L^d_t \qquad (3.5.)$$

The likelihood function is:

$$L = \prod_t h(L_t) \qquad (3.6.)$$

Thus, after estimating the parameters of the demand and supply model, the probability that an observation belongs to the demand or supply function can be estimated. Maddala and Nelson (1974) suggest doing this by estimating λ_t in (3.2.). These are the (unconditional) probabilities as calculated in Sealey (1979). Gersovitz (1980) suggests calculating the conditional probability being:

$$P(L^d_t < L^s_t \mid L_t), \qquad (3.7.)$$

and to classify an observation, firm i in period t, as belonging to the demand function if this probability is >0.5. Then, that firm is not credit rationed in the particular period t. The observation belongs to the supply function if the probability is <0.5. This firm is classified as credit rationed in the period t.

Thus:

$$P(L^d_t < L^s_t \mid L_t) = \int_{L_t}^{\infty} g(L_t, L^s_t)\, d L^s_t / h(L_t) \qquad (3.8.)$$

where $h(L_t)$ is defined in (3.5.)

Lee (1983) shows that the classification rule, also suggested by Gersovitz (1980), is optimal in the sense that the total probability of misclassifications is minimized.

This decision rule will also be used in this empirical study. To put it into more concrete terms, we calculate for each observation i in period t:

$$P\left(\frac{\beta_1 x_{1t} - \beta_2 x_{2t}}{\sigma} > \frac{u_{2t} - u_{1t}}{\sigma}\right)$$

The error terms are assumed to be distributed normally; $\sigma^2 = \text{var}(u_{2t} - u_{1t})$, $\beta_1 x_{1t}$ is the unconditional expectation of L^d_t and $\beta_2 x_{2t}$ is the unconditional expectation of L^s_t. The unconditional expectation of L^d_t is higher than the unconditional expectation of L^s_t if $P(L^d_t > L^s_t) > 0.5$. We remark that firms that are not classified as credit rationed in one period t, can be classified as credit rationed in another period. Switching between both categories throughout time is possible (Ogawa en Suzuki, 2000).

4.3. Data

4.3.1. Population and sample

The population of Belgian firms consists of those firms satisfying the following conditions:

- small or medium sized firm according to Belgian law[2];
- not being active in the agriculture or forestry industry or being a financial institution;
- having more than 10 employees;
- still active in 1998;
- not publicly noted;
- the published accounts for each year meet all the requirements set by the National Bank of Belgium;
- being a limited company ('NV') or a limited liability company ('(E)BVBA');

A panel data set, consisting of 2.698 randomly selected small and medium size Belgian firms for the period 1993-2001, is being used to estimate the disequilibrium model of Belgian SME corporate bank lending. Each observation x in our sample (x_{it}) or database consists of the data (being published accounts) for one firm i in one particular year t. Thus, each firm can appear repeatedly in our sample: for each year of its existence in the period 1993-2001 one observation x can be found. For the total of 2.698 firms, we become a sample consisting of 18664 published accounts reporting data on short term bank debt and 18627 published accounts reporting data on long term bank debt. In this sample, also 'null' values are included of firms who do not have short term or long term bank debt in a particular year. Our dataset includes firms which existed already before 1993, as well as firms which were set up in the period 1993-2001. By consequence, the panel is not balanced. Table 1 reports the distribution of observations over years for our sample.

[2] The definition used for 'Small and medium sized firms' is the definition set forward by Belgian law as companies which don't exceed more than one of the following criteria:
- maximum of 50 employees
- maximum sales of 6.250.000 euro
- maximum total of assets of 3.125.000 euro

and do not have more than 100 employees.

Table 1: Distribution of observations over years

Year	Long term bank debt	Short term bank debt
1993	1674	1677
1994	1830	1833
1995	1933	1936
1996	1995	1999
1997	2137	2141
1998	2194	2201
1999	2323	2327
2000	2295	2298
2001	2246	2252
Total of observations	**18627**	**18664**

Justification of the use of micro data

Performing a study concerning the existence of credit rationing making use of micro data, would be superior to studies making use of macro time series data. First of all, the disequilibrium model we want to estimate, contains a minimum condition (see equation (3) of our model). This condition can only be applied on a microlevel and not on an aggregated level (Maddala 1986). In addition, Perez (1998) states that the use of aggregated data averages the individual company level data. By this aggregation proces, a study based on these averages can lead to a result in which no credit rationing appears to be present, while in reality some companies do struggle with credit rationing (aggregation bias problem). Shen (2002) also asserts that the use of agregated macro time series data is ill-suited for identifying the sources of credit shrinking. The use of aggregate data makes it difficult to distinguish whether the reduced credit is supply constrained or due to a reduction in the credit demand (Favero, Giavazzi and Flabbi 1999).

Justification of the use of an endogenous classification

The endogenous classification of our study, firms being credit rationed versus non credit rationed, is an improvement over prior research in this area. In previous studies, an exogenous classification into those *a priori* expected to be more likely and those *a priori* expected to be less likely to face significant financial constraints, is mostly used (Fazzari et al. 1988, Hoshi et al. 1991, Berger and Udell 1992, Petersen and Rajan 1994, Gertler and Gilchrist 1994, Harhoff and Körting 1998, Bopaiah 1998). Those studies use various proxies (e.g. dividend policy, relationship characteristics, use of accounts payable…) to identify those firms which would be expected to be more likely to face credit constraints. Using these proxies to divide a sample into

two groups, the credit rationed firms versus the non credit rationed, creates at least two problems. First, companies are in this set up not allowed to switch between both groups (credit rationed to non credit rationed or vice versa) over time. Second, some of those proxies are the endogenous outcome of management decisions of a company e.g. decisions concerning dividend policy, company structure… By consequence, these proxies are not appropriate measures for credit rationing. We pursue the new methodology based on an endogenous classification applied by Atanasova and Wilson (2004) and Ogawa and Suzuki (2000).

4.3.2. Descriptive statistics

Outliers were removed by means of the method developed by Hadi (1992, 1994). A measure of distance from an observation to a cluster of points is defined. A base cluster of r points is selected and then that cluster is continually redefined by taking r+1 points 'closest' to the cluster as the new base cluster.

Table 2 reports some descriptive statistics for the sample of firms. The median company of our sample is 14 years in operation, has 1.399.000 euro in total assets and reports a positive value added of 723.000 euro. The average and median asset growth rate of the firms in our sample is positive. Remarkable is the fact that the median and average interestcover is negative. The solvency also appears rather low, for the median firm equity seems to constitute only 25% of total liabilities. The median firm possesses 57% of collateralizable wealth (being the sum of tangible assets and 50% of inventories and accounts receivable); half of it consists of tangible assets.

Table 2: Descriptive statistics (2.695 Belgian SMEs 1993-2001)

Variable	Mean	Median
Total assets	3.077.043 euro	1.399.000 euro
Value added	1.067.801 euro	723.000 euro
Cash flow/Total assets$_{t-1}$	0.1252334	0.0939227
Tangible assets/Total assets$_{t-1}$	0.3783213	0.2650185
Collaterizable value/Total assets$_{t-1}$	0.69211921	0.5742916
Net accounts payable/ Tot assets$_{t-1}$	-0.02961667	-0.0471166
Accounts payable/ Total assets$_{t-1}$	0.2607928	0.2325239
Asset growth rate	0.3218476	0.0477682
Solvency	0.2815375	0.2541209
Interestcover	-0.186052	-1.15
Return On Assets	3.721636	2.61
Quick ratio	1.37041	1.19247
Age	17.44685 year	14 year

5. ESTIMATION RESULTS

5.1. Results of the disequilibrium model for long and short term bank debt[2]

We now turn to the estimation and inference of the results from the disequilibrium model for corporate bank lending. The estimation was performed by means of the statistical package 'STATA8'. The estimated models can be found in table 3a and table 3b in appendix . Table 3a reports the disequilibrium model for long term bank debt; table 3b for short term bank debt. The Wald test of joint significance of the estimated coefficients indicates that the disequilibrium models are highly significant (p=0.0000 for both equations).

First, consider the coefficient estimates of the **demand** equations for **long term** and **short term** bank debt. In both models, the significant variables (on a 5% significance level) mentioned in the demand equations have the same sign (except for 'net accounts payable'). As predicted, we see that the *level of activity* ('ln(added value)') and growth ('asset growth') have a significant positive effect on the demand for long and short term bank debt. Looking at the *internal funds available,* the results suggest that a higher internal cash flow reduces in both analyses the desired demand for external bank debt. For short term bank debt, the 'quick ratio' also has a significant negative influence on the demand. These results support the pecking order theory. The coefficient on the Return On Assets, on the other hand, suggests a confirmation of the static trade off theory: having a higher return on assets increases the demand for bank debt, making use of the advantages of the tax shield.

Contrary to what was hypothesized, *trade credit* and bank borrowing seem to be, to a great extent, complements. The significant negative sign on the 'accounts payable' variable indicates a confirmation of the models which consider bank borrowing and trade credit as complements. For small firms, trade credit could be less expensive than bank debt due to the lower evaluation and transaction costs for suppliers. The same argument applies to the 'net accounts payable' variable in the analysis for short term bank debt. In the analysis for long term credit, we find the opposite sign for 'net accounts payable'. As hypothesized, this indicates that the more trade credit firms use compared to the amount of trade credit granted to their customers, the more long

[2] We checked the robustness of the results by using alternative measures of the variables included in our analysis. We used ln(assets) instead of ln(added value), return on equity instead of return on assets, a single group dummy instead of the double shareholder/participation dummy, return on equity instead of interestcover. The results of our initial model remained qualitatively the same after applying these changes.

term bank debt they would actually desire. This could indicate that the firms which are rationed by banks, rely on suppliers to fulfill their need for additional long term finance. Trade credit may play a role in mitigating the credit rationing problem as firms can appeal to trade credit when faced with borrowing constraints.

As far as the *ownership structure* is considered, we see that only the shareholder dummy is positively significant but only in the model for long term bank debt. Contrary to what was hypothesized, being (partly) owned by another firm by means of equity shares and thus having a shareholder, increases the demand for long term bank debt. A possible explanation for this surprising result, might be the fact that being part of a group increases the demand for long term bank debt in order to transfer this money to other (possible smaller) firms of the group who suffer from credit rationing but want to invest and expand (Ghatak and Kali 2001).

The coefficient of the *cost of capital* for bank debt is significantly negative as was expected. A higher interest rate, reduces the desire for long term bank debt. As far as the *industry* is concerned, the results suggest that retail firms would like more short term bank debt compared to production firms. This could be explained by the need to finance the period between the purchase of goods for resale and their actual sale and payment by the customer. Moreover, the results indicate that firms which provide services would like more long term bank debt compared to production firms. This could be due to the fact that for firms in the services industry who supply intangibles to its customers, it may take longer to develop an idea or a project which satisfies the needs of the customer. To bridge over this longer period, more long term bank debt is desired.

Examining the *time dummies*, we only find significant effects for the model for short term bank debt. For the dummies of 1998, 1999 and 2000, the results suggest that the desired demand for short term bank debt decreases more and more throughout time, compared to 1993. In 2001, we see a slight reversal compared to 2000 (significant at 10%), increasing the demand for short term bank debt again by 1%.

The estimation results of the equations of the **supply** of **long** and **short term** bank debt are mainly in line with our hypotheses set forward previously. In both models, the significant variables (on a 5% significance level) mentioned in both supply equations have the same sign.

A firm which is characterized by a higher *risk degree*, will be offered less long and short term credit by banks. The results indicate that the size of the firm measured by the amount of assets ('ln(assets)'), has a significant positive effect on the amount of bank debt supplied to a firm. In both analyses, one dummy variable concerning the industry, being 'retail' is positively significant, meaning that being active in the retail industry reduces the risk for the banks

compared to those being active in the production industry and thus improves the availability of bank debt. Surprisingly, the risk measures 'interestcover' and 'solvency' appear not to be significant in either analysis. Concerning the supply of long term credit, the positive significant coeffient for 'age' of the firm indicates that older firms are offered more long term bank debt. For the supply of short term credit, the cash flow seems to be an important measure of risk. As hypothesized, a higher cash flow increases the availability of short term bank debt.

Another very important element in the analysis is the amount of *collateral* available within a firm, which can be a risk mitigation towards the bank. As hypothesized, the amount of tangible assets available to offer as collateral, is positively related to the amount of long term credit offered by banks. For short term bank debt, the amount of accounts receivable and inventories which can be offered as collateral, appear to be an important determinant of short term bank debt availability. The coefficient of this variable has a significant positive sign.

The results suggest that the use of more *trade credit* compared to the amounts of accounts receivable ('net accounts payable'), reduces the amount of short and long term bank debt offered. This contradicts our hypothesis but agrees to the financing theory. Using more trade credit, compared to the trade credit granted to their customers, is a negative sign for the banks and reduces the availability of bank debt. In the analysis of long term bank debt, even the accounts payable industry dummy is positively significant, as was expected. It confirms the signaling value of trade credit for the supply of long term bank debt: if a firm uses more trade credit than the average use by the firms active in the same industry, it increases the amount of long term bank debt offered.

The *ownership structure* appears to be significant in both analysis: in analysing the supply of long term bank debt, having a shareholder as well as having a participation increases the availability of long term bank debt. In analysing the supply of short term bank debt, only the participation dummy is significant. This confirms our hypothesis.

5.2. Calculation of the proportion of credit rationed firms for long term and short term bank debt

After estimating our simultaneous equation models consisting of the demand and supply functions for short and long term bank debt, we can obtain the fitted values for our model concerning the quantity of bank debt demanded and supplied. When the demand for long (or short) term bank debt exceeds the supply of long (or short) term credit in a certain year t for a

firm i, firm i copes with credit rationing for long (or short) term bank debt in that particular year t. Table 4 presents the results of this calculation.

Table 4: % sample firms predicted to be credit rationed for long and short term bank debt.

Year	Long term bank debt	Short term bank debt
1993	54.65%	52.80%
1994	52.20%	49.07%
1995	55.92%	52.94%
1996	53.38%	53.93%
1997	56.39%	54.04%
1998	52.64%	53.23%
1999	51.83%	49.71%
2000	*45.71%*	*42.70%*
2001	*58.23%*	*65.64%*
1993-2001	***53.43%***	***52.67%***

Over the entire period, the results of our study suggest that more than 50% of the Belgian SMEs are credit rationed. Atanasova and Wilson (2004) estimated that 42.7% of SMEs in the UK in the period 1989-1999 were credit rationed for bank debt.

As hypothesized, we see that in most years long term bank debt is being slightly more rationed than short term bank debt, even though in many years the difference is minor. The year 2001 is the exception. First of all, we see that for this particular year more short term than long term bank debt is rationed. Second, we see for this year a spectacular increase in credit rationing of more than 10% for both kinds of bank debt. Since 2001, many SMEs also express their concern on the willingness of banks to offer credit. Statistics of the National Bank of Belgium also indicate that the lending behavior of banks to SMEs shows a downward trend since the beginning of 2001. Several reasons could explain this tendency.

First, there is the decreasing profitability of lending: in the near past, large firms but also SMEs were offered credit at very low interest rates. Due to the ever increasing competition between the many Belgian banks and the struggle for market share, the number of contracts of bank loans were considered more important than their profitability. In 2000 the average return on equity for Belgian banks was about 12% compared to 20% for banks in the UK. Nowadays, under pressure of the shareholders of banks, the profitability of bank loans has become their main goal.

Second, the consolidation in the Belgian banking industry might have a negative influence on the credit offered to SMEs. Consolidation leads to more complicated institutions, which from a

theoretical point of view would lead to a decrease in the amount of credit offered to SMEs. According to the organization model of Williamson (1967), organizational diseconomies are present in extending credit by large banks to small firms.
Third, the new Basel II Capital Accord, that obliges banks to hold a minimum of capital depending on the risk degree of the credit they extend to firms, might affect the amount of credit extended to SMEs in a negative way. One of the goals of Basel II is to fit the amount of equity of a bank to the real risk exposure of the banks in order to offer a better protection to the depositors. Unfortunately for SMEs, the loans offered to them generally have an inherent larger risk degree compared to loans offered to large firms. Consequently, banks might have to hold more capital for the credit they offer to small firms. Since capital is scarce and has to be used as efficient as possible, this could have a negative effect on the amount of credit offered to SMEs.

Table 5 in appendix shows some descriptive statistics for the credit rationed versus non credit rationed firms in our sample. We see that on average, *long term* rationed firms finance only 1.2% of their assets with long term bank loans whereas the unconstrained firms finance 4.4% of their assets with long term bank loans. These rationed firms have only 9.4% of their assets financed with bank debt versus 12.4% for the non credit rationed firms. Firms which are rationed for *short term* bank debt, finance only 7.6% of their assets with short term debt versus 8.6% for the unconstrained firms. The constrained and unconstrained firms finance almost the same proportion of their assets with bank debt.

The results reveal that credit rationed firms for *short term* bank debt are smaller, faster growing firms with a low return on assets, added value, quick ratio and cash flow to assets ratio. Moreover, they also have much less accounts receivable and inventories to offer as collateral.
For *long term* bank debt, we see that the credit rationed firms are in general smaller and younger firms with low cash flow to assets ratios and a low growth rate and much less to offer as collateral compared to unconstrained firms. Surprisingly, the constrained firms have a higher added value and return on assets ratio than unconstrained firms. This can be due to the desire of the bank to encourage firms to use their own profits to finance long term investments in order for the bank to ascertain itself of the belief of the firm in its own project and avoid risk shifting.
Remarkable is the fact that especially the collateral ratios are significantly different: the balance sheet of rationed firms for long term credit consists of 21% of tangible assets versus 57% for non rationed firms. The balance sheet of rationed firms for short term credit consists of 25% of accounts receivable and inventories to be offered as collateral versus 38% for non rationed firms.

In general, our results contradict many of the findings of Atanasova and Wilson (2004) who did not make the distinction between long and short term debt and found that in the U.K. constrained firms had a higher cash flow to assets ratio and were fast growing.

5. CONCLUSION

A large panel data set consisting of 2.698 Belgian SMEs was used to estimate the disequilibrium models of demand and supply of long and short term corporate bank loans. No previous study was found estimating the existence of credit rationing in a bank based economic system. The novelty of this study is that the model estimated is a disequilibrium model, allowing for the existence of credit rationing. Moreover, firms are endogenously classified as credit rationed or non rationed. No ex ante separation in two groups has to be made and thus firms can switch between both groups from one year to another.

The results of our study indicate that, over the entire period, 53.43% of the Belgian SMEs are credit rationed for long term bank debt and 52.67% for short term bank debt. In most years, long term bank debt is being slightly more rationed than short term bank debt except for the year 2001. For this particular year, more short term than long term bank debt is rationed and a spectacular increase in credit rationing of more than 10% for both kinds of bank debt arises.

The results reveal that credit rationed firms for *short term* bank debt are smaller, faster growing firms with a low return on assets, added value, quick ratio and cash flow to assets ratio. Moreover they also have much less accounts receivable and inventories to offer as collateral.

For *long term* bank debt, we see that the credit rationed firms are in general smaller and younger firms with low cash flow to assets ratios and a low growth rate and much less to offer as collateral compared to unconstrained firms. Surprisingly, the constrained firms have a higher added value and return on assets ratio than unconstrained firms.

We can conclude from both analyses that in Belgium, mainly young, small SMEs with little internal resources and a lack of assets to guarantee the repayment of debt, are most likely to be suffering from credit rationing.

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Table 3a: Disequilibrium model for long term bank debt

Independent variables[a]	**Desired DEMAND for bank debt**		**Independent variables**[a]	**SUPPLY of bank debt**	
	Coeff	**P>|Z|**		**Coeff**	**P>|Z|**
Cash flow/TA_{t-1}	-0.5585889	0.000*	Age	0.0005325	0.000*
Ln(added value)	0.20938	0.000*	Tangible assets/TA_{t-1}	0.1296446	0.000*
Return On Assets	0.0035993	0.000*	Interestcover	-0.0000162	0.674
Asset Growth	0.0538085	0.000*	Solvency	-0.0007921	0.881
Net accounts payable/TA_{t-1}	0.0444431	0.000*	Ln(assets)	0.0222404	0.000*
Accounts payable/TA_{t-1}	-0.1000621	0.000*	Net accounts payable/TA_{t-1}	-0.0362871	0.000*
Participation dummy	-0.0025622	0.640	Accounts payable industry dummy	0.0138398	0.000*
Shareholder dummy	0.0120647	0.009*	Participation dummy	0.0084135	0.021
Long term interest rate	-0.0067246	0.002*	Shareholder dummy	0.0175451	0.000*
Year dummy[b]			Industry[c]		
1994	-0.0081186	0.258	Building	0.0068843	0.134
1995	0.0030645	0.680	Retail	0.0161649	0.000*
1996	-0.00499	0.478	Services	-0.0045144	0.275
1997	-0.0091454	0.199			
1998	-0.0176915	0.027*			
1999	-0.0199265	0.013*			
2000	-0.022449	0.002*			
2001	-0.0130591	0.098			
Industry[c]					
Building	-0.0007424	0.916			
Retail	-0.0032749	0.587			
Services	0.0213348	0.001*			

[a] TA = total assets
[b] : 1993 is the suppressed comparison category
[c] : the manufacturing industry is the suppressed comparison category
*: significant at 5% level

Table 3b: Disequilibrium model for short term bank debt

Independent variables[a]	**Desired DEMAND for bank debt**		**Independent variables**[a]	**SUPPLY of bank debt**	
	Coeff	**P>|Z|**		**Coeff**	**P>|Z|**
Cash flow/TA_{t-1}	-0.6023426	0.000*	Age	-0.0000389	0.889
Ln(added value)	0.0214324	0.000*	Cash flow/TA_{t-1}	0.2016038	0.000*
Return On Assets	0.005387	0.000*	Acc receiv+inv/TA_{t-1}	0.1965015	0.000*
Asset Growth	0.0770958	0.000*	Interestcover	-0.000039	0.789
Quick ratio	-0.0182593	0.000*	Ln(assets)	0.0240186	0.000*
Net accounts payable/TA_{t-1}	-0.0727215	0.000*	Net accounts payable/TA_{t-1}	-0.2047134	0.000*
Account payable/TA_{t-1}	-0.059425	0.012*	Accounts payable industry dummy	0.0025151	0.786
Participation dummy	0.0109538	0.432	Participation dummy	0.0323026	0.044*
Shareholder dummy	-0.0062884	0.592	Shareholder dummy	-0.0017661	0.894
Short term interest rate	-0.0014399	0.893	Industry[c]		
Year dummy[b]			Building	0.0097188	0.631
1994	-0.0074935	0.801	Retail	0.0672637	0.000*
1995	-0.0058926	0.861	Services	-0.007796	0.668
1996	-0.0040205	0.895			
1997	-0.0046454	0.887			
1998	-0.0064624	0.820			
1999	-0.0122676	0.680			
2000	-0.0244211	0.539			
2001	0.0112093	0.472			
Industry[c]					
Building	0.0026825	0.881			
Retail	0.032256	0.035*			
Services	-0.020295	0.209			

[a] TA = total assets
[b] : 1993 is the suppressed comparison category
[c] : the manufacturing industry is the suppressed comparison category
*: significant at 5% level

Table 5: Descriptive statistics for credit rationed and non credit rationed firms

	Long term bank debt		***Short term bank debt***	
Variable	**Mean**	**Median**	**Mean**	**Median**
Non credit rationed firms				
Bank loans/assets$_{t-1}$	0.1236708 (2.04)	0.0181185[b]	0.1085979 (0.55)	0.0201694[b]
Long term bankloans/assets$_{t-1}$	0.0439834 (0.63)[a]	0[b]	0.0230789 (0.18)	0 [b]
Short term bankloans/assets$_{t-1}$	0.0796875 (1.43)	0.0052786	0.0855191 (0.48)	0.0071259 [b]
Ln(total assets)	7.339977 (1.10)[a]	7.293698[b]	7.346952 (1.09)[a]	7.320527[b]
Ln (value added)	6.612801 (0.87)	6.605298[b]	6.7185447 (0.84)[a]	6.699501[b]
Cash flow/assets$_{t-1}$	0.1765697 (0.76)[a]	0.1365297[b]	0.1731131 (0.73)[a]	0.1305008[b]
Tangible assets/assets$_{t-1}$	0.5682764 (4.02)[a]	0.4428571[b]		
Acc receiv + inv/assets$_{t-1}$			0.3829444 (3.08)[a]	0.3132404[b]
Net accounts payable/assets$_{t-1}$	-0.0183988 (2.35)	-0.0452489	-0.144613 (2.46)[a]	-0.1436059[b]
Accounts payable/ assets$_{t-1}$	0.2587381 (0.18)	0.2305141	0.2617202 (0.17)	0.2337349
Asset growth rate	0.3679523 (11.68)	0.0625915[b]	0.3504653 (10.10)	0.0822873[b]
Return On Assets	3.344172 (8.72)[a]	2.21[b]	4.771636 (9.13)[a]	3.2[b]
Age (years)	17.76761 (14.31)[a]	13	17.31 (12.95)	14
Quick ratio			1.521195 (0.85)[a]	1.26943[b]
Credit rationed firms				
Bank loans/assets$_{t-1}$	0.0940242 (0.45)	0.0141956[b]	0.1071666 (1.90)	0.0128549 [b]
Long term bankloans/assets$_{t-1}$	0.0125451 (0.04)[a]	0[b]	0.0308917 (0.57)	0 [b]
Short term bankloans/assets$_{t-1}$	0.081479 (0.45)	0.0055325	0.0762749 (1.34)	0.0041365 [b]
Ln (total assets)	7.250421 (1.10)[a]	7.197435[b]	7.241172 (1.10)[a]	7.177401[b]
Ln(value added)	6.613354 (0.84)	6.652444[b]	6.518496 (0.86)[a]	6.472346[b]
Cash flow/assets$_{t-1}$	0.0803684 (0.41)[a]	0.0686351[b]	0.0822367 (0.43)[a]	0.0727843[b]
Tangible assets/assets$_{t-1}$	0.2123113 (1.02)[a]	0.1535526[b]		
Acc receiv + inv/assets$_{t-1}$			0.2519588 (1.34)[a]	0.2189876[b]
Net accounts payable/assets$_{t-1}$	-0.0394206 (1.19)	-0.0486387	0.0735342 (0.95)[a]	0.0185382[b]
Accounts payable/assets$_{t-1}$	0.2625885 (0.18)	0.2342447	0.26012 (0.18)	0.2313511
Asset growth rate	0.2815547 (8.62)	0.0365675[b]	0.2959627 (10.21)	0.207864[b]
Return On Assets	4.051518 (9.57)[a]	2.97[b]	2.768969 (9.17)[a]	2.07[b]
Age (years)	17.16652 (12.50)[a]	14	17.56 (13.74)	14
Quick ratio			1.234512 (0.66)[a]	1.12078[b]

[a]: significant difference in means between unconstrained and constrained firms (t-test, 95% confidence interval)
[b]: significant difference in median between unconstrained and constrained firms (PearsonChi²-test, 95% confidence interval)